Prescribing Safety Assessment

Item Writing Manual

Revised Edition

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BRITISH PHARMACOLOGICAL SOCIETY

msc ASSESSMENT

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Prescribing Safety Assessment

The Prescribing Safety Assessment (PSA) has been developed by *MSC Assessment* and the *British Pharmacological Society* as a summative assessment of knowledge, judgement and skills related to prescribing medicines in the NHS. It is intended primarily for medical students at or near the end of their training and is based on competencies identified by the *General Medical Council* in Outcomes for graduates (2018) (originally published in Tomorrow's Doctors (2009)). These competencies include writing new prescriptions, reviewing existing prescriptions, calculating drug doses, identifying and avoiding both adverse drug reactions and medication errors, and amending prescribing to suit individual patient circumstances. The PSA is delivered as an on-line assessment. It assesses, as far as is possible within the confines of a virtual environment, complex skills including powers of deduction and problem-solving that are relevant to the work of Foundation (Year 1) doctors in the NHS.

Assessment structure

The assessment comprises eight sections (Figure 1), each containing a specific item style. There are either six or eight individual items in each section (Table 1). The assessment offers a total of 200 marks and candidates are normally expected to complete it within a total of two hours of examination time.

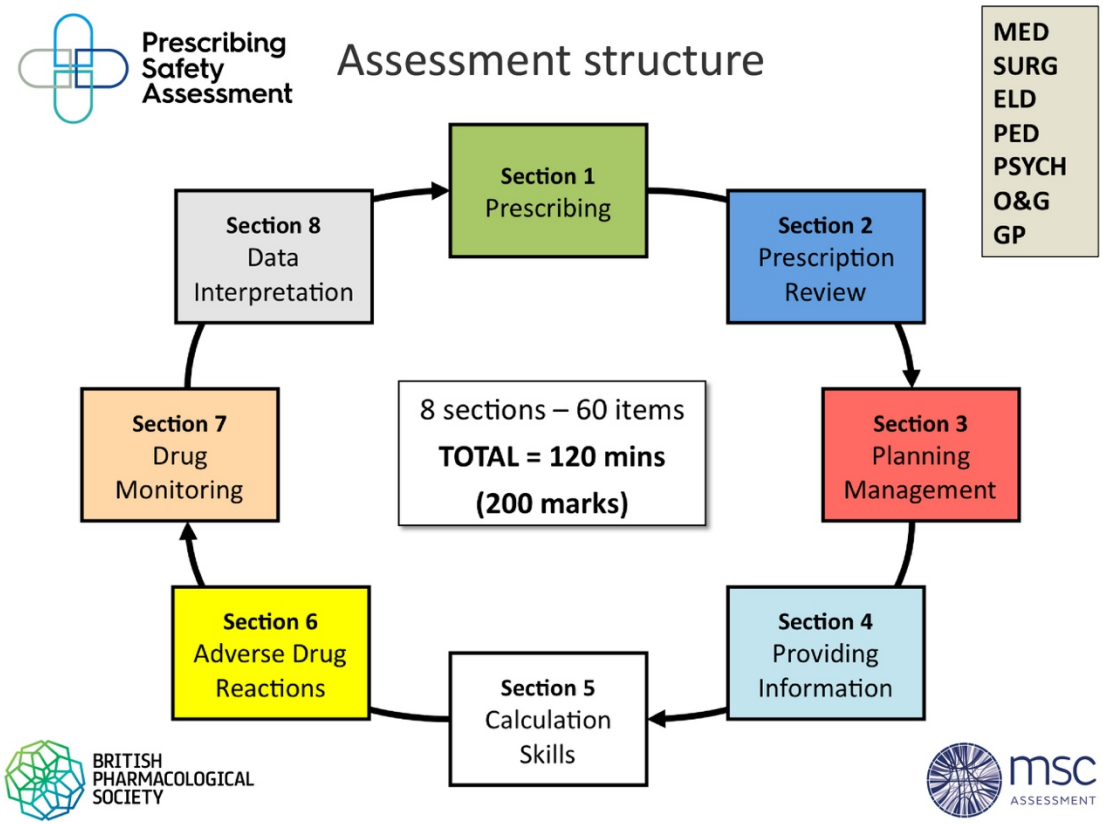

Figure 1. Basic structure of the Prescribing Safety Assessment (PSA)

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The 8 styles of item assess prescribing, prescription chart review, planning management, providing important information, calculation skills, adverse drug reactions, monitoring therapy and data interpretation. The item styles reflect not only the process of prescribing but also the related skills, judgement and knowledge required to review, advise and provide information about medicines. The skills assessed reflect the requirements of Outcomes for graduates (2018) and the recommendations of the Medical Schools Council Safe Prescribing Working Group (2007) about the competency requirements of Foundation doctors. The objectives of each item style and how to create them are described in more detail below.

Table 1. PSA sections and mark allocation

Section	Description	Marks	Comments
1	**Prescribing**	**80**	8 items of 10 marks each
2	**Prescription Review**	**32**	8 items of 4 marks each
3	**Planning Management**	**16**	8 items of 2 marks each
4	**Providing Information**	**12**	6 items of 2 marks each
5	**Calculation Skills**	**16**	8 items of 2 marks each
6	**Adverse Drug Reactions**	**16**	8 items of 2 marks each
7	**Drug Monitoring**	**16**	8 items of 2 marks each
8	**Data Interpretation**	**12**	6 items of 2 marks each
	TOTAL MARKS	**200**	

The PSA blueprint identifies 7 settings of clinical activity into which the 8 item styles are set. The minimum number of relevant items from each setting in each assessment is shown in Table 2. Examples of clinical cases and suitable item styles can be found in appendix B of the PSA blueprint.

Table 2. Coverage of clinical settings

Clinical setting	Minimum number of items
Medicine	8
Surgery	4
Elderly care	8
Paediatrics	4
Psychiatry	4
Obstetrics & Gynaecology	4
General Practice	8

Coverage of high-risk drug areas

Each PSA includes at least two items on each of the drug groups in Table 3. These drug groups were identified by the *National Patient Safety Agency* as one of the 8 high risk prescribing categories commonly associated with severe harm or death. The PSA blueprint does not require a minimum number of drugs from the other high-risk categories (anaesthetics, chemotherapy and antipsychotics) to appear in each assessment on the basis that foundation doctors would not routinely have responsibility for prescribing these agents. Some items may, however, require awareness of drugs in these categories.

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Table 3. Therapeutic groups of drugs that are included in all Prescribing Safety Assessments

Opioids
Anticoagulants
Insulins
Antibiotics
Infusion fluids

Purpose of the assessment

The PSA is intended to assess basic competence in relation to:

- core knowledge about common medicines
- basic problem-solving skills related to medicines
- judicious selection and prescription of common medicines
- treatment of common clinical conditions
- management of common medical emergencies
- review of prescriptions made by other prescribers
- calculation skills

The PSA is not meant to assess:

- the ability to investigate or diagnose medical conditions

General advice about PSA item writing

The following general advice relates to writing any PSA item style:

- Base items on clinical scenarios of a kind that a Foundation doctor can expect to face.
- Avoid using over-elaborate clinical scenarios containing excessive amounts of information, which require skills beyond those being assessed.
- Use the *British National Formulary*, to which candidates will have access during the assessment, as the ultimate arbiter of indications, dose ranges, adverse effects, interactions, etc.
- Use the item templates and writing manual guidance as far as possible: the PSA is a time-limited assessment and candidates must be confident that each item will appear in a familiar and consistent style.
- Provide clear feedback/justification for the answer to each item: this is absolutely essential for the quality assurance process, any appeals, and for the use of items in formative assessments.

Creating PSA items using the on-line authoring software

On-line authoring software facilitates creation of PSA items in the required format. The website is available at:
https://admin.prescribingsafetyassessment.ac.uk
Authors should log in using their unique username and password. The website provides guidance on house style and other matters that are described in full here.

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Writing specific PSA Items

Prescription writing skills (PWS) items

The Prescription writing skill section comprises eight items, each of which requires the prescribing of a single drug/intravenous fluid in response to a clinical scenario. Each of the eight items is worth 10 marks (making a total of 80 marks for this item style).

Reasoning and judgement required. Deciding on the most appropriate prescription (drug, dose, route and frequency) to write, based on the clinical circumstances and any supplementary information.

Measurable action to be assessed. Writing a safe and effective prescription for a single medicine, using the documentation provided, to tackle a specific indication highlighted by the question.

Content. This item style presents a clinical scenario followed by a request to prescribe a single appropriate medicine or intravenous fluid. It is distinguished from other item styles by the specific requirement to write a prescription on one of a variety of prescription forms. Typical scenarios involve the treatment of acute conditions (e.g. acute asthma attack, acute heart failure), chronic conditions (e.g. depression, reflux oesophagitis) and important symptoms such as pain. The candidate must exercise judgement when deciding between different drugs, different formulations, different routes, different doses, and different dose intervals. It is expected that prescriptions should meet appropriate standards: they must be unambiguous and complete [correct drug and dosage form, correct dose, route and frequency]. In line with modern electronic prescribing systems, the prescription will be automatically signed and date/time stamped.

The duration of treatment (e.g. 7 or 28 days) should be included on all General Practitioner forms as there is no facility for the candidate to specify a quantity to supply.

Good Prescribing items should:

- avoid using over-elaborate clinical scenarios containing excessive amounts of information
- state clearly the symptom or problem to be addressed by the prescription within the 'Prescribing Request' box
- if an intravenous fluid is required, have a mark scheme that complies with NICE Guidance CG174 (updated May 2017) or NICE Guidance NG29 (updated June 2020), where clinically appropriate
- require only one prescription to be written.

Each of the items should contain a prescribing request following the style:
'Write a prescription for ONE drug/IV fluid that is *most appropriate* to [*treat/alleviate/prevent*] [*symptom or problem*].
(*use the ['once only medicines'/'regular medicines'/'hospital IV fluid'/'general practice'] prescription form provided*)

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Prescribing items are each scored out of a total of 10 marks, including 5 marks for drug choice and 5 marks for the dosage (dose/route/frequency). In recommending a marking scheme, authors are expected to acknowledge that there will often be more than one optimal answer for any prescribing task and sub-optimal answers may also deserve some credit (see example marking scheme overleaf).

The allocation of 5 marks is given for an optimal drug with the opportunity to reduce this to 4, 3, 2 or 1 for suboptimal answers. Reasons why an answer might be considered suboptimal include clinical effectiveness, relevant published guidance, practicality, availability in the relevant clinical setting, likely tolerability, likely adherence, and potential for drug interactions. Scoring will normally be restricted to drugs with a recognised indication for the condition being treated.

Once the score for the drug selection out of 5 has been decided, that same score becomes the maximum possible for the dosage option. In the same way as for the suboptimal selection of drug, there will be a stepwise deduction of marks for suboptimal expressions of dose, route or frequency. All marks for dosage will be lost for doses, routes or frequencies that are ineffective or dangerous.

A number of pre-prepared mark schemes (drug sets) are available within the online authoring system for adaptation and use in Prescribing items. Before creating a new marking scheme for a PWS item, check if a 'drug set' already exists in the relevant subject, by reviewing the drop-down list, while in edit mode.

Drug sets can be used as a basis for a mark scheme, but **must be adapted** to match the specific scenario, where appropriate.

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Model Prescribing item

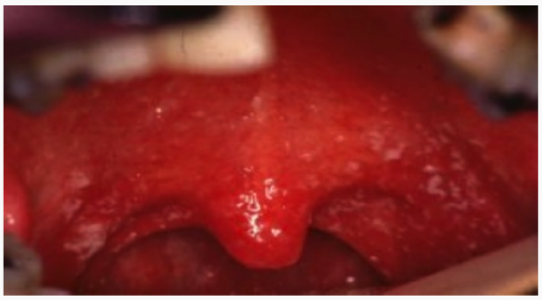
Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
PWS-4	UK-01-2010	GPR		Fungal	5		75	F	13-07-2025	Olga Sierocinska King	FF	-	-

Preview | Old versions | Relations | Associations | Unrecognised Drugs | Unrecognised DS | Incorrect DS

Case presentation
A 75-year-old woman presents to her GP with a sore throat and pain on swallowing. **PMH.** Breast cancer with bone metastases, recent chest infection. **DH.** Letrozole 2.5 mg PO daily, lansoprazole 30 mg PO daily, paracetamol 1 g PO 6-hrly. Amoxicillin 500 mg PO 8-hrly (5-day course completed yesterday). **SH.** Smokes 10 cigarettes/day.

On examination
Oral examination shows erythematous soft palate, white plaques visible on the mucosal surfaces (see image).

Prescribing request
Write a prescription for ONE drug that is *most appropriate* to treat the sore mouth.
(use the 'general practice' prescription form provided)



Marking scheme for model Prescribing item

Drug Group Name	Drug Group Score
Miconazole	5
Nystatin	5
Fluconazole	3
Itraconazole	2
Ketoconazole (local)	2
Ketoconazole (systemic)	2
Benzydamine hydrochloride	1
Chlorhexidine	1
Amoxicillin	0
Amphotericin	0
Clarithromycin	0
Metronidazole (systemic)	0
Paracetamol	0
Phenoxymethylpenicillin	0

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Prescription Review (REV) items

The Prescription Review section comprises eight items, each of which requires analysis of a list of currently prescribed drugs. Each of the eight items asks two questions and is worth 4 marks (making a total of 32 marks for this item style).

Reasoning and judgement required. Deciding which components of the current prescription are inappropriate, unsafe or ineffective for a patient based on their clinical circumstances.

Measurable action to be assessed. Identifying prescriptions (drugs, doses or routes) that are inappropriate, unsafe or ineffective from amongst the current list of prescribed medicines.

Content. This item style presents a scenario that requires review of a current list of prescribed medicines (e.g. an inpatient prescription chart, a referral letter from a general practitioner). Typically, this item style involves interpreting the list of medicines in light of a clinical problem (e.g. impaired renal function, loss of anticoagulant control, headache), spotting important drug interactions (e.g. verapamil with beta-blockers, clarithromycin with atorvastatin), identifying dangerous prescriptions (e.g. medicines with potential to cause serious harm, or containing serious dosing errors that are feasible to be administered as prescribed), or noting suboptimal prescriptions (e.g. loop diuretics prescribed to be given at night). The number of medicines listed in each Prescription Review item should range from 6 to 10. Some knowledge of common effects, adverse reactions and interactions of common medicines will be assumed. Candidates should have time to consult the BNF for relevant information that might be considered beyond the core knowledge base of a minimally competent Foundation doctor.

Good Prescription Review items should:

- state clearly in each of two questions associated with the list of prescribed medicines the reason why between 1 and 3 prescriptions need to be identified
- ask the candidate to identify prescriptions that are causing symptoms, contra-indicated, likely to interact, etc
- only rarely include dose errors, and if so, they must be plausible errors, such as due to drugs which have different doses for different population groups (e.g. pregnancy, renal failure, co-morbidities), be product-specific (e.g. the insulins) or have unusual frequencies (weekly vs daily etc)
- avoid questions asking which TWO drugs in the list of prescriptions interact with each other. Instead, include one of the interacting drugs in the lead-in (see Question B in the following example)
- ensure that question A and question B are on distinct topics to avoid potential ambiguity about which answer is required for which question (so avoiding, for example 'which drug is contra-indicated'/'which drugs should be deprescribed' in the same item)
- usually ask questions about an active clinical issue that is mentioned in the scenario (if only one question relates directly to the scenario, write it as question A for logical flow)

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Each of the items should follow the style:
'Select the [*ONE/TWO/THREE prescription/prescriptions*] that [*is/are*] [*most likely* to be] [a cause of/contains a dosing error/interact/contra-indicated, etc.].
(*mark [it/them] with a tick in column [A/B]*)'

Model Prescription Review item

Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
REV		MED		Cardiology symptoms/signs	3	2	57	M	07-05-2025	PSA Author	V0	-	-

Case presentation
A 57-year-old man is admitted to hospital with a lower respiratory tract infection, which is worsening, despite commencing a course of antibiotics. He also reports having a sore mouth. **PMH.** COPD, ischaemic heart disease. **DH.** In addition to clarithromycin 500 mg PO 12-hrly (day 4 of a 7-day course), his current prescriptions are listed (see box).

On examination
HR 110/min and rhythm regular.

Question A
Select the TWO prescriptions that are *most likely* to be a cause of his sore mouth.
(*mark them with a tick in column A*).

Question B
Select the ONE prescription that is *most likely* to interact with clarithromycin to cause tachycardia.
(*mark it with a tick in column B*)

Current Prescription

Medicine	Dose	Route	Frequency	A	B
beclometasone dipropionate (Clenil Modulite®)	200 micrograms	inhaled (INH)	twice daily (12-hrly)	✔	✖
co-amoxiclav (amoxicillin 250 mg/clavulanic acid 125 mg)	one tablet	oral (PO)	three times daily (8-hrly)	✔	✖
ethinylestradiol 30 micrograms/levonorgestrel 150 micrograms	one tablet	oral (PO)	daily	✖	✖
gentamicin 0.3% ear/eye drops	one drop	to left ear	five times daily	✖	✖
haloperidol decanoate	50 mg	intramuscular (IM)	every 4 weeks	✖	✖
hydrocortisone 1% cream	one application	topical (TOP)	daily	✖	✖
insulin lispro (Humalog®)	1 unit per 10 g carbohydrate	subcutaneous (SC)	three times daily (before meals)	✖	✖
isosorbide mononitrate m/r	30 mg	oral (PO)	twice daily (at 08:00 and 14:00)	✖	✖
nicotine lozenges	1 mg	oromucosal	as required	✖	✖
theophylline m/r (Uniphyllin SA®)	300 mg	oral (PO)	twice daily (12-hrly)	✖	✔

Justifications

Question A:	Question B:
Beclometasone is an inhaled corticosteroid. Patients who use inhaled corticosteroids sometimes experience a sore mouth and throat because of the development of oral candidiasis as a result of local suppression of the cellular immune response. Broad spectrum antibiotics such as amoxicillin can also lead to overgrowth of candida in the mouth.	Clarithromycin may increase the plasma levels of theophylline, potentially causing symptoms of toxicity including tachycardia.

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Planning Management (MAN) items

The Planning Management section comprises eight items, each of which requires identification of the most appropriate management option from a list of five. Each of the eight items is worth 2 marks (making a total of 16 marks for this item style).

Reasoning and judgement required. Deciding which treatment would be most appropriate to manage a particular clinical situation.

Measurable action to be assessed. Selecting the most appropriate treatment based on individual patient circumstances.

Content. This item style presents a clinical scenario followed by a request to identify the most appropriate treatment that would be part of initial management. This involves selecting between options (medicines, fluids and sometimes other treatments) that would be of real benefit and others that would have neutral or harmful effects. The candidate must decide on the most appropriate treatment, based on symptoms, signs and investigations, from a list of five. Such treatment might be preventive, curative, symptomatic or palliative. The candidate should show that they are able to select treatment that is appropriate to individual patients. They should be aware of situations where it is inappropriate to treat and also of the role of non-drug therapies (e.g. physiotherapy, TENS machines for pain relief). Some of these scenarios may relate to the management of clinical toxicological emergencies that a foundation doctor might be expected to manage. Some of the scenarios may include information in the resources section to replicate e-prescribing alerts using the statement: '*A decision is made to prescribe [medicine], but the prescribing interface warns of a potential [allergy / interaction / caution / contraindication / therapeutic duplication] (see image).*

The likely diagnosis (or differential diagnosis) should be clear from the scenario but need not be identified, to reflect the fact that planning management is sometimes necessary when there remains a degree of uncertainty about the underlying diagnosis (e.g. dyspnoea, abdominal pain, reduced conscious level).

Good Planning Management items should:

- be based on a list of 5 management options from which the candidate will be required to select the most appropriate
- avoid using over-elaborate clinical scenarios containing excessive amounts of information
- contain sufficient information to allow a competent candidate to select the best option unambiguously
- contain 4 distracting options that, while plausible, are clearly less appropriate than the correct answers in relation to the clinical scenario.

Each of the items should follow the style:
'Select the *most appropriate* management option at this stage.
(*mark it with a tick*)'

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Model Planning Management item

Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
MAN		ELD	MED	Infections of respiratory tract	3		70	F	11-07-2018	PSA Author	V0	-	-

Case presentation
A 70-year-old woman is admitted to hospital with worsening breathlessness and a cough productive of green sputum. **PMH.** Hypertension. **DH.** Amlodipine 5 mg PO daily, salbutamol 200 micrograms INH as required, amoxicillin 500 mg PO 8-hrly for 5 days. **SH.** Longstanding smoker.
On examination
Temperature 36.8°C, HR 96/min and rhythm regular, BP 170/92 mmHg, RR 22/min, O_2 sat 96% breathing air. Respiratory examination reveals a widespread expiratory wheeze.
Investigations
CXR shows hyper-expansion of the lung fields and some old scarring at the left apex.

Question
Select the *most appropriate* management option at this stage.
(*mark it with a tick*)

Resources associated with this item

No resource has been associated with this item.

MANAGEMENT OPTIONS*

A	atenolol 50 mg PO	✗
B	furosemide 50 mg IV	✗
C	hydrocortisone 100 mg IV	✗
D	oxygen 35% via a venturi mask	✗
E	salbutamol 5 mg NEB in air	✓

Answers

Option A Justification

There are no indications, other than the raised blood pressure, for atenolol and the presence of worsening reversible airways obstruction would contra-indicate it in the acute situation.

Option B Justification

There is no evidence of fluid overload or pulmonary oedema.

Option C Justification

The likely diagnosis means that a short course of oral corticosteroids is indicated, but IV corticosteroid is not necessary given the modest severity of the exacerbation.

Option D Justification

The likely diagnosis would make oxygen at this concentration potentially hazardous and the saturations suggest that it is unnecessary.

Option E Justification

The clinical presentation strongly suggests that a diagnosis of COPD with infective exacerbation is most likely at this stage. The patient has a widespread wheeze and so a nebulised bronchodilator such as salbutamol would help to relieve this problem.

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Providing Information (COM) items

The Providing Information section comprises six items, each of which requires identification of the most important piece of information from a list of five. Each of the six items is worth 2 marks (making a total of 12 marks for this item style).

Reasoning and judgement required. Deciding what is the most important piece of information that should be provided to patients, carers or other health professionals. This information may help patients to choose whether to take the medicine or may provide information that will enable a medicine to be used safely and effectively.

Measurable action to be assessed. Selecting the information that is most important.

Content. This item style presents a brief scenario in which a patient is about to start taking a new treatment or where further advice about an existing treatment is required. The candidate is expected to select the most important piece of information that they would provide to the intended recipient from a list of 5 that includes four distractors. The task is to select which of the five options listed is more important than the others.

Good Providing Information items should:

- be based on a clinical scenario in which a patient is about to start taking a medicine or has other reasons to ask for information that is relevant to its effectiveness and safety (the scenario might alternatively involve transfer of information to a carer or a professional colleague)
- be based on a list of 5 information options relating to the scenario, from which the candidate will be required to select the *most important*
- avoid over-elaborate clinical scenarios but contain sufficient information to allow a competent candidate to select the best option unambiguously
- contain 4 distracting options that, whilst plausible and (ideally) true in some situations, are clearly less relevant or incorrect to provide to the patient in the situation described
- express information options using language appropriate to the recipient, for example avoiding medical and scientific jargon when providing information for patients

Each of the items should follow the style:
'Select the *most important* information option that should be provided for the [*patient/mother/staff nurse/GP*].
(*mark it with a tick*)'

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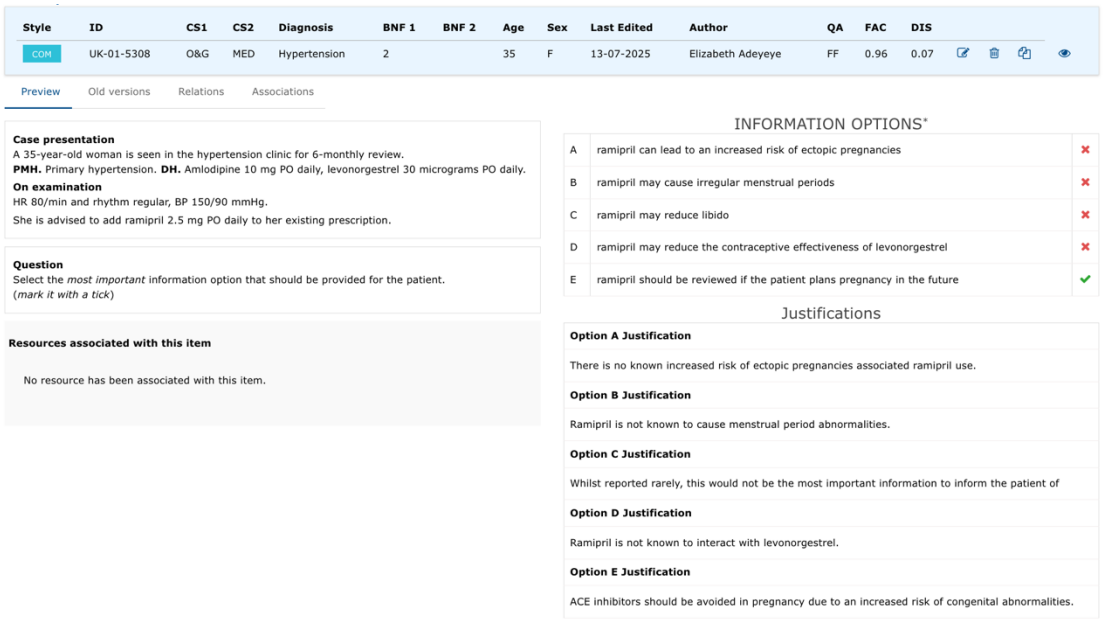
Model Providing Information item



Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
COM	UK-01-5308	O&G	MED	Hypertension	2		35	F	13-07-2025	Elizabeth Adeyeye	FF	0.96	0.07

Preview | Old versions | Relations | Associations

Case presentation
A 35-year-old woman is seen in the hypertension clinic for 6-monthly review.
PMH. Primary hypertension. **DH.** Amlodipine 10 mg PO daily, levonorgestrel 30 micrograms PO daily.
On examination
HR 80/min and rhythm regular, BP 150/90 mmHg.
She is advised to add ramipril 2.5 mg PO daily to her existing prescription.

Question
Select the *most important* information option that should be provided for the patient.
(*mark it with a tick*)

Resources associated with this item

No resource has been associated with this item.

INFORMATION OPTIONS*

A	ramipril can lead to an increased risk of ectopic pregnancies	✖
B	ramipril may cause irregular menstrual periods	✖
C	ramipril may reduce libido	✖
D	ramipril may reduce the contraceptive effectiveness of levonorgestrel	✖
E	ramipril should be reviewed if the patient plans pregnancy in the future	✔

Justifications

Option A Justification

There is no known increased risk of ectopic pregnancies associated ramipril use.

Option B Justification

Ramipril is not known to cause menstrual period abnormalities.

Option C Justification

Whilst reported rarely, this would not be the most important information to inform the patient of

Option D Justification

Ramipril is not known to interact with levonorgestrel.

Option E Justification

ACE inhibitors should be avoided in pregnancy due to an increased risk of congenital abnormalities.

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Calculation Skills (CAL) items

The Calculation Skills section comprises eight items, each of which requires calculation of the correct figure based on a very brief clinical scenario. Each of the eight items is worth 2 marks (making a total of 16 marks for this item style).

Reasoning and judgement required. Making an accurate drug dosage calculation based on numerical information.

Measurable action to be assessed. Recording the answer accurately with appropriate units of measurement.

Content. This item style will present a scenario in which the candidate has to make an accurate calculation of the dose or rate of administration of a medicine. They must interpret the problem correctly and use basic arithmetic skills to derive the correct answer. Examples of potential scenarios might include identifying the correct amount of medicine to achieve a required dose, making necessary dose adjustments based on weight or body surface area, or diluting a drug for administration in an infusion pump. These items will also include testing the candidate's ability to recognise and convert different expressions of drug doses and concentrations.

Good Calculation Skills items should:

- be based on a very brief clinical scenario that requires a calculation to be made in order to select a safe and effective dose or to plan the patient's treatment in some other way
- include a minimum of clinical detail sufficient to put the calculation into context
- contain all the relevant numerical data with standard units
- be sufficiently complex that they may require the use of a calculator, and/or involve multiple steps to obtain the correct answer

These items may also contain reasonable distracting data that the competent candidate might need to reject as irrelevant to the calculation.

Each of the calculation requests should follow the style:
'What [*dose/volume/duration/rate etc.*] [(*mL)/(mg)/(mL/h)/(tablets) etc.*] of [*name of the medicine*] [*should the patient take/is required etc.*] [*per dose/each day etc.*] . . .
(*write your answer in the box provided*)'

Model Calculation Skills item

Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
CAL		PED	MED	Neurology symptoms/signs	4		0	M	06-12-2021	PSA Author	V0	-	-

Case presentation
A 2-month-old boy in the paediatric emergency department requires a dose of midazolam to be administered buccally for status epilepticus. The dose of buccal midazolam is 300 microgram/kg (max 2.5 mg), repeated once if necessary after 10 minutes. Weight 5.0 kg.

Midazolam oromucosal solution is available as a 5 mg/mL solution.

Calculation
What volume (mL) of midazolam oromucosal solution should the patient be given for the first dose?
(*write your answer in the box provided*)

Answer: 0.3 mL

Justifications

Working

The dose of midazolam is 300 micrograms x 5 = 1500 microgram (1.5 mg).

The concentration of the solution available is 5 mg/mL.

Therefore, volume required = 1.5/5 mL = 0.3 mL

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Adverse Drug Reaction (ADR) items

The Adverse Drug Reaction section comprises eight items (two of each type A–D), each of which requires identification of the most appropriate answer from a list of five. Each of the eight items is worth 2 marks (making a total of 16 marks for this item style).

Reasoning and judgement required. Identifying likely adverse reactions to specific drugs, drugs that are likely to be causing specific adverse drug reactions, or potentially dangerous drug interactions, and deciding on the best approach to managing a clinical presentation that results from the adverse effects of a drug.

Measurable action to be assessed. Selecting likely adverse reactions of specific drugs, selecting drugs to discontinue as they are likely causes of specific reactions, avoiding potential drug interactions and providing appropriate treatment for patients suffering an adverse event.

Content – Type A items. This item style requires the candidate to identify the most likely adverse effect of a specific drug. Examples might include the commonest adverse effect caused by commonly prescribed drugs, such as calcium channel blockers, beta$_2$-agonists, non-steroidal anti-inflammatory drugs, aminoglycoside antibiotics, etc.
Content – Type B items. This item style requires the candidate to consider a presentation that could potentially be caused by an adverse drug reaction and identify the medicine most likely to have caused the presentation. Examples might include newly recognised renal impairment, hepatic dysfunction, hypokalaemia, urinary retention, etc.
Content – Type C items. This item style requires the candidate to consider a presentation resulting from a potential interaction between medicines currently being prescribed to a patient and identify the drug most likely to be clinically important. Examples might include interactions such as warfarin–statins, NSAIDs–ACE inhibitors, etc.
Content – Type D items. This item style requires the candidate to consider a clinical scenario in which a patient is suffering an adverse drug event and decide on the most appropriate course of action. Examples of adverse events might include acute anaphylaxis, excessive anticoagulation, drug-induced hypoglycaemia, diuretic-induced dehydration, etc.

Good Adverse Drug Reaction items should:

- be based on well-recognised adverse effects, so that competent candidates are not faced with the need to refer repeatedly to the *British National Formulary*
- use synonyms as descriptions of some adverse effects to reduce utility of the search function as a look-up strategy in the BNF
- include answers that are correct based on their common occurrence in practice due to their pharmacological action, (even if the BNF lists the adverse effect as frequency 'not known')
- be based on a list of 5 options (drugs/adverse effects/interactions/actions) relating to the scenario, from which the candidate will be required to select the most appropriate
- avoid over-elaborate clinical scenarios, but contain sufficient information to allow a competent candidate to select the best option unambiguously

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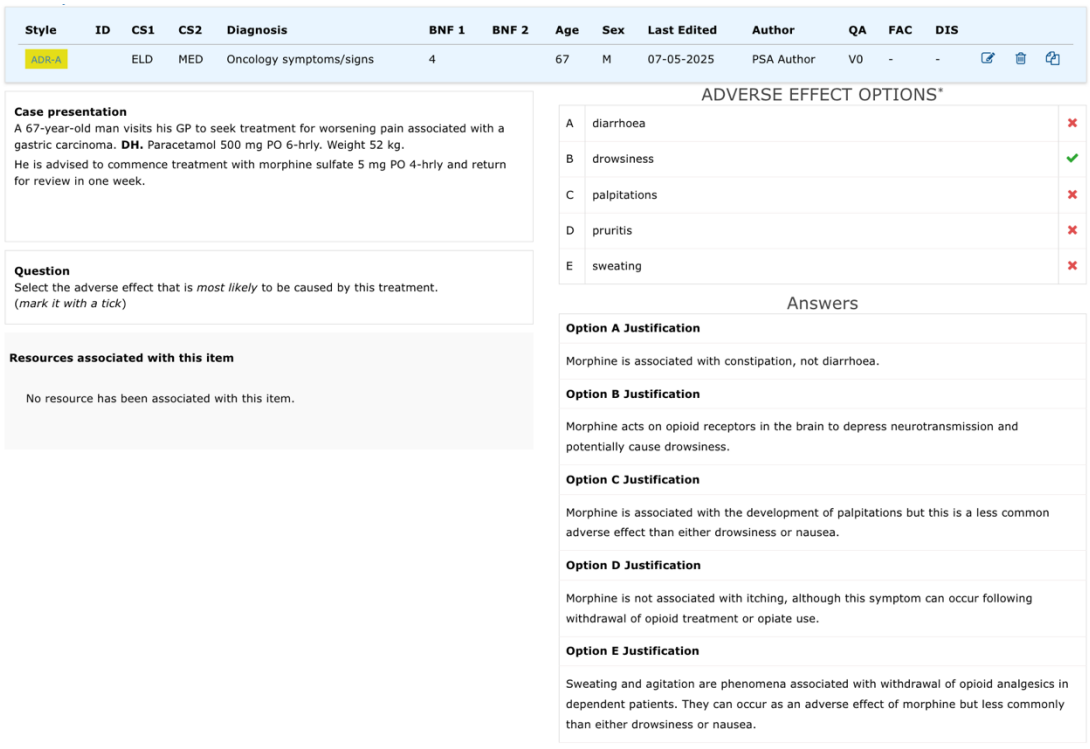
- contain 4 distracting options that, while plausible, are clearly less appropriate than the correct answer in relation to the clinical scenario.
- For ADR-A items, use distractors that have some commonality with the keyed answer (e.g. all same body system/all blood results/all ADRs that are reported but are less likely for that drug)
- For ADR-B items, to avoid repetition, in the DH section, use the phrase: **DH.** His/her current medications are listed (right)
- For ADR-C items, to avoid repetition, in the DH section, use the phrase: **DH.** In addition to X, his/her current medications are listed (right)

Each of the items should follow the style:
Type A – 'Select the adverse effect that is *most likely* to be caused by this treatment.
(*mark it with a tick*)'
Type B – 'Select the prescription that is *most likely* to be contributing to the [*insert adverse effect*].
(*mark it with a tick*)'
Type C – 'Select the prescription that is *most likely* to interact with [*the drug specified in the stem*] to [*describe the clinical problem here*].
(*mark it with a tick*)'
Type D – 'Select the *most appropriate* option for the management of this adverse drug reaction.
(*mark it with a tick*)'

Model Adverse Drug Reactions item



Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
ADR-A		ELD	MED	Oncology symptoms/signs	4		67	M	07-05-2025	PSA Author	V0	-	-

Case presentation
A 67-year-old man visits his GP to seek treatment for worsening pain associated with a gastric carcinoma. **DH.** Paracetamol 500 mg PO 6-hrly. Weight 52 kg.
He is advised to commence treatment with morphine sulfate 5 mg PO 4-hrly and return for review in one week.

Question
Select the adverse effect that is *most likely* to be caused by this treatment.
(*mark it with a tick*)

Resources associated with this item
No resource has been associated with this item.

ADVERSE EFFECT OPTIONS*

A	diarrhoea	✗
B	drowsiness	✓
C	palpitations	✗
D	pruritis	✗
E	sweating	✗

Answers

Option A Justification
Morphine is associated with constipation, not diarrhoea.

Option B Justification
Morphine acts on opioid receptors in the brain to depress neurotransmission and potentially cause drowsiness.

Option C Justification
Morphine is associated with the development of palpitations but this is a less common adverse effect than either drowsiness or nausea.

Option D Justification
Morphine is not associated with itching, although this symptom can occur following withdrawal of opioid treatment or opiate use.

Option E Justification
Sweating and agitation are phenomena associated with withdrawal of opioid analgesics in dependent patients. They can occur as an adverse effect of morphine but less commonly than either drowsiness or nausea.

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Drug Monitoring (TDM) items

The Drug Monitoring section comprises eight items, each of which requires identification of the most appropriate answer from a list of five. Each of the eight items is worth 2 marks (making a total of 16 marks for this item style).

Reasoning and judgement required. Deciding on how to monitor the beneficial and harmful effects of medicines.

Measurable action to be assessed. Identifying the most appropriate method of assessing the success or failure of a therapeutic intervention.

Content. This item style presents a scenario that involves making judgements about how best to assess the impact of treatments that are ongoing or are being planned. Candidates are expected to demonstrate that they understand how to plan appropriate monitoring for beneficial and harmful effects, based on factors such as clinical history, examination and investigation. This may involve taking blood samples at the right time, deciding which measurement is likely to lead to the most appropriate assessment of outcome, or the timing of that measurement. Examples of prescriptions that might require appropriate monitoring are digoxin for atrial fibrillation, inhaled corticosteroids for asthma, oral contraception, levothyroxine for hypothyroidism, etc.

Good Drug Monitoring items should:

- be based on a clinical scenario in which a patient is starting to take a treatment and the candidate is being asked to identify the best way of monitoring its beneficial or adverse effects
- be based on a list of 5 monitoring options relating to the treatment identified, from which the candidate will be required to select the most appropriate
- avoid over-elaborate clinical scenarios, but contain sufficient information to allow a competent candidate to select the best option unambiguously
- only include options that can be measured objectively such as hepatic function/renal function (cf hepatic function test) if appropriate and avoid including symptoms that have no objective monitoring parameter (e.g. nausea, headache)
- contain 4 distracting options that, while plausible, are clearly less appropriate than the correct answer in relation to monitoring the beneficial or adverse effects of the treatment
- include a timescale within which the monitoring options should be judged (if appropriate).

Each of the items should follow the style:
'Select the *most appropriate* option to monitor for [*beneficial/adverse*] effects of this prescription [*after x hours/days/months etc.*] of treatment. (*mark it with a tick*)'
Alternative wording may be used if the above is unsuitable:
'Select the *most appropriate* monitoring option that is required before starting treatment.'
'Select the *most appropriate* monitoring option to guide ongoing treatment after x days.'

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Model Drug Monitoring item

Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
TDM		ELD	MED	Bacterial infection	5		71	F	11-07-2018	PSA Author	V0	-	-

Case presentation
A 71-year-old woman is admitted to the respiratory ward with severe community-acquired pneumonia. She has been coughing up thick green sputum for 2 days.
On examination
Temperature 36.8°C, RR 20/min. Dullness to percussion and crackles at right lung base.
Investigations
CXR confirms right lower lobe pneumonia.
Treatment with co-amoxiclav (amoxicillin 1 g/clavulanic acid 200 mg) 1.2 g IV 8-hrly is initiated.

Question
Select the *most appropriate* option to monitor for beneficial effects of this prescription in the first 3 days of treatment.
(*mark it with a tick*)

Resources associated with this item

No resource has been associated with this item.

MONITORING OPTIONS*

A	chest auscultation	✗
B	chest X-ray	✗
C	heart rate	✗
D	respiratory rate	✓
E	review of sputum colour	✗

Answers

Option A Justification

The auscultatory findings will take several days to resolve.

Option B Justification

The chest X-ray appearance is unlikely to resolve in the early stages of treatment.

Option C Justification

Heart rate is not a good indicator of treatment success.

Option D Justification

Successful treatment of the pneumonia will improve gas exchange and the hypoxia and reduce the respiratory rate.

Option E Justification

Sputum colour is a poor guide to the success of treatment for pneumonia.

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Data Interpretation (DAT) items

The Data Interpretation section comprises six items, each of which requires identification of the most appropriate answer from a list of five. Each of the six items is worth 2 marks (making a total of 12 marks for this item style).

Reasoning and judgement required. Deciding on the meaning of the results of investigations as they relate to decisions about ongoing drug therapy.

Measurable action to be assessed. Making an appropriate change to a prescription based on those data.

Content. This item style involves interpreting data in the light of a clinical scenario and deciding on the most appropriate course of action with regard to prescribing. This may involve withdrawing a medicine, reducing its dose, no change, increasing its dose or prescribing a new medicine. The key focus of these items is interpreting the data and deciding on its implications for prescribing. Examples of data to be considered might include drug concentrations, haemoglobin concentration, white cell count, liver or renal function, serum cholesterol, nomograms, etc.

Good Data Interpretation items should:

- be based on a clinical scenario where a treatment decision (e.g. choosing from a selection of treatment options, deciding on a dosage change) relies upon interpreting data from an investigation (e.g. physiological measurement, blood test)
- be based on a list of 5 prescribing options relating to the treatment identified, from which the candidate will be required to select the most appropriate
- avoid over-elaborate clinical scenarios, but contain sufficient information to allow a competent candidate to select the best option unambiguously
- contain 4 distracting options that, while plausible, are clearly less appropriate than the correct answer in relation to responding to the data.

Each of the items should follow the style:
'Select the *most appropriate* decision option with regard to *the [(insert drug name here) prescription/the treatment of (describe clinical condition here)*] based on these data.
(*mark it with a tick*)'

Data Interpretation items **must** involve interpretation of a measured variable relevant to drug treatment. The challenge for the candidate is to use the measurement as a guide to changing the current prescription by adjusting the dosage of an existing medicine, withholding a medicine, or substituting an alternative.

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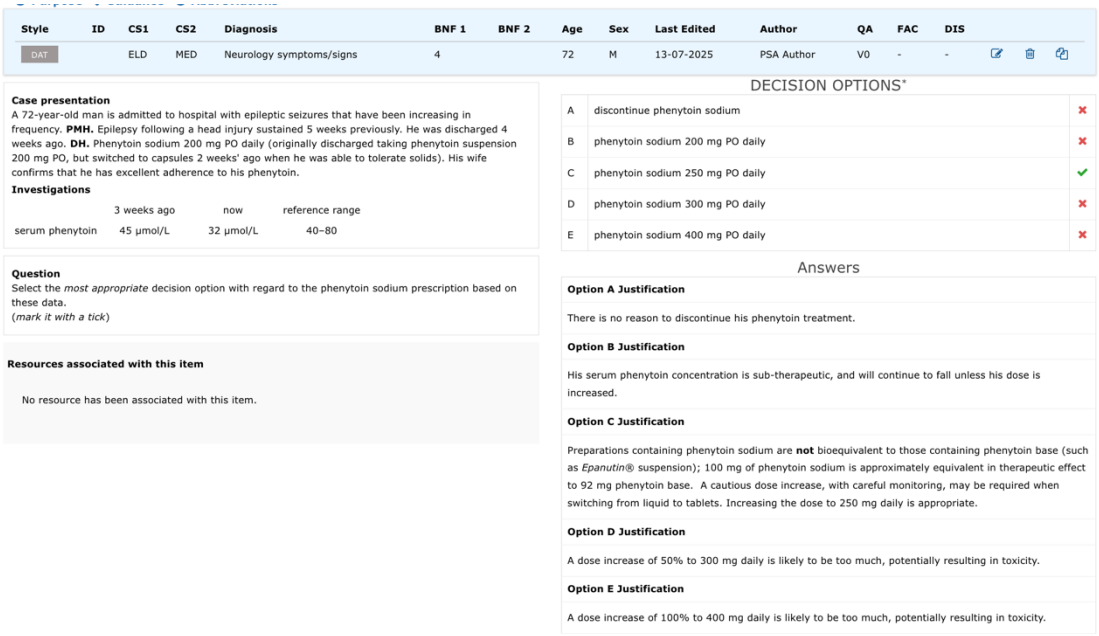
Model Data Interpretation item



Style	ID	CS1	CS2	Diagnosis	BNF 1	BNF 2	Age	Sex	Last Edited	Author	QA	FAC	DIS
DAT		ELD	MED	Neurology symptoms/signs	4		72	M	13-07-2025	PSA Author	V0	-	-

Case presentation
A 72-year-old man is admitted to hospital with epileptic seizures that have been increasing in frequency. **PMH.** Epilepsy following a head injury sustained 5 weeks previously. He was discharged 4 weeks ago. **DH.** Phenytoin sodium 200 mg PO daily (originally discharged taking phenytoin suspension 200 mg PO, but switched to capsules 2 weeks' ago when he was able to tolerate solids). His wife confirms that he has excellent adherence to his phenytoin.

Investigations

	3 weeks ago	now	reference range
serum phenytoin	45 µmol/L	32 µmol/L	40–80

Question
Select the *most appropriate* decision option with regard to the phenytoin sodium prescription based on these data.
(*mark it with a tick*)

Resources associated with this item

No resource has been associated with this item.

DECISION OPTIONS*

A	discontinue phenytoin sodium	✖
B	phenytoin sodium 200 mg PO daily	✖
C	phenytoin sodium 250 mg PO daily	✔
D	phenytoin sodium 300 mg PO daily	✖
E	phenytoin sodium 400 mg PO daily	✖

Answers

Option A Justification

There is no reason to discontinue his phenytoin treatment.

Option B Justification

His serum phenytoin concentration is sub-therapeutic, and will continue to fall unless his dose is increased.

Option C Justification

Preparations containing phenytoin sodium are **not** bioequivalent to those containing phenytoin base (such as *Epanutin*® suspension); 100 mg of phenytoin sodium is approximately equivalent in therapeutic effect to 92 mg phenytoin base. A cautious dose increase, with careful monitoring, may be required when switching from liquid to tablets. Increasing the dose to 250 mg daily is appropriate.

Option D Justification

A dose increase of 50% to 300 mg daily is likely to be too much, potentially resulting in toxicity.

Option E Justification

A dose increase of 100% to 400 mg daily is likely to be too much, potentially resulting in toxicity.

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Guidance on good item writing

Aims of the items

The PSA tests knowledge and skills related to the prescribing of medicines used in the treatment of common clinical conditions. It also tests the ability to process information set out in a clinical scenario and to use this to make a judgement about the safest and most effective treatment(s) to be prescribed. It aims to assess the competencies identified in Outcomes for graduates (2018) and by the Medical Schools Council Safe Prescribing Working Group (2007) including the ability to:

- write a safe and legal prescription
- appraise critically the prescribing of others
- plan appropriate therapy for common indications
- provide patients with appropriate information about their medicines
- calculate safe and appropriate medication doses
- monitor the efficacy and effects of medication
- detect and report adverse drug reactions
- interpret and act on data.

Candidates are also expected to demonstrate knowledge of evidence-based medicine and nationally approved management guidelines related to common clinical presentations. These aims have led to the item styles and assessment structure outlined above.

Three of the 8 item styles aim to be close simulations of the relevant skills. Prescribing items necessitate writing a prescription into a template that includes a drug name, dose, route and frequency. Prescription Review items require candidates to identify pre-existing prescriptions that require review and amendment. Calculation Skills items require an accurate calculation based on numerical data to choose a correct dose or timing for drug administration.

The other five item styles are based on identifying the single best answer (SBA) from a list of five possible answers. This format aims to simulate the challenge of making clinical decisions. In addition to testing knowledge and comprehension, it also allows for assessment of higher-level functions, such as application analysis, synthesis and evaluation. SBAs are superior to multiple true/false questions in their potential to assess the ability to interpret information and to solve clinical problems, as well as assessing core knowledge. The assessment is an 'open-book format, allowing access to the BNF. Single best answer questions that combine the need to access information from within the BNF (or other resources attached to items) and apply it to a specific clinical scenario replicate medication-related activity in the clinical setting.

Item content

When deciding on item content, authors should ensure that the subject meets the aims of the PSA (as stated above). PSA items are used for formative and summative assessment, and some are retired each year, so the item bank always requires replenishing with material that tests core knowledge, even if similar items already exist. Authors should refer to the

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PSA blueprint for suitable topics, and in addition, are encouraged to create items that are based on current issues, by referring to sources such as NICE guidance and MHRA Drug Safety Updates.

Structure of the items

Each item comprises three main components:

- *The stem*. A few lines/paragraphs of text explaining the clinical presentation upon which the item is based.
- *The lead-in*. A single line stating the requested action from the candidate.
- *The answer options*. Normally a list of five options (including one correct answer and four distractors). In the case of Prescribing items the answer will be written into a form, for Prescription Review items the options are the current prescriptions taken by the patient, and for Calculation Skills items the answer will be a single numerical value.

Each of these components is discussed in detail below.

The stem

Clinical scenarios are conceived simply as the background to the prescribing-related knowledge or ability to be tested. The time available for candidates to read the stem is limited so the information it contains should be complete, concise, clear and unambiguous, omitting any extraneous details. Write the text of the stem in the present tense ('A 78-year-old woman is admitted/presents with…').

The stem must include:

- the age and sex of the patient ('A 45-year-old man/woman', 'a 17-year-old boy/girl')
- the setting of care, if relevant (e.g. outpatient clinic, emergency department)
- the presenting condition
- relevant medical, family and social history
- relevant drug treatment
- relevant physical examination findings, including the weight, where relevant
- results of relevant investigations (with reference ranges for comparison) in standard order.

Prescribing items test clinical judgement and will typically have stems that comprise text of 200–300 words divided into three paragraphs headed '**Case presentation**', '**On examination**' and '**Investigations**' in bold.

The **Case presentation** paragraph will state the age and gender of the patient and outline the presenting condition, and may include past medical history, drug history, family history and social history. These may be prefixed by the abbreviations **PMH.**, **DH.**, **FH.** and **SH.** in bold, which do not need to be defined. Details of the drug history should include the full regimen for each item. For reasons of brevity, allergies are only

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included in the vignette if relevant to the case. The following example shows the style preferred:

> **DH.** Bendroflumethiazide 2.5 mg PO daily, simvastatin 20 mg PO nightly, amoxicillin 250 mg PO 8-hrly, metformin hydrochloride 1 g PO twice daily (with meals).

The **On examination** paragraph will contain a list of relevant examination findings that help to put the prescribing decision in context. Weight is obligatory for paediatric cases. The following example shows the style preferred:

> **On examination**
> Temperature 37.0°C, HR 94/min and rhythm regular, BP 116/76 mmHg, JVP 4 cm above sternal angle, RR 16/min, O_2 sat 94% breathing air. Apex beat in 6th left intercostal space, anterior axillary line, HS normal, bilateral ankle oedema. Slightly short of breath at rest, inspiratory crackles at both lung bases. Abdomen soft, with hepatomegaly 4 cm below right costal margin. Neurological examination normal. Weight 78 kg. BMI 24 kg/m^2 (18–25).

The **Investigations** paragraph will contain a list of relevant investigations that support the prescribing decision in standard order (haematology–biochemistry–ECG–radiology–other investigations). Investigations will be presented with reference ranges. The following example shows the style preferred:

> **Investigations**
> Hb 146 g/L (130–175), WCC 9.8 × 10^9/L (4.0–11.0), platelets 190 × 10^9/L (150–400).
>
> Na^+ 140 mmol/L (137–144), K^+ 4.2 mmol/L (3.5–5.3), U 7.2 mmol/L (2.5–7.0), Cr 85 µmol/L (60–110).
>
> ECG shows sinus tachycardia, LBBB.
>
> CXR shows consolidation in left lower zone.
>
> ABPM daytime average 140/95 mmHg.

Prescription writing, prescription review and planning management items will usually follow the three-heading model above.

The stems for other items will normally be shorter (50–200 words) and may appear under a single heading of '**Case presentation**', which may include any relevant examination findings and investigations if these are suitably brief.

Some items may be supported by a resource (e.g. clinical photograph/X-ray/scan/ECG/monitoring chart/nomogram/excerpt of guidance/electronic alert). In all cases there should be an appropriate mix of text, investigations and images to allow a candidate to assimilate the information in about 2 minutes.

Please refer to **Appendix I** for a list of acceptable terms and abbreviations, to **Appendix II** for a table of reference ranges and

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thresholds for laboratory tests, and to **Appendix III** for British Approved Names of drugs. For further information about drug names and prescribing information refer to the *British National Formulary*.

Use plain English and be concise. Avoid use of unapproved abbreviations, jargon, or terms that may not be understood by candidates whose first language is not English. Use approved names for all medicines, avoid proprietary names unless these are recommended by the *British National Formulary*.

The lead-in

The lead-in should indicate clearly the basis on which any choice of options is to be made, how many options are to be selected and how to make those selections. The lead-in to Prescribing items will indicate clearly the purpose of the prescription to be written. The lead-in for the Calculation Skills items will indicate the units in which the numerical answer should be given.

Lead-ins should avoid negatively worded questions, such as 'What is the *least likely* diagnosis?' or 'What is the *least appropriate* treatment?' Negatively worded questions may be misread by candidates who are expecting to identify the *most correct* answer and present an artificial challenge that has no equivalent in everyday clinical practice.

The lead-in to all items will generally be consistent with the following templates and will appear in a highlighted box clearly separated from the stem:
Prescribing – 'Write a prescription for ONE drug/IV fluid that is *most appropriate* to [*treat/alleviate/prevent*] [*symptom or problem*].
(*use the* [*'once only medicines'/'regular medicines'/'hospital IV fluid'/'general practice'] prescription form provided*)'

Prescription Review – 'Select the [ONE/TWO/THREE prescription(s)] that [is/are] *most likely* to [be a cause of/contain a serious dosing error/interact/be contra-indicated, etc.].
(*mark [it/them] with a tick in column [A/B]*)'

Planning Management – 'Select the *most appropriate* management option at this stage.
(*mark it with a tick*)'

Providing Information – 'Select the *most important* information option that should be provided for the [*patient/mother/staff nurse/GP*].
(*mark it with a tick*)'

Calculation Skills – 'What [*dose/volume/duration/rate etc.*] [*(mL)/(mg)/(mL/h)/(tablets) etc.*] of [*name of the medicine*] [*should the patient take/is required etc.*] [*per dose/each day etc.*] . . .
(*write your answer in the box provided*)'

Adverse Drug Reactions – Type A – 'Select the adverse effect that is *most likely* to be caused by this treatment.
(*mark it with a tick*)'

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Adverse Drug Reactions – Type B – 'Select the prescription that is *most likely* to be contributing to the [*insert adverse effect*].
(*mark it with a tick*)'

Adverse Drug Reactions – Type C – 'Select the prescription that is *most likely* to interact with [*the drug specified in the stem*] to [*describe the clinical problem here*].
(*mark it with a tick*)'

Adverse Drug Reactions – Type D – 'Select the *most appropriate* option for the management of this adverse drug reaction.
(*mark it with a tick*)'

Drug Monitoring – 'Select the *most appropriate* option to monitor for the [*beneficial/adverse*] effects of this prescription [after x hours/days/months etc.] of treatment.
(*mark it with a tick*)'

Data Interpretation – 'Select the *most appropriate* decision option with regard to *the [(insert drug name here) prescription/the treatment of (describe clinical condition here)*] based on these data.
(*mark it with a tick*)'

The five options

The Prescribing and Calculation skills items require the candidate to enter the answer into a blank form. For Prescription Review items the options are the pre-existing prescriptions related to the case scenario. For all other items there will be five options that contain one correct answer to the lead-in question and four distractors.

Make sure that all the options are:

- relevant to the stem and follow logically from it
- supported by information in the stem, so that candidates can anticipate their appearance
- related to the lead-in
- balanced in length and content and not overcomplicated.

The first word of each option should begin with a **lower-case letter**, unless this word is a proper noun. The answer options will be automatically sorted into **alphabetical order** by the on-line authoring software (any that start with a number or Greek character will be placed first) and labelled A to E. The four distractors should be plausible and realistic; answers that are clearly wrong lessen the question's ability to discriminate among candidates. Authors should indicate the correct answer in the item template by selecting it with a tick.

To minimise the challenge presented by having to read through 60 questions, the style and format of each item are standardised. A guide to the preferred style is presented in **House style** below.

Resources

Resources, such as clinical images, excerpts of longer guidance, nomograms and replicas of e-prescribing system alerts, may be used to

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complement items in the PSA. Use resources only if their interpretation is needed to reach the correct answer, and avoid using images that render the stem redundant because image identification leads directly to the correct answer. For information about resources and issues of consent see **Appendix VI**.

Constructing good quality multiple choice questions

The approach that leads most reliably to a good quality question uses the following principles (adapted from NBME guide):

Each item should focus on an important concept or testing point.
Examples of unexpected ignorance, misconceptions or errors of judgement that have become apparent when teaching students usually offer fruitful ideas for testing-points.

Each item should assess application of knowledge, rather than pure recall or ability to look up an isolated fact.
PSA items should test synthesis (the ability to interpret information (from the scenario, the BNF and any resources embedded in the question) and integrate it to reach a conclusion), and/or judgement (the ability to choose a course of action taking into account the advantages and disadvantages of the alternatives).

The item lead-in should be focused, closed and clear. If the item does not pass this '**cover-test**', the scenario may need amending to make it clear that other predictable correct options have already been addressed in the scenario.

The question should be related to the case vignette. Questions that can be answered without reference to the vignette are to be avoided.

All options should be homogenous and plausible to avoid cueing to the correct option.
Create plausible distractors containing sufficient detail to make them credible. Make sure that these are indisputably less correct than the correct answer.

Each item should be reviewed to identify and remove technical flaws that add irrelevant difficulty or benefit savvy test-takers.
The stem should be written as economically as possible, and the lead-in and the alternative answers must follow logically from it. Avoid having two directly contradictory options, as these may rule out the other distractors.

Provide feedback for each answer option
This supports the QA process and, if the item is used in a practice paper, may help a candidate understand why their answer was incorrect. Where possible, include a specific reason why the correct option is preferred to each of the individual distractors.

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Check that the style of the item conforms to that preferred by the PSA (see House style and Model items). This includes appropriate metadata tagging of each item.

Common pitfalls

- Information presented out of order (e.g. elements of past medical history in first line of stem, examination findings/investigations with presenting condition, symptoms interspersed with/following examination findings)
- Excessive detail, irrelevant medical/drug/family/social history, examination findings or investigations. N.B. For brevity, allergy history is only included if relevant to the specific scenario.
- Use of the past tense – scenarios should be written in the present tense
- Abbreviations that are not listed as acceptable in the PSA
- Investigations listed in order different from that used in Table of Normal Values, containing incorrect units or lacking reference ranges
- Options in Providing Information items using language/terminology that would be inappropriate for the intended recipient
- Drug histories containing prescriptions for which no indication is shown
- Calculation skills items resulting in doses that can't be accurately measured or administered, and/or where variations in arithmetical rounding may result in more than one acceptable answer
- Calculation skills items involving reconstitution that omit to take the displacement value of the active substance into account
- Data Interpretation items containing no data, or data irrelevant for selection of correct prescription option
- Questions about lesser known or unimportant facts that test 'BNF look-up' skills without any application of knowledge

Rules regarding use of artificial intelligence and the PSA

- Generative AI can be used to generate **ideas** for question topics
- It **must not** be used to generate PSA content (especially on a public server) – this includes writing questions for use locally
- To protect the integrity of the PSA item bank, never provide an AI tool with prompts for generating PSA content, such as by uploading:
    - items (including own drafts)
    - house style guides
    - item templates
    - blueprints

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Summary points

- avoid over-elaborate case presentations
- ensure that clinical scenarios and knowledge, skills and judgement required are relevant to the work of a Foundation doctor
- check that questions pass the cover test
- avoid asking questions about trivial facts
- avoid asking questions that trick candidates or deliberately mislead them
- avoid lists of options that are unnecessarily complicated
- avoid making the preferred option significantly longer than the others
- avoid use of double options unless all five alternatives comprise double options
- avoid including options with common characteristics, where distractors are conceived simply as permutations of the correct answer
- avoid presenting information for the first time in the list of options
- make sure that numeric data are stated consistently
- avoid including words or terms in the stem that cue the correct answer
- do not prompt generative AI to create PSA-style item content

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House style

The following recommendations are conventions that the top publishers prefer, and which we have adopted as house style (with a few exceptions as noted).

Abbreviations
Avoid abbreviations in the stem wherever possible by spelling out the full words, at least the first time they appear in a single item. Exceptions include common abbreviations related to the clinical history, medicine administration routes and frequencies, examination and investigations. A full list of these accepted abbreviations, which do not require definition, is provided in Appendix I.

For all items: Use the abbreviated forms of medicine administration routes and frequencies (as listed in Appendix l) in the case presentation.
For MAN, COM, ADR, TDM and DAT items, use the abbreviated forms of medicine administration routes and frequencies (as listed in Appendix l) in the options list.
For REV items use the full description of medicine administration routes and frequencies (including the abbreviation in parentheses) in the list of current prescriptions. These should be selected from the drop-down lists provided.

Abbreviations of more than one capital letter take no full stops (e.g. CT, MCV, not C.T., M.C.V.)

Units of time will be written in full when they appear in the stem (years, weeks, hours, minutes) but most will be abbreviated when they appear in the investigations or in the answers (h, min, s). The exception will be when the time of day is used in the stem: this will be written using the 24-h clock notation (i.e. 09.00 h).

When expressing measurements, the following technical abbreviations are preferred:
HbA_{1c}, kPa, P_aCO_2, P_aO_2 (or, if already clear that these are results of arterial blood gases, PCO_2, PO_2), S_aO_2.

Transfer factor and transfer coefficient will be written out in full, at the least on the first occasion that they appear.

The choice of ‘a’ and ‘an’ before an abbreviation depends on pronunciation, not spelling. Thus, write ‘a CT scan’, but ‘an MRI scan’.

Font
The on-line authoring system at https://admin.prescribingsafetyassessment.ac.uk/ automatically formats the text to the desired style. The default font is Calibri 12-point. This can be emboldened, italicised, underlined and altered to super/subscript where required (for example for scientific terms (e.g. HbA_{1c} and ^{14}C-labelled)).

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Grammar and spelling
The following are examples of preference and rules concerning words or expressions to be used in PSA items.

Avoid the terms 'known', 'known to be' and 'known to have' in relation to a diagnosis; thus, it is preferable to write 'A 48-year-old man with hypertension' rather than 'A 48-year-old man with known hypertension'.

Capitalise the first letter of proper names (e.g. Gram positive) and the generic names of bacteria (when referring to both the genus and the species), but use lower case for all other nouns, including hospital departments (e.g. emergency department, intensive care unit, outpatient clinic), clinicians (e.g. cardiologist) and disorders (e.g. type 2 diabetes).

Write:
- 'A 30-year-old man/woman', not 'male/female'
- 'He is found to have type 2 diabetes', not 'he is diagnosed with type 2 diabetes'
- 'The outpatient clinic', not 'outpatients'
- 'Breathlessness of sudden onset', not 'sudden onset breathlessness'
- '**DH.** Warfarin sodium 3 mg PO daily', not 'she is taking warfarin'
- 'He is advised to take', or' His GP prescribes a course of x' not 'he is prescribed'
- 'He is treated with', not 'he receives' or 'he is started on'
- 'She undergoes dialysis', *not* 'she has dialysis' *or* 'she is dialysed'.

Prefer 'because of' to 'due to', 'before' to 'prior to', 'comprised' to 'consisted of', 'started' to 'commenced', 'concentration' (of a substance in blood/urine) to 'level', 'concentration' (of a drug or compound in solution) to 'strength', 'orientated' to 'oriented', and 'vasodilatation' to 'vasodilation'.

Use digraphs if their Latin or Greek roots support them. Thus, write anaemia, caecum and faecal, diarrhoea and oesophagus, but leucopenia, thrombocytopenia and osteopenia, and fetal, never foetal. Write oestradiol when referring to the hormone, but estradiol when referring to the drug.

Prefer -ise to -ize. Whereas -ize is used without exception by American writers and publishers and is championed in the United Kingdom by Oxford University Press, most other publishers (and writers) in the UK favour -ise. Thus, write generalised and luteinising hormone.

Resist the tendency to create verbs from nouns. Thus, 'the patient was endoscoped and lasered' should read 'the patient underwent endoscopy and laser treatment'.

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Examination findings and investigations

Present the examination findings in the following order:
1. temperature
2. pulse (HR)
3. blood pressure (BP)
4. jugular venous pressure (JVP)
5. respiratory rate (RR)

Urinalysis results should be placed at the end of the examination paragraph, not in the list of investigations, using the form 'Urinalysis showed blood +, protein ++, leucocytes trace, nitrites nil.'
Write 'mini-mental state examination' and 'Glasgow coma score'.

List relevant investigations in the standard order haematology-biochemistry-ECG-radiology-other investigations.

The term 'X-ray' (not x-ray, x ray or X-Ray), although not strictly correct, is widely understood and need not be replaced by 'radiograph'. Refer to 'CT (or MR) scan'. Thus, write:

- 'CT scan head'
- 'MRI scan brain'
- 'US abdomen'
- 'isotope bone scan'
- 'ventilation/perfusion isotope lung scan'.

When referring to imaging investigations **in the list of investigations**, refer to echocardiogram (the visible record) rather than echocardiography (the investigation). Similarly, refer to MR angiogram, electroencephalogram, etc. However, when referring to imaging investigations **in the list of options**, refer to echocardiography (the investigation) not echocardiogram (the visible record). Similarly, refer to angiography, electroencephalography, endoscopic retrograde cholangiopancreatography, etc.

Grand Exemplars

The image below illustrates the preferred layout of the case presentation, on examination and investigations sections of a question. No single question would contain this much detail, but the ordering, and formatting and other conventions in this illustration may be used as an exemplar of how to present the relevant details.

Grand Exemplar – case presentation, on examination and investigations sections

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Case presentation
A [*age*]-year-old [*man/woman/child*] presents to [*location and situation*] with [*symptom*] etc. **PMH.** Disease 1, disease 2, disease 3 .. [*describe any past medical history relevant to the scenario*]. **DH.** Generic name (brand name if required®) 5 mg PO daily, drug 20 mg PO 8-hrly, drug 1 g PO as required. [*list any current prescriptions*]. **FH.** Father died of asthma. **SH.** [*include any relevant social history*].

On examination
Include any general observations here. Temperature 37.0°C, HR 94/min and rhythm regular, BP 116/76 mmHg, JVP 4 cm above sternal angle, RR 16/min, O_2 sat 94% breathing air. Apex beat in 6th left intercostal space, anterior axillary line, HS normal, bilateral ankle oedema. Inspiratory crackles at both lung bases. PEFR 200 L/min (60% of expected). Abdomen soft, with hepatomegaly 4 cm below right costal margin. Neurological examination normal. Weight 76 kg.

Investigations
Hb 140 g/L (130–175/115–165), MCV 90 fl (80–96), WCC 6.0 × 10^9/L (4.0–11.0), platelets 200 × 10^9/L (150–400), PT 13 s (11.5–15.5), INR 1.0 (<1.4), ESR 40 mm/1st h (<20).
Na^+ 140 mmol/L (137–144), K^+ 4.2 mmol/L (3.5–5.3), U 7.2 mmol/L (2.5–7.0), Cr 85 µmol/L (60–110), eGFR 36 mL/min/1.73 m^2 (>60).
Alb 36 g/L (37–49), bili 34 µmol/L (1–22), ALT 30 U/L (5–35), alk phos 50 U/L (45–105), GGT 90 (<50), HbA_{1c} 30 mmol/mol (20–42). CRP 5 mg/L (<10).

ECG shows sinus tachycardia, LBBB.
CXR shows consolidation in left lower zone (see image).
US abdomen shows fatty liver.
CT brain shows left temporal subdural haematoma.

The image below shows the preferred layout of the current prescription section of REV items, illustrating the correct descriptions for medicines (including combination preparations, those requiring trade names, and non-solid dose forms). The expressions of dose, route and frequencies should be selected from the drop-down lists provided.

Grand exemplar - current prescription in REV items

Current Prescription

Medicine	Dose	Route	Frequency	A	B
beclometasone dipropionate (Clenil Modulite®)	200 micrograms	inhaled (INH)	twice daily (12-hrly)	✔	✘
co-amoxiclav (amoxicillin 250 mg/clavulanic acid 125 mg)	one tablet	oral (PO)	three times daily (8-hrly)	✔	✘
ethinylestradiol 30 micrograms/levonorgestrel 150 micrograms	one tablet	oral (PO)	daily	✘	✘
gentamicin 0.3% ear/eye drops	one drop	to left ear	five times daily	✘	✘
haloperidol decanoate	50 mg	intramuscular (IM)	every 4 weeks	✘	✘
hydrocortisone 1% cream	one application	topical (TOP)	daily	✘	✘
insulin lispro (Humalog®)	1 unit per 10 g carbohydrate	subcutaneous (SC)	three times daily (before meals)	✘	✘
isosorbide mononitrate m/r	30 mg	oral (PO)	twice daily (at 08:00 and 14:00)	✘	✘
nicotine lozenges	1 mg	oromucosal	as required	✘	✘
theophylline m/r (Uniphyllin SA®)	300 mg	oral (PO)	twice daily (12-hrly)	✘	✔

Nomenclature

Bacteria and viruses

Although it is conventional for the Latinised names of bacteria in binary combination (stating both genus and species) to be italicised (e.g. *Streptococcus faecalis, Chlamydia* spp.), **we do not follow this convention** as italic script can be challenging for dyslexic candidates. Nevertheless, where the name of a bacterium appears in binary combination, the generic name should begin with a capital letter, with the specific name all in lower case. Anglicised versions of these names used in a general sense should appear in lower-case roman (e.g. staphylococcal

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infection, legionella pneumonia). Viruses are known by their subfamily names (herpes simplex virus, enterovirus), which are never italicised.

Genetic terms
Denote genes and chromosomes by letters and numbers. Whereas the names of bacterial and bacteriophage genes are italicised, genes from higher animals are usually referred to using roman letters (e.g. tRNA genes). Oncogenes are denoted as: c-myc, c-ras etc. Plasmid names are roman and start with a lower-case p. Endonucleases should take the form EcoRI, Sau3A etc. Denote chromosomes by roman capitals (e.g. X and Y). Generations are referred to also by lettered symbols in roman capitals: the parental (P), the first generation (F1), the second generation (F2) and so on.

Medicines
Use British Approved Name for medicinal substances. Refer to **Appendix III: Table of BANs** for list of BANs amended to conform with the Recommended International Non-proprietary Names (rINN). All non-proprietary names of medicines are lower case. Include the salt name of a medicine if it is provided in the BNF index.

For the small number of medicines that should be prescribed by a proprietary or trade name (such as biological medicines and those with pharmacokinetic variations between products) this should be identified by including the trade name in parentheses that follow the generic pharmacological component(s) and their strength. Proprietary names will begin with a capital letter and retain a registration or trademark symbol where appropriate. For example, write 'ciclosporin 25 mg (Neoral®) PO daily'.
Combination products should include their generic components (without the salt form), followed by the proprietary name (e.g. beclometasone 87 micrograms/formoterol 5 micrograms/glycopyrronium 9 micrograms per dose inhaler (Trimbow®).

Write 'glucose 5%', not 'dextrose 5%', and 'sodium chloride 0.9%' not 'normal saline'. Write 'β-adrenoceptor blocker', not 'β-blocker' or 'beta-blocker'. When referring to a medicine in an item stem, make clear why it is being taken/given and include the dose, and the route and frequency of administration.

Other conventions in connection with medicines include the following:
- a 'dose' is the amount of a medicine administered at a single point in time, whereas 'dosage' refers to the number and frequency of doses administered over a specific period of time
- refer to a drug 'concentration', not a drug 'level'
- use the term 'regimen' rather than 'regime' when referring to a prescribed medicine or a standard combination of medicines used to treat a specific condition
- use the term 'adverse effect' rather than 'unwanted effect' or 'side-effect.'

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Numbers
As a rule, numbers from one to nine should be in words, with 10 and over in figures, unless this threshold is embraced (e.g. 9 or 10 items, not nine or 10 items). There are three exceptions:

- a number at the beginning of a sentence should always be spelt out
- in text, use arabic numerals when describing age (except for 'thirties', 'forties', etc.), names of conditions (e.g. type 2 diabetes), symbols, all abbreviated forms of units, and all units of time (minutes, hours, days, weeks, months, years)
- when stating medicine dosages, use arabic numerals for the dose (e.g. carbamazepine 200 mg) but spell out the number of dosage units to be administered 'one tablet', 'one inhalation')
- convert the dosing frequency (e.g. three times daily) to a dose interval (e.g. 8-hrly) for dosing at regular intervals. However, use the format 'three times daily (as directed)' for medicines that should be given at other intervals during the day (e.g. oral hypoglycaemics, long-acting nitrates). Do not use abbreviations for Latin terms to signify dosing frequency (e.g. bd, tds, prn)

For numbers less than one, always precede the decimal point by a zero (e.g. 0.75). However, avoid decimal points for the doses of medicines; express doses smaller than 1 g in mg, and doses smaller than 1 mg (e.g. 0.5 mg) as micrograms (this should not be abbreviated, so write 500 micrograms, not 500 µg). In contrast to the requirement for expressing units of dose in full, units of measurement may be abbreviated to µg (e.g. µg/mL) as this is less likely to introduce error.

Always express temperature to one decimal place (e.g. 37.0°C, not 37°C) and ensure that all investigation results are expressed to the same number of decimal places as are used in their respective reference ranges.

Punctuation
Insert only a single letter space after all sentence punctuation, including full stops. Use a soft return (shift-enter) to move to a new line after section headings but use hard returns (enter) to create a new paragraph, such as a new section of the case presentation.

Apostrophes
Write 'an 8-month history', and '3 months pregnant', but '6 months' duration'. Apostrophes are not used in toponymic designations (e.g. Ebola fever, Lyme disease), but still tend to be used for eponymic designations that derive from one person's name (e.g. Alzheimer's disease, Graves' disease), despite the trend in North America towards using bare surnames. Eponymic designations that derive from two or more names do not carry an apostrophe (e.g. Creutzfeldt–Jakob disease), nor do commonly used abbreviations (e.g. flu).

Commas
The comma that is used to separate numbers into units of three (e.g. 2,200) is dropped in technical and scientific work (2200) and replaced by a space for five-figure numbers and above (32 400, 3 240 000).

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En rules
En rules are slightly longer than hyphens. Between names they distinguish between eponyms that are derived from the names of two people (e.g. Cheyne–Stokes) as opposed to those derived from the double-barrelled or unhyphenated name of one person (e.g. Brown-Séquard, Bence Jones). Thus, write Epstein–Barr virus, not Epstein-Barr or Epstein Barr.

En rules, not hyphens, are also used between words of equal importance whose order can be reversed without loss of meaning (e.g. dose–response, cost–benefit, tonic–clonic).

En rules are also used to indicate a range, without spaces before or after. Thus, write 76–96, not 76 – 96 or 76-96.

An en rule is also used to denote a minus sign.

To type an en rule, press Ctrl and the minus key on the numeric keyboard (using a PC), or Alt and the hyphen key (using a Mac). When using a PC laptop with no numeric keyboard, an en rule can be obtained from the Symbol menu.

Hyphens
Adjectives comprising prefixes are set as one word (e.g. antituberculous, postoperative), but use a hyphen for ease of reading where there is a risk of mispronunciation (e.g. un-ionised, nephro-urogram). Exceptions include nouns such as post mortem and amino acid.

Words beginning with ‘non’, indicating negation, are usually hyphenated (e.g. non-scaly, non-proliferative).

Use hyphens when referring to fractions (e.g. one-half, two-thirds) or compound numbers (e.g. twenty-four, thirty-six).

Compound modifiers that precede a noun are hyphenated (long-standing hypertension, first-degree heart block) but those that follow a noun are not. Do not hyphenate adjectival compounds beginning with adverbs ending in -ly (e.g. negatively worded questions).

Hyphenate ‘30 pack–year smoking history’ without a hyphen between the number and ‘pack’.

When writing the names of antibodies, use a hyphen where the name of the antibody includes an abbreviation (e.g. anti-Ro), or where the name includes more than one word (e.g. anti-neutrophil cytoplasmic antibodies, anti-smooth muscle antibodies, anti-hepatitis C antibodies); do not use a hyphen where the antibody is a single word (e.g. anticentromere, antimitochondrial), unless there is a danger of mispronunciation.

Plurals
Abbreviations form the plural by adding -s, not -’s (e.g. ECGs). Abbreviated units of measurement usually take the same form in both singular and plural (e.g. mg, mL, h).

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Quotation marks
British practice is to enclose quoted matter between single (not double) quotation marks, and this rule also applies to expressions that may be unfamiliar to some candidates (e.g. 'well-woman clinic'). Double quotation marks should be used only for direct speech.

Spacing
Write <5 or –10 (not < 5 or – 10), 36.9°C (not 36.9 °C) and 20% (not 20 %), but otherwise leave a space between a numeral and any units (e.g. 25 mg, 120/70 mmHg), and either side of × and = signs.

Symbols
Abbreviate litre as 'L' (not 'l') and millilitre as 'mL' (not 'ml') and write µmol, (not umol), mmHg, cm, H_2O and × (from symbol menu), not x (e.g. 4.2×10^9/L). The degree symbol in 37.0°C' is also Symbol font, not a superscript letter 'o'. Many symbols have keyboard shortcuts but these differ depending on the hardware being used, so a list of shortcuts is not provided.

Isotopes should be written as a superscript number preceding the elemental abbreviation (e.g. ^{14}C, ^{131}I).

Greek characters
Use α, β, γ, etc. rather than alpha, beta, gamma, etc. For example, TNF-α, TNF-β,
β-adrenoceptor blocker, β_2-agonist, etc. (Exceptions: gamma globulin, epoetin alfa, interferon beta, and other drug names.)

Ethnicity
Only include the patient's ethnicity if it is relevant to the question being asked. If so, use the UK Government's terminology of ethnic groups available at https://www.ethnicity-facts-figures.service.gov.uk/style-guide/ethnic-groups/

Table style

To insert a table, produce the table in a Word document, copy it and then use the 'paste from Word' button to insert the table into the item form. The following style is recommended for tables:

- Use lower case throughout, except for proper names, chemical symbols (such as PO_2, mmHg) (see Example 1 below)
- Headings for columns should be in bold. Headings for rows will be non-bold, unless other values are given and contrasted with normal values, when the word 'normal' should appear in bold (see Example 2 below)
- Column headings should follow the order of the Table of reference ranges and thresholds
- Align decimal points vertically.

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Example 1.

	PO_2	**PCO_2**	**pH**	**bicarbonate**
pre-treatment	12.1	5.6	8.1	45
post-treatment	11.5	4.8	7.4	21

Example 2.

	mean arterial pressure (mmHg)	**mean right atrial pressure (mmHg)**	**mean pulmonary arterial pressure (mmHg)**	**mean pulmonary arterial wedge pressure (mmHg)**	**mean cardiac output (L/min)**
normal	**85**	**3**	**15**	**9**	**5.0**
Day 1	80	8	22	20	3.0
Day 2	110	18	20	11	4.0
Day 3	85	6	16	8	2.5
Day 4	66	20	22	20	2.0
Day 5	75	2	12	8	3.5

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When including a table to show data that has changed over time, either embed it in the item, or create the table in Word and attach an image as a resource. The time periods and reference ranges should be presented as columns and the criteria that is being measured included as a row, as in the example below:

	before statin	**3 months after initiation**	**reference range**
serum cholesterol	6.9 mmol/L	3.4 mmol/L	(<5.2)
serum LDL cholesterol	4.80 mmol/L	2.00 mmol/L	(<3.36)
serum HDL cholesterol	0.98 mmol/L	0.96 mmol/L	(>1.55)
fasting serum triglycerides	2.02 mmol/L	1.38 mmol/L	(0.45–1.69)

Where there are multiple values of one measurement over times of day, then put the times in the columns, and the days in the rows as follows:

	Blood Glucose Concentration (mmol/L)			
	Before Breakfast	Before Lunch	Before Evening Meal	Before Bedtime
Day 1	10.8	6.8	6.4	6.8
Day 2	11.1	6.7	6.5	6.1
Day 3	11	6.1	6.3	5.9

Use the terms ‘Day 1, Day 2, Day 3, rather than days of the week, or dates to avoid the need to update the data to align with exam sitting dates.

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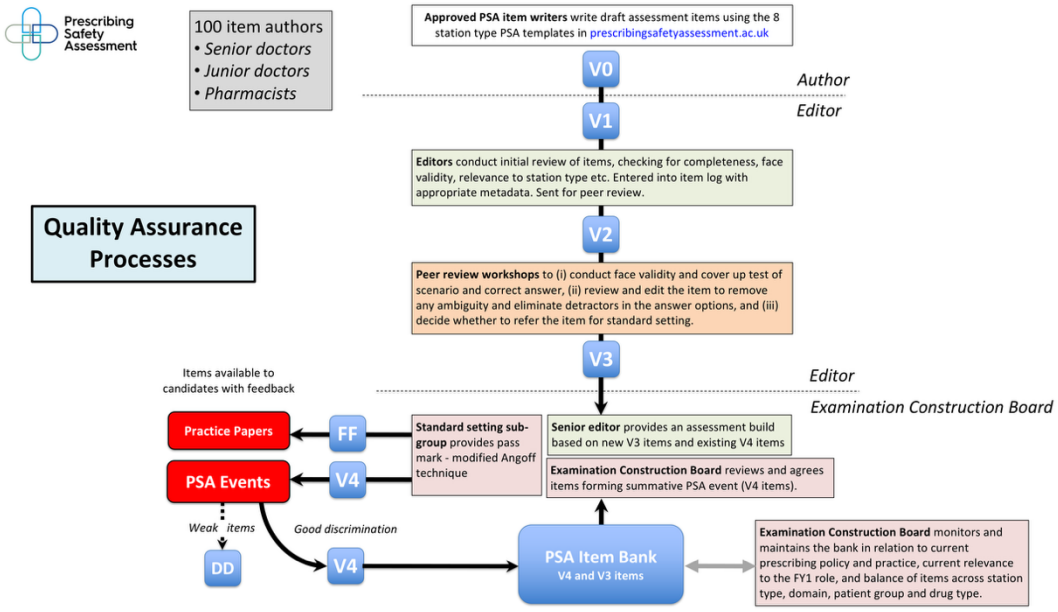
PSA quality assurance process summary

The flow chart below shows the progress of item material through successive versions (V0/VR–V4) from first drafting through the stages of editing and quality assurance to the item bank, and onwards to consideration by the Examination Construction Board and Standard Setting Group for inclusion in an Assessment.



Peer Review Process

The PSA peer review meetings provide assurance that all PSA items that are entered into the item bank (and might be viewed by candidates) are fit for the intended purpose – to assess the prescribing-related competencies described in the blueprint. The meeting format allows a group of clinicians/pharmacists to look in detail at PSA items and assess them against an agreed set of review criteria according to a standardised process. Each event requires people, time, facilities and supporting information.

People

- Clinicians/pharmacists with an understanding of clinical pharmacology and of the prescribing activity required of Foundation doctors, who have attended a training workshop on writing items for the PSA.
- A chair with a detailed understanding of the PSA items and peer review processes. This individual will provide brief training and introduction to the process, will monitor the process and ensure that all of the steps are taken for each item being reviewed.
- Members who work in groups of 4–7. They review edited versions (V2) of the items that group members have written. The group come to a consensus about whether the item is appropriate for inclusion, subject to any modifications being made.

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Quality assurance

- Every alteration that is made to an item is recorded with a fully traceable version history. Whenever an item is edited, a brief explanation of the change that has been made should be entered in the update notes section. Any points that are intended to be considered and/or acted upon by the author, editor or assessment board should be made in the review notes section of the item.
- Items that are unsuitable or require further work are returned to the author (VR).
- Items that are approved by the peer review group are saved as V3.
- Peer review meetings take place annually, ensuring that questions about recent changes in practice are included within the item bank. Psychometric data pertaining to used items is used to review item performance. All items are reviewed periodically, using a rolling programme, to ensure that the bank remains up to date.

Time

- Peer review meetings will usually take place face-to-face over two days at a suitable venue with one overnight stay. In exceptional circumstances, peer review may take place remotely via videoconference.

Facilities

- Separate rooms to accommodate each group. Each group uses a computer, digital projector and screen/plasma screen for real-time editing. Participants usually use their own devices for viewing the interface and accessing the digital versions of the BNF.

Documents and other information

The following will be provided to participants as appropriate:

- PSA Item Writing Manual and Blueprint
- Overview of the PSA peer review process
- A list of items to be peer reviewed in hard copy and on the PSA website
- Certificate of attendance for CPD accreditation
- Expenses claim forms
- Evaluation forms

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Process

Where possible, peer reviewers will consider items in the same style sequentially before moving on to another style. They will examine one item at a time, using the same standardised process. There are three main steps to the peer review process: initial review, detailed review, edit and decisions. These are described in detail below.

Initial review (focus: face validity)

Looking at the scenario and question only:

1) Are the scenario and question relevant to the prescribing duties of an F1 doctor?
2) Do the scenario and question elicit the reasoning and judgement required by the item type (see Blueprint)?
3) Do the scenario and question elicit the measurable action required by the item type (see Blueprint)?

For MCQ items only:

4) Consider the appropriate answer to the question. Reveal the answer option. Does the item pass the cover test? Is the answer option the correct answer?

For Prescribing items only:

5) Consider all the optimal and suboptimal but creditworthy answers to the question. Reveal optimal and sub-optimal answers. Is/are all the optimal and sub-optimal answers included appropriately?

For Calculation Skills items only:

6) Consider the appropriate answer to the question. Reveal the given answer. Is the answer the only correct one?

Detailed review (focus: ambiguity and artificial bias)

Looking at the whole item including the correct answer and feedback provided on why this is the correct answer:

1) Do the scenario and question lead the candidate inappropriately to a correct or incorrect answer (i.e. bias)?
2) Are the scenario and question clear and unambiguous? Consider:
   - appropriate use of language
   - spelling and grammar
   - appropriate and accurate information

For SBA items only and looking at the answer options:

3) Is the correct answer too easy to identify from the list of options?
4) Is the correct answer too difficult to identify from the list of options?

Edit and decisions

1) Record whether the item is accepted or rejected.
   a. If accepted, convert the item status to V3.
   b. If rejected but retrievable, convert the status to VR (returned to author for further work).
   c. If rejected and not retrievable, delete the item (change status to DD)
2) Modify the item as agreed and record any changes made
3) Record brief justification of decisions made

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Revised Edition (August 2026) updated and reviewed by Professor Simon Maxwell (Medical Director, PSA) & Dr Lynne Bollington (Lead Consultant, PSA).

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APPENDIX I
Acceptable terms and abbreviations

Prescribing frequency and form terms (and abbreviations where permitted)

-	as required
-	once only
-	daily
-	nightly
-	every 30 minutes
-	every hour
2-hrly	every 2 hours (2-hrly)
3-hrly	every 3 hours (3-hrly)
4-hrly	six times daily (4-hrly)
-	five times daily (as directed, before food, etc (*as appropriate*))
6-hrly	four times daily (6-hrly)
-	four times daily (as directed, before food, etc (*as appropriate*))
8-hrly	three times daily (8-hrly)
-	three times daily (as directed, before food, etc (*as appropriate*))
12-hrly	twice daily (12-hrly)
-	twice daily (as directed, before food, etc (*as appropriate)*)
-	every other day
-	every 3 days
-	every 4 days
-	twice weekly
-	three times weekly
-	five times weekly
-	weekly
-	every 2 weeks
-	every 4 weeks/monthly
-	every 6 weeks
	every 8 weeks (2-monthly)
	every 12 weeks (3-monthly)
m/r	modified-release

Prescribing route terms (and abbreviations where permitted)

-	buccal
INH	inhaled
-	intradermal
IM	intramuscular
IV	intravenous
-	intravitreal
-	nasal
NEB	nebulised
PO	orally
-	oromucosal
PR	rectal
SL	sublingual
SC	subcutaneous

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-	to both ears
-	to left/right ear
-	to both eyes
-	to left/right eye
TOP	topical
-	transdermal
PV	vaginal

Clinical history

PMH	past medical history
DH	drug history (includes non-prescription, herbal remedies and allergies)
FH	family history
SH	social history

Clinical diagnoses

AF	atrial fibrillation
CKD (stage)	chronic kidney disease
COPD	chronic obstructive pulmonary disease
DVT	deep venous thrombosis
GORD	gastro-oesophageal reflux disease
LBBB/RBBB	left/right bundle branch block
UTI	urinary tract infection
VF	ventricular fibrillation

Clinical examination

ABPM	ambulatory blood pressure monitoring (mmHg)
BMI	body mass index
BP	blood pressure (mmHg)
FEV_1	forced expiratory volume in 1 second
FiO_2	fraction of inspired oxygen
FVC	forced vital capacity
HR	heart rate (per minute)
HS	heart sounds
JVP	jugular venous pressure (centimetres)
NEWS	national early warning score
O_2 sat	peripheral oxygen saturation (SpO_2)
PEFR	peak expiratory flow rate
RASS	Richmond agitation-sedation scale
RR	respiratory rate (per minute)

Other common abbreviations

BNF/BNFC	British National Formulary/BNF for Children
ENT	Ear, Nose and Throat
GP	General practitioner
NHS	National Health Service
NICE	The National Institute for Health and Care Excellence

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Investigations - Haematology

FBC	full blood count
Hb	haemoglobin
MCV	mean cell volume
WCC	white cell count
ESR	erythrocyte sedimentation rate
PT	prothrombin time
INR	international normalised ratio
aPTT	activated partial thromboplastin time

Investigations - Biochemistry

Na^+	serum sodium
K^+	serum potassium
Cl^-	serum chloride
HCO_3^-	serum bicarbonate
U	serum urea
Cr	serum creatinine
eGFR	estimated glomerular filtration rate
CrCl	estimated creatinine clearance
Ca^{2+} (corrected)	serum corrected calcium
Ca^{2+}	serum ionised calcium
PO_4^{3-}	serum phosphate
alb	serum albumin
bili	serum total bilirubin
ALT	serum alanine aminotransferase
AST	serum aspartate aminotransferase
alk phos	serum alkaline phosphatase
GGT	serum gamma-glutamyltranspeptidase
HbA_{1c}	haemoglobin A_{1c}

Investigations – Immunology/Rheumatology

CRP	serum C-reactive protein
HIV	human immunodeficiency virus

Investigations - Others

AXR	abdominal X-ray
CSF	cerebrospinal fluid
CTPA	CT pulmonary angiogram
CXR	chest X-ray
DEXA	dual energy X-ray absorptiometry (scan)
US	ultrasound scan
CT	computerised tomography
MRI	magnetic resonance imaging (scan)
TSH	serum thyroid stimulating hormone

Units of measurement

g/L	grams per litre
mg/L	milligrams per litre
µg/L	micrograms per litre
mmol/L	millimoles per litre
µmol/L	micromoles per litre

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APPENDIX II

Table of reference ranges and thresholds

Ranges appear in the order in which values should appear in lists of investigations. The name of the investigation should appear in full in each item, unless the abbreviated form is shown in parentheses beside it. The units appear before the ranges in parentheses for ease of copying and pasting from this document to items. Italicised words should not be reproduced in items. Variants of the most commonly reported values for pregnant women and children are given in dark grey.

Haematology

Haemoglobin (Hb)	
males	g/L (130–175)
females	g/L (115–165)
pregnant women	g/L (105–140)
infants and children	
0–6 days	g/L (145–220)
7 days	g/L (140–186)
8 days – 3 months	g/L (95–125)
3 months – 4 years	g/L (110–140)
5–12 years	g/L (115–140)
red cell count	
males	$\times 10^{12}$/L (4.3–5.9)
females	$\times 10^{12}$/L (3.5–5.0)
infants and children	
at birth (full term)	$\times 10^{12}$/L (3.7–6.5)
2 weeks	$\times 10^{12}$/L (3.9–5.9)
4 weeks	$\times 10^{12}$/L (3.1–4.3)
2–6 months	$\times 10^{12}$/L (3.9–5.5)
6 months – 1 year	$\times 10^{12}$/L (4.1–5.3)
1–6 years	$\times 10^{12}$/L (3.9–5.3)
6–12 years	$\times 10^{12}$/L (4.0–5.2)
haematocrit	
males	(0.40–0.52)
females	(0.36–0.47)
infants and children	
at birth (full term)	(0.47–0.75)
2 weeks	(0.41–0.65)
4 weeks	(0.28–0.42)
2–6 months	(0.31–0.41)
6 months – 1 year	(0.33–0.41)
1–6 years	(0.34–0.40)
6–12 years	(0.34–0.45)

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mean cell volume (MCV)	
adults	fL (80–96)
infants and children	
0–3 months	fL (100–130)
3–4 months	fL (85–100)
4 months – 4 years	fL (70–86)
4–12 years	fL (77–91)
mean cell haemoglobin (MCH)	
adults	pg (27–33)
infants and children	
0–3 months	pg (31–37)
3–4 months	pg (27–33)
4 months – 12 years	pg (23–31)
mean cell haemoglobin concentration (MCHC)	g/dL (32–35)
white cell count (WCC)	
adults	$\times 10^9$/L (4.0–11.0)
pregnant women	$\times 10^9$/L (6.0–16.0)
infants and children	
0–6 days	$\times 10^9$/L (10.0–26.0)
7 days	$\times 10^9$/L (5.0–21.0)
8 days – 6 months	$\times 10^9$/L (6.0–15.0)
7 months – 5 years	$\times 10^9$/L (5.0–12.0)
neutrophils	
adults	$\times 10^9$/L (1.5–7.0)
infants and children	
0–3 days	$\times 10^9$/L (5.0–13.0)
4 days	$\times 10^9$/L (1.5–10.0)
5 days – 6 years	$\times 10^9$/L (1.5–8.0)
7–11 years	$\times 10^9$/L (2.0–6.0)
lymphocytes	
adults	$\times 10^9$/L (1.5–4.0)
infants and children	
0–2 days	$\times 10^9$/L (2.0–4.5)
3 days	$\times 10^9$/L (3.0–9.0)
4 days – 12 months	$\times 10^9$/L (4.0–10.0)
1–6 years	$\times 10^9$/L (1.5–9.5)
7–10 years	$\times 10^9$/L (1.5–7.0)
monocytes	
adults	$\times 10^9$/L (0.20–1.00)
infants and children	
0–3 days	$\times 10^9$/L (0.50–1.50)
4 days – 6 years	$\times 10^9$/L (0.30–1.10)
7–10 years	$\times 10^9$/L (0.20–1.20)

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eosinophils	
adults	× 10^9/L (0–0.40)
infants and children	
0–3 days	× 10^9/L (0.10–2.00)
4 days – 6 years	× 10^9/L (0.10–1.00)
7–10 years	× 10^9/L (0.10–0.80)
basophils	× 10^9/L (0–0.10)
platelets	× 10^9/L (150–400)
reticulocytes	× 10^9/L (25–85)
reticulocytes	% (0.5–2.4)
erythrocyte sedimentation rate (ESR)	
adults	mm/h (<20)
pregnant women	mm/h (18–70)
plasma viscosity (25°C)	mPa/s (1.50–1.72)

Coagulation screen

prothrombin time (PT)	s (11.5–15.5)
international normalised ratio (INR)	(<1.4)
but, for patients taking warfarin (INR)	(target 2.5 (or 3.5))
activated partial thromboplastin time (aPTT)	s (30–40)
thrombin time	s (15–19)
fibrinogen	g/L (1.8–5.4)
bleeding time	min (3.0–8.0)

Coagulation factors

factors II, V, VII, VIII, IX, X, XI, XII	IU/dL (50–150)
von Willebrand factor antigen	IU/dL (45–150)
von Willebrand factor activity	IU/dL (50–150)
protein C	IU/dL (80–135)
protein S	IU/dL (80–120)
antithrombin	IU/dL (80–120)
activated protein C resistance	(2.12–4.00)
fibrin degradation products	mg/L (<100)
D-dimer	mg/L (<0.5)

Haematinics

serum iron	µmol/L (12–30)
serum iron-binding capacity	µmol/L (45–75)
serum ferritin	µg/L (15–300)
serum transferrin	g/L (2.0–4.0)
serum vitamin B_{12}	ng/L (160–760)
serum folate	µg/L (2.0–11.0)
red cell folate	µg/L (160–640)
serum haptoglobin	g/L (0.13–1.63)
zinc protoporphyrin:haemoglobin ratio	µmol/mol haemoglobin (<70)
haemoglobinopathy screen:	
haemoglobin A	% (>95)
haemoglobin A_2	% (2–3)
haemoglobin F	% (<2)
haemoglobin S	% (0)
transferrin saturation	% (20–50)
methaemoglobin	% (<1)

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Chemistry

Blood

serum sodium (Na^+)	
adults	mmol/L (137–144)
pregnant women	mmol/L (130–140)
serum potassium (K^+)	
adults	mmol/L (3.5–5.3)
pregnant women	mmol/L (3.3–4.1)
serum chloride (Cl^-)	mmol/L (95–107)
serum bicarbonate (HCO_3^-)	mmol/L (20–28)
anion gap	mmol/L (12–16)
serum urea (U)	
adults	mmol/L (2.5–7.0)
pregnant women	mmol/L (2.4–4.2)
infants and children	
0–12 months	mmol/L (0.8–5.5)
1–16 years	mmol/L (2.5–6.5)
serum creatinine (Cr)	
adults	µmol/L (60–110)
pregnant women	µmol/L (44–77)
infants and children	
Neonate	µmol/L (21–75)
1 month – 4 years	µmol/L (13–39)
5–11 years	µmol/L (29–53)
12+ years	µmol/L (40–90)
estimated glomerular filtration rate (eGFR)*	mL/min/1.73 m^2 (>60)
creatinine clearance (CrCl)*	mL/min (>90)

* Either eGFR or CrCl can be used, in line with relevant BNF monograph

serum corrected calcium (Ca^{2+} (corrected))	mmol/L (2.20–2.60)
serum ionised calcium (Ca^{2+})	mmol/L (1.13–1.32)
serum phosphate (PO_4^{3-})	mmol/L (0.8–1.4)
serum total protein	g/L (61–76)
serum albumin (alb)	g/L (37–49)
serum globulin	g/L (24–27)
serum total bilirubin (bili)	µmol/L (1–22)
serum conjugated bilirubin	µmol/L (<3.4)
serum alanine aminotransferase (ALT)	U/L (5–35)
serum aspartate aminotransferase (AST)	U/L (1–31)
serum alkaline phosphatase (alk phos)	U/L (45–105)
serum gamma glutamyl transferase/transpeptidase (GGT)	
males	U/L (<50)
females	U/L (4–35)
serum lactate dehydrogenase	U/L (10–250)
serum acid phosphatase	U/L (2.6–6.2)
serum creatine kinase	
males	U/L (24–195)
females	U/L (24–170)
serum creatine kinase MB fraction	% (<5)
serum troponin I	µg/L (<0.1)
serum troponin T	µg/L (<0.01)
high-sensitivity troponin I	ng/L (<36)

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fasting plasma glucose	mmol/L (3.0–6.0)
random (or 'finger prick') capillary glucose	mmol/L (<11.1)
haemoglobin A_{1c} (HbA_{1c})	mmol/mol (20–42)
serum α_1-antitrypsin	g/L (1.1–2.1)
serum copper	µmol/L (12–26)
serum caeruloplasmin	mg/L (200–350)
serum aluminium	µg/L (<10)
blood lead	µmol/L (<0.5)
serum magnesium	mmol/L (0.75–1.05)
serum zinc	µmol/L (6–25)
serum urate	
males	micromol/L (230–460)
females	micromol/L (190–360)
plasma lactate	mmol/L (0.6–1.8)
plasma ammonia	µmol/L (12–55)
serum angiotensin-converting enzyme	U/L (25–82)
plasma fructosamine	µmol/L (<285)
serum amylase	U/L (60–180)
serum osmolality	mosmol/kg (278–300)
serum osmolar gap	mosmol (<10)
thiopurine methyltransferase	U/L (>25)
random (or 'finger-prick') capillary ketones	mmol/L (<0.6)

Urine

glomerular filtration rate	mL/min (70–140)
24-h urinary total protein	g (<0.2)
24-h urinary albumin	mg (<30)
24-h urinary creatinine	mmol (9–18)
24-h urinary calcium	mmol (2.5–7.5)
24-h urinary copper	µmol (0.2–0.6)
24-h urinary urate	mmol (<3.6)
24-h urinary oxalate	mmol (0.14–0.46)
24-h urinary urobilinogen	µmol (1.7–5.9)
24-h urinary coproporphyrin	nmol (<300)
24-h urinary uroporphyrin	nmol (6–24)
24-h urinary δ-aminolevulinate	µmol (8–53)
24-h urinary 5-hydroxyindoleacetic acid	µmol (10–47)
urinary osmolality	mosmol/kg (100–1000)
urinary osmolality after dehydration	mosmol/kg (>750)
urinary albumin:creatinine ratio	
males	mg/mmol (<2.5)
females	mg/mmol (<3.5)
urinary protein:creatinine ratio	mg/mmol (<30)
urine microscopy:	
white cells	/µL (<10)

Faeces

stool weight (non-fasting)	g (<200)
24-h faecal nitrogen	mmol (70–140)
24-h faecal urobilinogen	µmol (50–500)

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24-h faecal coproporphyrin	µmol (0.018–1.200)
faecal coproporphyrin	mmol/g dry weight (0.46)
24-h faecal protoporphyrin	µmol (<4)
faecal protoporphyrin	nmol/g dry weight (<220)
faecal total porphyrin	
ether soluble	nmol/g dry weight (10–200)
ether insoluble	nmol/g dry weight (<24)
24-h faecal fat (on normal diet)	mmol (<20)
osmolality	mosmol/kg (300)
osmolar gap [300 – 2 × (faecal Na + K)]	mosmol/kg (<100)
faecal calprotectin	µg/g (<50)
faecal elastase	µg/g (>200)
faecal α_1-antitrypsin	µg/g (<300)

Lipids and lipoproteins

serum cholesterol	mmol/L (<5.2)
serum LDL cholesterol	mmol/L (<3.36)
serum HDL cholesterol	mmol/L (>1.55)
fasting serum triglycerides	mmol/L (0.45–1.69)

Arterial blood gases, breathing air

PO_2	kPa (11.3–12.6)
PCO_2	kPa (4.7–6.0)
pH	(7.35–7.45)
H^+	nmol/L (35–45)
bicarbonate	mmol/L (21–29)
base excess	mmol/L (±2)
lactate	mmol/L (0.5–1.6)
carboxyhaemoglobin:	
non-smoker	% (<2)
smoker	% (3–10)
oxygen saturation (incl. target range if receiving O_2)	% (target 94–98)
methaemoglobin	% (<1)

Venous blood gases

PO_2	kPa (4.0–5.3)
PCO_2	kPa (5.5–6.8)
pH	(7.31–7.41)
H^+	nmol/L (39–49)
bicarbonate	mmol/L (23–29)

Endocrinology

Adrenal steroids (blood)

plasma renin activity	
(after 30 min supine)	pmol/mL/h (1.1–2.7)
(after 30 min upright)	pmol/mL/h (3.0–4.3)

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plasma aldosterone (*normal diet*)	
(after 30 min supine)	pmol/L (135–400)
(after 4 h upright)	pmol/L (330–830)
plasma aldosterone:renin ratio	(<25)
plasma angiotensin II	pmol/L (5–35)
serum cortisol (09.00 h)	nmol/L (200–700)
serum cortisol (22.00 h)	nmol/L (50–250)
overnight dexamethasone suppression test (after 1 mg dexamethasone):	
serum cortisol	nmol/L (<50)
low-dose dexamethasone suppression test (2 mg/day for 48 h):	
serum cortisol	nmol/L (<50)
high-dose dexamethasone suppression test (8 mg/day for 48 h):	
serum cortisol	nmol/L (should suppress to <50% of day 0 value)
short tetracosactide (Synacthen®) test (250 micrograms):	
serum cortisol (30 min after tetracosactide)	nmol/L (>550)
serum 11-deoxycortisol	nmol/L (24–46)
serum dehydroepiandrosterone (09.00 h)	nmol/L (7–31)
serum dehydroepiandrosterone sulphate	
males	µmol/L (2–10)
females	µmol/L (3–12)
serum androstenedione	
males	nmol/L (1.6–8.4)
females	nmol/L (0.6–8.8)
postmenopausal	nmol/L (0.9–6.8)
serum 17-hydroxyprogesterone	
males	nmol/L (1–10)
females	
follicular	nmol/L (1–10)
luteal	nmol/L (10–20)
serum oestradiol	
males	pmol/L (<180)
females	
postmenopausal	pmol/L (<100)
follicular	pmol/L (200–400)
mid-cycle	pmol/L (400–1200)
luteal	pmol/L (400–1000)
serum progesterone	
males	nmol/L (<6)
females	
follicular	nmol/L (<10)
luteal	nmol/L (>30)
serum testosterone	
males	nmol/L (9–35)
females	nmol/L (0.5–3.0)
serum dihydrotestosterone	
males	nmol/L (1.0–2.6)
females	nmol/L (0.3–9.3)
serum sex hormone binding protein	
males	nmol/L (10–62)
females	nmol/L (40–137)

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Adrenal steroids (urine)

24-h urinary aldosterone	nmol (14–53)
24-h urinary free cortisol	nmol (55–250)

Pancreatic and gut hormones

oral glucose tolerance test (75 g)	
2-h plasma glucose	mmol/L (<7.8)
plasma gastrin	pmol/L (<55)
plasma or serum insulin	
overnight fasting	pmol/L (<186)
after hypoglycaemia (plasma glucose <2.2 mmol/L)	pmol/L (<21)
serum C-peptide	pmol/L (180–360)
plasma glucagon	pmol/L (<50)
plasma pancreatic polypeptide	pmol/L (<300)
plasma vasoactive intestinal polypeptide	pmol/L (<30)

Anterior pituitary hormones

plasma adrenocorticotropic hormone (09.00 h)	pmol/L (3.3–15.4)
plasma adrenocorticotropic hormone (22.00 h)	pmol/L (3.3–15.4)
plasma follicle-stimulating hormone	
males	U/L (1.0–7.0)
females	
follicular	U/L (2.5–10.0)
midcycle	U/L (25–70)
luteal	U/L (0.32–2.10)
postmenopausal	U/L (>30)
serum growth hormone	
basal, fasting and between pulses	µg/L (<0.4)
2 h after glucose tolerance test (75 g)	µg/L (<1)
insulin-induced hypoglycaemia (blood glucose <2.2 mmol/L):	
serum growth hormone	µg/L (>3)
serum cortisol	nmol/L (>580)
serum luteinising hormone	
males	U/L (1.0–10.0)
females	
follicular	U/L (2.5–10.0)
midcycle	U/L (25–70)
luteal	U/L (1.0–13.0)
postmenopausal	U/L (>30)
serum prolactin	mU/L (<360)
serum thyroid-stimulating hormone (TSH)	mU/L (0.4–5.0)

Posterior pituitary hormones

plasma antidiuretic hormone	pmol/L (0.9–4.6)

Thyroid hormones

serum thyroid-binding globulin	mg/L (13–28)

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serum T4	nmol/L (58–174)
serum free T4	pmol/L (10.0–22.0)
serum T3	nmol/L (1.07–3.18)
serum free T3	pmol/L (3.0–7.0)
serum thyroid-stimulating hormone receptor antibodies	U/L (<7)
serum anti-thyroid peroxidase antibodies	IU/mL (<50)
serum thyroid receptor antibodies	U/L (<10)
technetium-99m scan of thyroid (20-min uptake)	% (0.4–3.0)

Catecholamines (blood)

(*Plasma recumbent with venous catheter in place for 30 min prior to collection of sample*)

plasma adrenaline	nmol/L (0.03–1.31)
plasma noradrenaline	nmol/L (0.47–4.14)
plasma metadrenaline	pmol/L (<600)
plasma normetadrenaline	pmol/L (<1000)

Metanephrines (urine)

24-h urinary metanephrine	µg (<2)
24-h urinary normetanephrine	µg (<3)

Others

plasma parathyroid hormone	pmol/L (0.9–5.4)
plasma calcitonin	pmol/L (<27)
serum cholecalciferol (vitamin D_3)	nmol/L (60–105)
serum vitamin D	nmol/L (45–90)
serum 1,25-$(OH)_2$-cholecalciferol	pmol/L (43–149)
serum insulin-like growth factor 1	
13–20 y	nmol/L (9.3–56.0)
21–40 y	nmol/L (7.5–37.3)
41–60 y	nmol/L (5.6–23.3)
>60 y	nmol/L (3.3–23.3)
serum IGF1:IGF2 ratio	(<10)

Immunology/Rheumatology

CD4 count	$\times 10^6$/L (430–1690)
CD8 count	$\times 10^6$/L (150–1000)
serum complement C3	mg/dL (65–190)
serum complement C4	mg/dL (15–50)
total serum haemolytic complement activity CH50	U/L (150–250)
serum C-reactive protein (CRP)	mg/L (<10)
serum IgG	g/L (6.0–13.0)
serum IgA	g/L (0.8–3.0)
serum IgM	g/L (0.4–2.5)
serum IgE	kU/L (<120)
serum IgD	mg/L (20–120)
serum IgG4	g/L (0.08–1.30)

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serum κ free light chains	mg/L (3.3–19.4
serum λ free light chains	mg/L (5.7–26.3)
serum free light-chain ratio	(0.26–1.65)
serum β_2-microglobulin	mg/L (<3)
serum mast cell tryptase (1 h post-reaction)	µg/L (2–14)
interferon-γ release assay for M. tuberculosis	(negative/positive)

Autoantibodies

anti-acetylcholine receptor antibodies	
anti-adrenal antibodies	(negative at 1:10)
anticentromere antibodies	(negative at 1:40)
anticardiolipin antibodies:	
IgG	U/mL (<10)
IgM	U/mL (<10)
anti-cyclic citrullinated peptide antibodies	
anti-double-stranded DNA antibodies (ELISA)	U/mL (<73)
anti-glomerular basement membrane antibodies	
anti-lactoferrin antibodies	
anti-neutrophil cytoplasmic antibodies:	
c-ANCA	
p-ANCA	
PR3-ANCA	U/mL (<10)
MPO-ANCA	U/mL (<10)
antinuclear antibodies	(negative at 1:20)
extractable nuclear antigen	
gastric parietal cell antibodies	(negative at 1:20)
intrinsic factor antibodies	(negative)
interstitial cells of testis antibodies	(negative at 1:10)
anti-Jo-1 antibodies	
anti-La antibodies	
antimitochondrial antibodies	(negative at 1:20)
anti-RNP antibodies	
anti-Scl-70 antibodies	
anti-Ro antibodies	
anti-skeletal muscle antibodies	(negative at 1:60)
anti-Sm antibodies	
anti-smooth muscle antibodies	(negative at 1:20)
anti-thyroid colloid and microsomal antibodies	(negative at 1:10)
antigliadin antibodies	IU/L (<10)
antiendomysial antibodies	
anti-tissue transglutaminase antibodies:	
IgA	U/mL (<15)
IgG	U/mL (<5)
rheumatoid factor	kIU/L (<30)
antistreptolysin titre	IU/mL (<200)

Hepatitis virus serology

A: anti-hepatitis A IgG antibody	negative

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	anti-hepatitis A IgM antibody	negative
B:	anti-hepatitis B core (anti-HBc) antibody	negative
	anti-hepatitis B surface (anti-HBs) antibody	negative
	hepatitis B surface antigen (HBsAg)	IU/mL (lower detection limit 10, equivalent to 50 copies/mL)
	hepatitis B e antigen (HBeAg)	IU/mL (lower detection limit 10, equivalent to 50 copies/mL)
	HBV DNA(*viral load*)	IU/mL (lower detection limit 250)
	HBV genotype	A–H
C:	anti-hepatitis C antibody	negative
	HCV RNA (*viral load*)	IU/mL (lower detection limit 15)
	HCV genotype	1–6
D:	anti-hepatitis D IgG antibody	negative
	anti-hepatitis D IgM antibody	negative
E:	anti-hepatitis E IgG antibody	negative
	anti-hepatitis E IgM antibody	negative

Tumour markers

serum α-fetoprotein	kU/L (<10)
serum carcinoembryonic antigen	μg/L (<10)
serum neurone-specific enolase	μg/L (<12)
serum prostate-specific antigen	
males under 40	μg/L (<2)
males over 40	μg/L (<4)
serum β-human chorionic gonadotropin	U/L (<5)
serum CA 125	U/mL (<35)
serum CA 15-3	U/mL (<35)
serum CA 19-9	U/mL (<33)

Viral loads

cytomegalovirus viral load	copies/mL (lower detection limit 400)
Epstein–Barr viral load	copies/mL (lower detection limit 250)
hepatitis B viral load	IU/mL (lower detection limit 250)
hepatitis C viral load	IU/mL (lower detection limit 15)
HIV viral load	copies/mL (lower detection limit 40)
human herpesvirus-6 viral load	copies/mL (lower detection limit 50)
human herpesvirus-8 viral load	copies/mL (lower detection limit 50)

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Therapeutic drug concentrations

serum amikacin (multiple-dose regimen)	
(peak)	mg/L (<30)
pre-dose (trough)	mg/L (<10)
serum amikacin (once daily dose regimen)	mg/L (<5)
serum carbamazepine	µmol/L (20–50)
blood ciclosporin	nmol/L (100–150)
plasma clozapine	mg/L (0.35–0.50)
serum digoxin (taken at least 6 h post-dose)	nmol/L (1.0–2.0)
serum gentamicin (multiple-dose regimen)	
infective endocarditis (peak)	mg/L (3–5)
pre-dose (trough)	mg/L (<1)
other indications (peak)	mg/L (5–10)
pre-dose (trough)	mg/L (<2)
serum lithium	mmol/L (0.4–1.0)
serum phenobarbital	µmol/L (65–172)
serum phenytoin	µmol/L (40–80)
serum primidone	µmol/L (23–55)
blood tacrolimus	
≤12 months following transplant	ng/mL (8–12)
>12 months following transplant	ng/mL (5–10)
serum tobramycin (peak)	mg/L (<10)
pre-dose (trough)	mg/L (<2)
plasma theophylline	mg/L (10–20)
serum vancomycin (pre-dose)	mg/L (10–20)

Cerebrospinal fluid (CSF)

opening pressure	mmH_2O (120–250)
total protein	g/L (0.15–0.45)
albumin	g/L (0.066–0.442)
chloride	mmol/L (116–122)
glucose	mmol/L (3.3–4.4)
lactate	mmol/L (1.0–2.0)
cell count	/µL (≤5)
white cell count	/µL (≤5)
red cell count	/µL (0)
lymphocyte count	/µL (≤3.5)
neutrophil count	/µL (0)
IgG:albumin ratio	(≤0.26)
Ig index (≤0.88)	

Synovial fluid

white cell count	/mL (<200)

Pulmonary function

transfer factor for CO (TL_{CO})	% (80–120) mmol/min/kPa
transfer coefficient (K_{CO})	% (100) mmol/min/kPa/L

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Cardiac pressures

mean arterial pressure	mmHg (96)
mean right atrial pressure	mmHg (3)
mean pulmonary arterial pressure	mmHg (15)
mean pulmonary arterial wedge pressure	mmHg (9)
mean cardiac output	L/min (5)

Hepatic venous pressures

portal venous pressure	mmHg (4–8)
hepatic venous pressure	mmHg (2–4)
hepatic venous pressure gradient	mmHg (<5)

ECG measurements

PR interval	ms (120–200)
QRS complex	ms (40–120)
corrected QT interval (QTc)	
males	ms (<440)
females	ms (<460)

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APPENDIX III

British Approved Names (BANs) of certain medicines (altered to conform with Recommended International Non-proprietary Names)

ADRENALINE AND NORADRENALINE: Adrenaline and noradrenaline are the terms used in the titles of monographs in the European Pharmacopoeia and are thus the official names in the United Kingdom and European Union. For these substances, BP 2009 shows the European Pharmacopoeia names and the rINNs at the head of the monographs; the BNF has adopted a similar style.

Former BAN	New BAN
acyclovir	aciclovir
adrenaline	adrenaline (epinephrine)
amethocaine	tetracaine
amoxycillin	amoxicillin
beclomethasone	beclometasone dipropionate
bendrofluazide	bendroflumethiazide
benzhexol	trihexyphenidyl hydrochloride
busulphan	busulfan
cephalexin	cefalexin
cephradine	cefradine
chlormethiazole	clomethiazole
chlorpheniramine	chlorphenamine maleate
chlorthalidone	chlortalidone
cholecalciferol	colecalciferol
cholestyramine	colestyramine
clomiphene	clomifene citrate
colistin sulphomethate sodium	colistimethate sodium
cyclosporin	ciclosporin
cysteamine	mercaptamine
dexamphetamine	dexamfetamine sulfate
dicyclomine	dicycloverine hydrochloride
dimethicone(s)	dimeticone
dimethyl sulphoxide	dimethyl sulfoxide
dothiepin	dosulepin hydrochloride
doxycycline hydrochloride	doxycycline
eformoterol	formoterol fumarate
ethamsylate	etamsylate
ethinyloestradiol	ethinylestradiol
flumethasone	flumetasone pivalate
flupenthixol	flupentixol
flurandrenolone	fludroxycortide
frusemide	furosemide
hexamine hippurate	methenamine hippurate
hydroxyurea	hydroxycarbamide
indomethacin	indometacin
lignocaine	lidocaine hydrochloride
methotrimeprazine	levomepromazine
methylene blue	methylthioninium chloride
mitozantrone	mitoxantrone

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nicoumalone	acenocoumarol
noradrenaline	noradrenaline (norepinephrine)
oestradiol	estradiol
oestriol	estriol
oxpentifylline	pentoxifylline
phenobarbitone	phenobarbital
riboflavine	riboflavin
salcatonin	calcitonin (salmon)
sodium calciumedetate	sodium calcium edetate
sodium cromoglycate	sodium cromoglicate
sodium ironedetate	sodium feredetate
sodium picosulphate	sodium picosulfate
stilboestrol	diethylstilbestrol
sulphadiazine	sulfadiazine
sulphasalazine	sulfasalazine
sulphinpyrazone	sulfinpyrazone
tetracosactrin	tetracosactide
thiopentone	thiopental sodium
thymoxamine	moxisylyte
thyroxine sodium	levothyroxine sodium
tribavirin	ribavirin
tri-iodothyronine sodium	liothyronine sodium
trimeprazine	alimemazine tartrate
urofollitrophin	urofollitropin

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APPENDIX IV

Diagnostic classification ('Diagnosis')

Cardiology
Congenital heart disease
Pericardial disease
Myocardial disease
Valvular heart disease
Dysrhythmias
Coronary artery disease (ischaemia)
Vascular disease
Systemic hypertension
Pulmonary hypertension
Cardiology symptoms/signs

Dermatology
Bullous conditions
Bacterial skin infections
Viral skin infections
Rickettsial disease
Fungal skin infections
Non-infectious infiltrates
Disorders of skin appendages
Disorders of skin vasculature
Pigmentation disorders
Systemic disorders and the skin
Tumours/naevi of skin
Genetic disorders of skin
Dermatology symptoms/signs

Endocrinology and metabolic medicine
Hereditary endocrine conditions
Pituitary
Thyroid disease
Parathyroid glands
Adrenal gland disorders
Diabetes mellitus
Diabetes insipidus
Carcinoid syndrome
Menopause
Ovarian disorders
Testicular disorders
Bone disease
Growth disorders
Nutrition
Inborn errors carbohydrate metabolism
Inborn errors of amino acid metabolism
Lysosomal storage disorders
Disorders of purine metabolism
Porphyria
Wilson's disease
Lipid disorders
Electrolyte disorders
Endocrine symptoms/signs

Gastroenterology
GI haemorrhage
Oesophageal disorders
Stomach and duodenal disorders
Small intestinal disorders
Pancreatic disorders
Inflammatory bowel disease
Bowel ischaemia
Colon and rectal disorders
Liver disorders
Biliary tree
Mouth and salivary gland
Peritonitis
Gastroenterology symptoms/signs

Haematology
Macrocytic anaemias
Microcytic anaemias
Disorders of iron metabolism
Normocytic anaemia (non-haemolytic)
Hereditary haemolytic anaemia
Acquired haemolytic disorders
Abnormal haemoglobins
Methaemoglobinaemia
Porphyria
Polycythaemia
Platelet disorders
Coagulation disorders
Thrombophilia
Non-malignant white cell disorders
Splenic disorders
Transfusion medicine
Malignant haematology
Stem cell transplantation
Haematology symptoms/signs

Infectious diseases
Bacterial infection
Fungal
Helminths
Protozoal
Rickettsial
Mycoplasma
Chlamydia
Spirochaetes
Viral
Prion diseases
Septicaemia
Infectious diseases symptoms/signs

Neurology
Cerebrovascular disease
Coma and brain death
Confusional states
Degenerative diseases
Movement disorders
Dizziness
Loss of consciousness
Headache and facial pain
Hydrocephalus
CNS infections
Myelopathy/radiculopathy
Demyelinating disorders
Myopathy
Motor neurone disease
Neuromuscular junction disorders
Neuropathy
Sleep disorders
Tumours of CNS
Paraneoplastic syndromes
Benign intracranial hypertension
Congenital/developmental disorders
Neurology symptoms/signs

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Oncology and palliative medicine
Premalignant conditions
Paraneoplastic syndromes
Tumours
Palliative care
Oncology symptoms/signs

Ophthalmology
Disorders of the eyelid
Disorders of the lacrimal gland
Disorders of the orbit
Disorders of the conjunctiva
Episcleral and scleral disorders
Corneal disorders
Disorders of the iris and ciliary body
Disorder of anterior chamber of eye
Disorders of the lens
Choroidal/chorioretinal disorders
Disorders of vitreous and retina
Glaucoma
Disorders of optic nerve/visual fields
Pupillary function abnormality
Nystagmus
Thyroid eye disease
Ophthalmology symptoms/signs

Psychiatry
Organic mental disorder
Dementia
Psychoactive substance misuse
Psychotic disorder
Mood disorder
Neurotic disorder
Stress and adjustment disorder
Behavioural disorders
Personality disorders
Factitious disorder
Learning disability
Disorder of psychological development
Childhood hyperkinetic syndrome
Tic disorder
Suicide and parasuicide
Alcohol syndromes
Psychiatry symptoms/signs

Nephrology
Hereditary renal disease
Glomerular disease
Proteinuria
Tubulo-interstitial nephritis
Reflux nephropathy
Renal calculus disease
Obstructive uropathy
Urinary tract infection
Renovascular disease/ischaemia
Hypertension
Malignancy of urinary tract
Acute renal failure
Chronic renal failure
Renal tubular disease
Diabetes insipidus
Electrolyte abnormalities
Pregnancy and renal disease
Loin pain
Drug-induced renal disease
Nephrology symptoms/signs

Respiratory medicine
Genetic disorders of lung
Hypersensitivity/allergy
Hypoventilation
Respiratory failure
Infections of respiratory tract
Pulmonary thromboembolism
Pulmonary haemorrhage
Primary pulmonary hypertension
Interstitial lung disease
Extrinsic allergic alveolitis
Pulmonary eosinophilia
Systemic disorders involving lung
Toxicity/occupational lung disease
Tumours of respiratory tract
Acid–base balance
Pneumothorax
Lung transplant
Respiratory symptoms/signs

Rheumatology
Inflammatory joint disease
Connective tissue diseases
Crystal deposition disease
Diseases of bone
Osteoarthritis
Soft tissue disorders
Charcot joint
Rheumatology symptoms/signs

Geriatric medicine
Incontinence
Falls in the elderly
Geriatric medicine symptoms/signs

Overdose/Poisoning
Overdose/Poisoning

Surgery
Surgical pain
Postoperative pain
Fluid balance
Prevention of surgical complications
Other postoperative care
Trauma

Obstetrics & Gynaecology
Amenorrhoea
Menorrhagia/uterine bleeding
Contraception
Fertility
Abortion
Pregnancy
Childbirth
Breastfeeding
Menopause

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APPENDIX V

Therapeutic classification ('Drug')

Gastrointestinal system
Cardiovascular system
Respiratory system
Central nervous system
Infections
Endocrine system
Obstetrics, gynaecology, and urinary tract disorders
Malignant disease and immunosuppression
Nutrition and blood
Musculoskeletal and joint diseases
Eye
Ear, nose and throat
Skin
Immunological products and vaccines
Anaesthesia
Toxicology

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APPENDIX VI

Adding resources to PSA items

Documents, photographs and other images may be added to PSA items to provide further clinical context, using the 'add resource' button. In all cases, the resource must contain information that is **required** to answer the question. Resources are likely to be most appropriate in MAN and DAT items. In order to ensure that resources are suitable for use, authors should bear the following points in mind:

- Documents such as prescription charts and patient monitoring forms should be transcribed onto a blank form to avoid revealing confidential information.
- Scanned copies of imaging investigations (e.g. ECGs, X-rays) should have all identifying data removed.
- Where appropriate, patient consent must be obtained
- Acceptable file types are *.jpg, *.jpeg, *.png and *.gif.

Use the 'Add Resource' button in the PSA author template to add resources to individual question items. Once the image has been uploaded, check the item to ensure that the resource is clearly legible when viewed on the screen.

Documentary resources

Documentary resources may be included in items to provide further contextual details about the clinical scenario. Examples of suitable resources include IV fluid administration records, culture and sensitivity reports, 'NEWS' charts and home blood glucose monitoring diaries. Exemplars are provided here and can be completed by hand or electronically. The resource file can be created by using the 'screen-grab' function, or by taking a photograph of the hard-copy.

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Sensitivity chart

Bacteria	Escherichia Coli
Drug	**Sensitive (S) / Resistant (R)**
Amoxicillin	
Co-amoxiclav	
Ceftriaxone	
Ciprofloxacin	
Doxycycline	
Ertapenem	
Gentamicin	
Nitrofurantoin	
Ofloxacin	
Piperacillin/tazobactam	
Tigecycline	
Trimethoprim	

Home blood glucose diary

	Self-monitored capillary blood glucose (mmol/L)			
	Before breakfast	Before lunch	Before evening meal	Before bed
Day 1				
Day 2				
Day 3				

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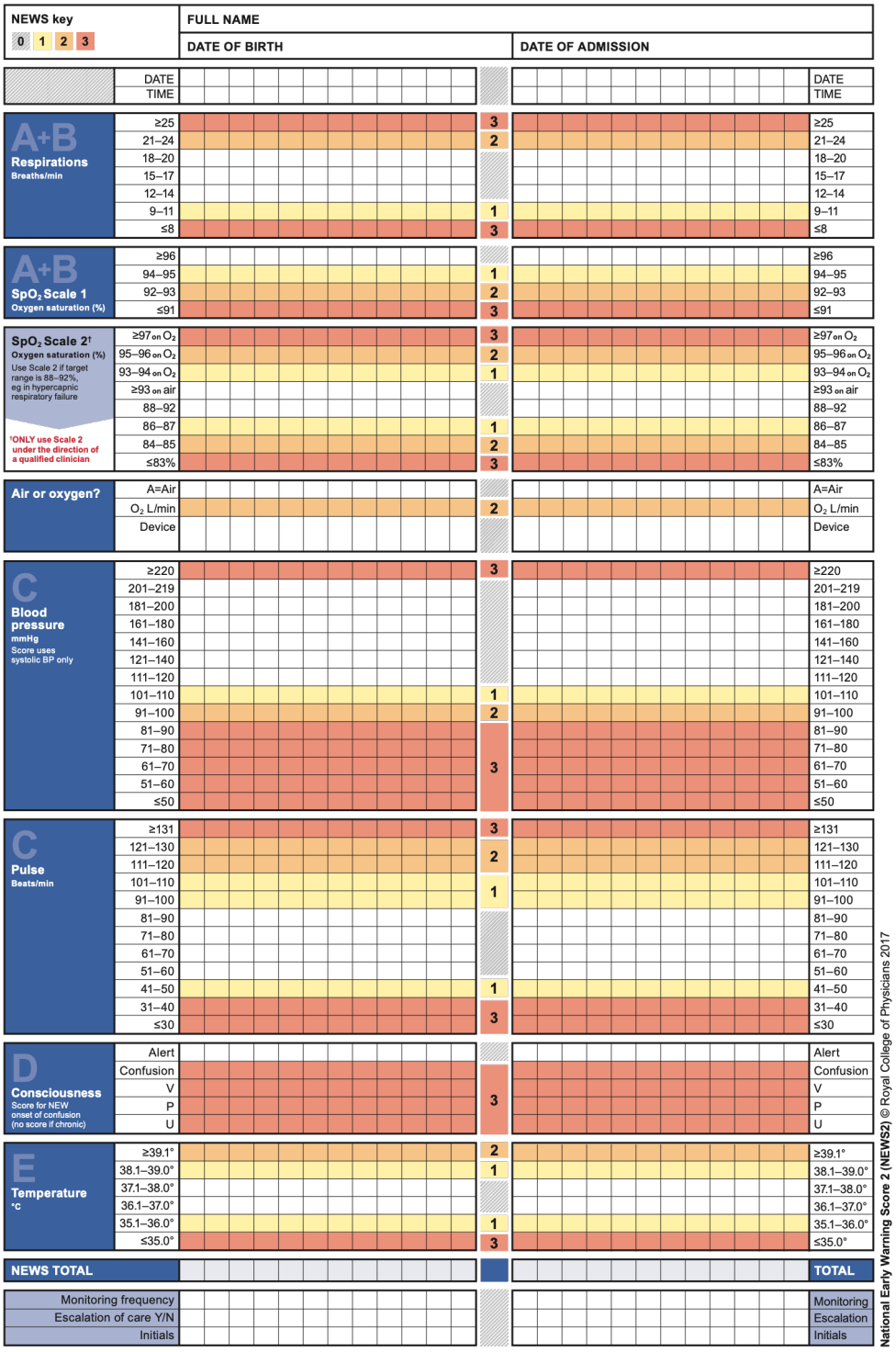
NEWS Chart available to download at RCP NEWS observation chart N.B. It may be necessary to zoom in on the relevant section to make this chart legible as a resource.



NEWS key 0 1 2 3	FULL NAME / DATE OF BIRTH		DATE OF ADMISSION	
	DATE / TIME			DATE / TIME
A+B Respirations Breaths/min	≥25	3		≥25
	21–24	2		21–24
	18–20			18–20
	15–17			15–17
	12–14			12–14
	9–11	1		9–11
	≤8	3		≤8
A+B SpO_2 Scale 1 Oxygen saturation (%)	≥96			≥96
	94–95	1		94–95
	92–93	2		92–93
	≤91	3		≤91
SpO_2 Scale 2† Oxygen saturation (%) Use Scale 2 if target range is 88–92%, eg in hypercapnic respiratory failure †ONLY use Scale 2 under the direction of a qualified clinician	≥97 on O_2	3		≥97 on O_2
	95–96 on O_2	2		95–96 on O_2
	93–94 on O_2	1		93–94 on O_2
	≥93 on air			≥93 on air
	88–92			88–92
	86–87	1		86–87
	84–85	2		84–85
	≤83%	3		≤83%
Air or oxygen?	A=Air			A=Air
	O_2 L/min	2		O_2 L/min
	Device			Device
C Blood pressure mmHg Score uses systolic BP only	≥220	3		≥220
	201–219			201–219
	181–200			181–200
	161–180			161–180
	141–160			141–160
	121–140			121–140
	111–120			111–120
	101–110	1		101–110
	91–100	2		91–100
	81–90	3		81–90
	71–80			71–80
	61–70			61–70
	51–60			51–60
	≤50			≤50
C Pulse Beats/min	≥131	3		≥131
	121–130	2		121–130
	111–120			111–120
	101–110	1		101–110
	91–100			91–100
	81–90			81–90
	71–80			71–80
	61–70			61–70
	51–60			51–60
	41–50	1		41–50
	31–40	3		31–40
	≤30			≤30
D Consciousness Score for NEW onset of confusion (no score if chronic)	Alert			Alert
	Confusion	3		Confusion
	V			V
	P			P
	U			U
E Temperature °C	≥39.1°	2		≥39.1°
	38.1–39.0°	1		38.1–39.0°
	37.1–38.0°			37.1–38.0°
	36.1–37.0°			36.1–37.0°
	35.1–36.0°	1		35.1–36.0°
	≤35.0°	3		≤35.0°
NEWS TOTAL				TOTAL
Monitoring frequency				Monitoring
Escalation of care Y/N				Escalation
Initials				Initials

National Early Warning Score 2 (NEWS2) © Royal College of Physicians 2017

Reproduced from: Royal College of Physicians. *National Early Warning Score (NEWS) 2: Standardising the assessment of acute-illness severity in the NHS*. Updated report of a working party. London: RCP, 2017.

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IV fluid administration chart

Date	Route	INFUSION FLUID		ELECTROLYTE or added drug		Duration	Prescriber		Given Checked	Time		FLUID OUTPUT During each period	
		Name and strength	Volume (mL)	Name	Dose		Name	Signature		Start	End	Urine (mL)	Other
23.10	IV	SODIUM CHLORIDE 0.9%	500	KCl	20 mmol	15 mins	F JONES	F Jones	TW/FA	09.00	09.15		
	I												

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Position		**Time: 10 AM**	**Blood pressure and heart rate**	**Associated symptoms**
Lying down		5 minutes	BP 116/74 mmHg HR 68/min	None
Sitting		1-2 minutes	BP 100/54 mmHg HR 80/min	Light-headedness (mild)
Standing		1-2 minutes	BP 90/50 mmHg HR 78/min	Light-headedness (mild)

Position		**Time: 6 PM**	**Blood pressure and heart rate**	**Associated symptoms**
Lying down		5 minutes	BP 126/80 mmHg HR 68/min	None
Sitting		1-2 minutes	BP 122/84 mmHg HR 72/min	None
Standing		1-2 minutes	BP 120/84 mmHg HR 78/min	None

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Clinical images and photographs

A number of image banks are available on the internet, providing access to photographs, illustrations and other images that may be used free of charge for educational purposes. Examples of image banks that may be used include:

- http://library.med.utah.edu/heal/
- http://phil.cdc.gov/phil/home.asp
- http://www.danderm-pdv.is.kkh.dk/atlas/index.html

If an image is taken from the internet (e.g. Google images), usage rights must be checked to ensure that Educational use is permitted. The author must declare the source of the image by noting the URL in the 'review notes' section of the item.

Photographs of individual patients may be used, provided they are anonymised and appropriate consent has been obtained.

Obtaining consent for making visual recordings of patients to use in the PSA
PSA authors are responsible for ensuring that any visual recordings (e.g. photographs) of patients supplied to the PSA for use in assessments have been obtained in compliance with the guidance set out by the GMC '*Making and using visual and audio recordings of patients* (March 2013)' available from http://www.gmc-uk.org/guidance/ethical_guidance/making_audiovisual.asp.

A photograph obtained before 1997, either as part of the patient's treatment or assessment, or for teaching purposes within a medical setting, may be used without consent provided it has been effectively anonymised so that the patient is no longer identifiable.

Consent is not required to use images taken from **pathology slides, X-rays, laparoscopic images, images of internal organs or ultrasound images**, provided that they are effectively anonymised by removal of any identifying marks.

With the exception of the above, all other visual recordings, including those taken as part of patient care, require written or verbal consent to be obtained.

A consent form is available for use with images (see **Consent form for using images in the PSA**) below and can be downloaded from the PSA interface. When images requiring consent are uploaded to the PSA interface, a copy of the relevant signed consent form must be sent to bpsassessment@bps.ac.uk with a note of the item number the image relates to.

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MSC ASSESSMENT/BRITISH PHARMACOLOGICAL SOCIETY

Consent for using images in the Prescribing Safety Assessment (PSA)

Patient's name. _____

Hospital Trust or GP practice _____

***Delete where inapplicable*

I hereby give my consent to have photographs, video recordings or other images made of *myself/my family member/my ward to be used by MSC Assessment and the British Pharmacological Society for the purpose of the Prescribing Safety Assessment. I have been assured by Dr_____ that *my/his/her identity will be protected when any such image is reproduced.

I understand and agree that the British Pharmacological Society of the UK may also use these anonymised images as illustrations for its eLearning project *Prescribe.*

Patient/Guardian/Legal representative

Signature: **Name:**

Physician seeking consent

Signature: **Name:**

Date:

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APPENDIX VII

Metadata tagging of PSA items

Data types

All items will be tagged with the following information:

Age:	enter freehand
Sex:	see drop-down menu
Diagnosis:	see Appendix IV (drop-down menu)
High risk drug:	see Table 3 (drop-down menu – only if applicable)
Setting:	see Table 2 (drop-down menu)
Drug:	see Appendix V (drop-down menu)
Free Text:	Leave blank (for editorial team use)

In CAL items:	
Calculation type:	(drop down menu)
No of steps:	No of stages required to complete calculation (1-8)

Item Performance

Psychometric data about the facility and discrimination of items used in assessments are added to individual items once they are available.

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