

MRCPCH Theory and Science Paper Introduction

Welcome to the MRCPCH Theory and Science paper for computer-based testing.

If you are new to the MRCPCH computer-based examination, please note that some questions may appear in a slightly different format from how they did in paper format.

Please answer all of the parts to each of the questions. You will have 2 hours and 30 minutes to complete the examination (unless you have been granted additional time).

For each question, please ensure that you scroll down in order to view all parts of the question. Please answer all parts of the question and check that you have entered an answer for all of the questions before you finish your examination.

You can adjust your display preferences at any point during the exam by clicking the preferences icon at the bottom of your screen.

You may find it helpful to eliminate some of the answer options to help you concentrate on others. You can do this by right-clicking over an answer option to strike a line through it. Right-clicking over it again will remove the line. Please note that this does not apply to Extended Matching Questions.

There is a highlight function that you may wish to use during the examination to help you to identify key text or questions to which you would like to return. You can do this by highlighting some text with your cursor and then clicking on the marker icon when it appears. The text will become highlighted in yellow and will remain highlighted throughout the remainder of the examination.

You will also be able to see an overview of the progress of your exam by clicking on the keyboard icon (section review) at the bottom left of your screen. Here you will see the number of questions that you have flagged, number of questions attempted and questions that you have not answered.

Where questions are based upon images, data charts or any other visual material, the material will be embedded within the question, and you will also be able to open the image separately and move it around the screen. Some of these images will be automatically enlarged when opened up separately; however, please note that not all of the images are meant to enlarge when this pop-up box is activated.

Extended Matching Questions

In this type of question, 3 scenarios are given, followed by a list of options. For each scenario, you will be asked to choose the option from the list that is the most appropriate. Type the correct letter in the given box. Please note that the response entered is not case-sensitive, so it will not affect your result if the letter you type is in lower case or upper case. Nine marks are available for this type of question (3 marks for each correctly answered scenario).

Best of 5 Questions

Each Best of 5 question consists of a simple statement or short clinical scenario leading to 5 options. In this examination, all options could be possible but only 1 is the best answer. Please click on the most appropriate option (4 marks for each correct answer).

Please Remember:

Please answer all parts of each question. If you do not answer all parts of a question, you will only be awarded marks for the part of the question you have answered. Take care when answering the Extended Matching Questions, as they have multiple parts and you may need to scroll down to answer all parts.

It is strictly forbidden to talk to, read the work of, or attempt in any way to communicate with other candidates whilst the examination is in progress. Please exercise vigilance to ensure that no other candidate can attempt to copy your work.

The College has tools which can identify the copying of answers or collusion between candidates to share answers. If such a situation were to arise all identified parties will be investigated.

Breaches of these instructions, or misbehaviour in any other way relating to this theory examination, including continuing to attempt to answer after the allotted time, may lead to suspension from the examination.

Any attempt at copying or colluding to gain advantage may lead to permanent suspension from College examinations and notification to the GMC.

If a candidate is suspected of malpractice during an examination, they will be asked to leave the examination venue by the Chief Invigilator.

Copyright law protects examination questions and the intellectual property of their authors. The unauthorised use of questions is a breach of copyright law.

Section: EMQ

1 You will be presented with three scenarios and a list of types of study design.

Type in one answer only for each of the 3 scenarios below.

Note: each answer may be used more than once.

(EMQ 228)

1.1 A paediatric dermatology unit is one of several approached by a pharmaceutical company who are developing a new 4 times daily antibiotic for the treatment of acne. They wish to compare their product with erythromycin. The clinic population is large enough to recruit 300 children. Efficacy would be tested by independent examination of the skin.

Choose the most appropriate study design from the list below:

- A Case controlled study
- B Case series
- C Cohort study
- D Cross over trial
- E Double blind randomised controlled trial
- F Meta-analysis
- G Open label study
- H Qualitative study
- I Quasi-randomised control study
- J Systematic review

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 228a)

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1.2 A researcher plans to do a short-term study to compare the efficacy and acceptability of 2 spacer devices when treating children with asthma. He can recruit 30 children aged 4 to 11 years.

Choose the most appropriate study design from the list below:

- A Case controlled study
- B Case series
- C Cohort study
- D Cross over trial
- E Double blind randomised controlled trial
- F Meta-analysis
- G Open label study
- H Qualitative study
- I Quasi-randomised control study
- J Systematic review

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 228b)

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- 1.3** A district general hospital children's diabetic service proposes to introduce a transition service in conjunction with the adult diabetic service. Prior to this they wish to identify important issues faced by the 15 teenagers leaving the paediatric service in the next 2 years.

Choose the most appropriate study design from the list below:

- A Case controlled study
- B Case series
- C Cohort study
- D Cross over trial
- E Double blind randomised controlled trial
- F Meta-analysis
- G Open label study
- H Qualitative study
- I Quasi-randomised control study
- J Systematic review

Please add the correct answer in the box below.

(EMQ 228c)

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- 2** You will be presented with three histology reports on endoscopic biopsies from the distal duodenum and a list of diagnoses.

Type in one answer only for each of the 3 clinical scenarios below.

Note: each answer may be used more than once.

(EMQ 217)

2.1 There is a patchy enteropathy with relatively mild disturbance of crypt-villous architecture. Mucosal lymphocyte and eosinophil populations are increased, while intraepithelial lymphocyte numbers are within the normal range.

Choose the most likely diagnosis from the list below based on the above histology report.

- A Abetalipoproteinaemia
- B Autoimmune enteropathy
- C Coeliac disease
- D Cow's milk sensitive enteropathy
- E Crohn's disease
- F Giardiasis
- G Lymphangiectasia
- H Microvillous inclusion disease (microvillous atrophy)
- I Primary hyperlipidaemia
- J Whipple's disease

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 217a)

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2.2 The villous height is within normal limits, but the villi are distorted by ectatic villous core lacteals. There is no significant inflammatory infiltrate.

Choose the most likely diagnosis from the list below based on the histology report.

- A Abetalipoproteinaemia
- B Autoimmune enteropathy
- C Coeliac disease
- D Cow's milk sensitive enteropathy
- E Crohn's disease
- F Giardiasis
- G Lymphangiectasia
- H Microvillous inclusion disease (microvillous atrophy)
- I Primary hyperlipidaemia
- J Whipple's disease

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 217b)

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2.3 There is a diffuse enteropathy characterised by crypt hyperplasia and villous atrophy. The intraepithelial lymphocyte count is increased.

Choose the most likely diagnosis from the list below based on the histology reports.

- A Abetalipoproteinaemia
- B Autoimmune enteropathy
- C Coeliac disease
- D Cow's milk sensitive enteropathy
- E Crohn's disease
- F Giardiasis
- G Lymphangiectasia
- H Microvillous inclusion disease (microvillous atrophy)
- I Primary hyperlipidaemia
- J Whipple's disease

Please add the correct answer in the box below.

(EMQ 217c)

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3 You will be presented with 3 groups of side-effects and a list of drugs commonly used on a neonatal intensive care unit.

Type in one answer only for each of the 3 clinical scenarios below.

Note: each answer may be used more than once.

(EMQ 511v1:2)

3.1 Respiratory depression, hypotension, urinary retention and bradycardia.

Select the agent most likely to be associated with the above undesired effects:

- A Dexamethasone
- B Dopamine
- C Furosemide
- D Indomethacin
- E Liposomal amphotericin
- F Morphine
- G Prostaglandin E2
- H Sildenafil
- I Gentamicin
- J Vancomycin

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 511v1a:2)

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3.2 Anaemia, diarrhoea, electrolyte imbalance and hepatic function abnormalities.

Select the agent most likely to be associated with the above undesired effects:

- A Dexamethasone
- B Dopamine
- C Furosemide
- D Indomethacin
- E Liposomal amphotericin
- F Morphine
- G Prostaglandin E2
- H Sildenafil
- I Gentamicin
- J Vancomycin

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 511v1b:2)

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3.3 Glucose instability, hypertension and increased risk of cerebral palsy if given in the first week of life.

Select the agent most likely to be associated with the above undesired effects:

- A Dexamethasone
- B Dopamine
- C Furosemide
- D Indomethacin
- E Liposomal amphotericin
- F Morphine
- G Prostaglandin E2
- H Sildenafil
- I Gentamicin
- J Vancomycin

Please add the correct answer in the box below.

(EMQ 511v1c:2)

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4 You will be presented with 3 clinical scenarios and a list of investigations.

Type in one answer only for each of the 3 clinical scenarios below.

Note: each answer may be used more than once.

(EMQ 175:2)

4.1 A 7 day old boy with birth weight of 3.6 kgs presents with poor feeding, vomiting and bleeding from the umbilical stump. He is jaundiced, has hepatomegaly and a full fontanelle. A sibling previously died at 2 weeks of age from E.coli septicaemia.

Investigations:

Capillary blood glucose 5.5 mmol/l (2.5 – 5.5 mmol/l)

Arterial blood gas

pH 7.35 (7.35 – 7.45)

pCO₂ 5.4 kPa (4.6 – 6.0 kPa)

pO₂ 12.5 kPa (11 - 15 kPa)

bicarbonate 22 mmol/l (19 – 28 mmol/l)

Which of the following is most likely to be abnormal?

- A Cerebrospinal fluid glycine
- B Plasma phenylalanine
- C Red blood cell galactose-1-phosphate uridyl transferase activity
- D Plasma insulin
- E Serum 17-hydroxyprogesterone
- F Urine succinylacetoacetate
- G Serum cortisol
- H Serum lactate
- I Plasma acylcarnitine
- J Urine methylmalonic acid

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 175a:2)

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4.2 A boy was born at term weighing 4.2 kg. At 1 day of age he is not breastfeeding well and has an apnoeic episode.

Investigations:

Capillary blood glucose <2mmol/l (2.5 – 5.5 mmol/l)

Arterial blood gas

pH 7.33 (7.35 – 7.45)

pCO₂ 5.0 kPa (4.6 – 6.0 kPa)

pO₂ 12.5 kPa (11 - 15 kPa)

bicarbonate 21 mmol/l (19 – 28 mmol/l)

Which of the following is most likely to be abnormal?

- A Cerebrospinal fluid glycine
- B Plasma phenylalanine
- C Red blood cell galactose-1-phosphate uridyl transferase activity
- D Plasma insulin
- E Serum 17-hydroxyprogesterone
- F Urine succinylacetoacetate
- G Serum cortisol
- H Serum lactate
- I Urine acylcarnitine
- J Urine methylmalonic acid

Please add the correct answer in the box below and then scroll down to the next part of the question.

(EMQ 175b:2)

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4.3 A girl, weighing 3.2 kg, was born at term to consanguineous parents. She was discharged home breastfeeding. At 6 days of age she presents with lethargy, poor feeding and vomiting. Apart from an increased respiratory rate, examination is normal.

Investigations:

Capillary blood glucose 3.5 mmol/l (2.5 – 5.5 mmol/l)

Plasma ammonia 187 μ mol/l (<100 μ mol/l)

Arterial blood gas

pH 7.05 (7.35 – 7.45)

pCO₂ 2.6 kPa (4.6 – 6.0 kPa)

pO₂ 12.5 kPa (11 - 15 kPa)

bicarbonate 5 mmol/l (19 – 28 mmol/l)

Which of the following is most likely to be abnormal?

- A Cerebrospinal fluid glycine
- B Plasma phenylalanine
- C Red blood cell galactose-1-phosphate uridyl transferase activity
- D Plasma insulin
- E Serum 17-hydroxyprogesterone
- F Urine succinylacetoacetate
- G Serum cortisol
- H Serum lactate
- I Plasma acylcarnitine
- J Urine methylmalonic acid

Please add the correct answer in the box below.

(EMQ 175c:2)

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Section: BO5

5 A 14 year old boy with muscle weakness is undergoing respiratory assessment.

Lung function tests:

FVC 52% predicted

FEV₁ 53% predicted

Peak expiratory flow:

before bronchodilator 80% predicted

after bronchodilator 84% predicted

What is the best interpretation of the findings?

Select one answer only

(BO5 119)

- A Bronchial hyper-reactivity
- B Hyperinflation
- C Impaired gas exchange
- D Restrictive lung disease
- E Ventilation-perfusion mismatch

- 6** A 3 year old girl is on maintenance chemotherapy for acute lymphatic leukaemia. She is admitted with a limp, fever and local tenderness of the femur. Blood cultures and bone aspiration are performed.

What is the most likely pathogen?

Select one answer only

(BO5 353)

- A Haemophilus influenzae
- B Mycobacterium tuberculosis
- C Pseudomonas aeruginosa
- D Salmonella enteritidis
- E Staphylococcus aureus

- 7** A 14 year old girl is referred for further investigation and management of menorrhagia.

Investigations:

Blood

APTT	51 seconds (22 - 41 seconds)
Prothrombin time	11 seconds (10 - 12 seconds)
Platelets	$325 \times 10^9/l$ (150 - $400 \times 10^9/l$)
Fibrinogen	31 g/l (1.5 - 4.0 g/l)
Factor IX	81% (50 - 120%)
Factor VIII	38% (50 - 120%)

What is the most likely diagnosis?

(BO5 1110)

- A** Glanzmann thrombasthenia
- B** Haemophilia B
- C** Protein C deficiency
- D** Vitamin K deficiency
- E** von Willebrand disease

- 8 Objective:** You have been asked to peer-review a study comparing 2 smoking cessation methods in 2 secondary schools. School A is in an affluent area; pupils are aged 13-17 years. School B is in an inner-city area; pupils are aged 11-16 years.

The 2 treatment options:

- Inhaler containing nicotine for 4 months
- Inhaler containing placebo for 4 months

Both inhalers look identical and there is no difference in taste.

Methodology: 30 children in each school who wish to give up smoking are randomly assigned to treatment or placebo by envelope. The school nurse is informed by the research team as to which inhaler to provide.

Outcome measure: Salivary cotinine after 12 months

Analysis: Chi-squared test

What is the most important flaw in this study?

Select one answer only

(BO5 1144:2)

- A Inappropriate statistical analysis
- B No intention-to treat analysis
- C Non-comparable populations
- D Research team not blinded
- E Subject not blinded

- 9 A well new-born infant is found to have an isolated unilateral ptosis, with equal and reactive pupils and normal eye movements.

What is the most likely pathophysiological mechanism to account for these findings?

Select one answer only

(BO5 6051)

- A Dysfunction of the levator palpebrae superioris
- B Facial nerve zygomatic branch compression injury
- C Transplacental acetylcholine receptor antibodies
- D Disruption of the sympathetic nerve supply to the eye
- E Congenital third nerve palsy

- 10 You are an ST2 paediatric trainee. A staff nurse has contacted you to inform you that she has just administered a 5 fold overdose of vancomycin to a 10 week old baby on the paediatric ward.

What is the most likely side-effect in the next 24 hours?

Select one answer only

(BO5 6024)

- A Interstitial nephritis
- B Sensorineural hearing loss
- C Pulmonary haemorrhage
- D Anaphylaxis
- E Neutropenia

- 11** A 13 year old girl presents with weight loss, occasional headaches and blurred vision. Ophthalmology examination demonstrates bitemporal hemianopia, and an MRI brain scan confirms an intracranial tumour.

What is the most likely anatomical site of the lesion?

Select one answer only

(BO5 112 SUR)

- A Brain stem
- B Cerebellopontine angle
- C Pituitary fossa
- D Posterior fossa
- E Temporal lobe

- 12** Which toxin is most frequently involved in the pathogenesis of bullous impetigo caused by staphylococcus?

Select one answer only

(BO5 6046:2)

- A Exfoliative toxin B
- B Panton-Valentine leukocidin
- C Toxic Shock Syndrome Toxin 1
- D Exfoliative toxin A
- E Enterotoxin A

13 How is the effect of azathioprine in immunosuppression primarily achieved?

Select one answer only

(BO5 1275:2)

- A Downregulation of interleukin-6
- B Downregulation of tumour necrosis factor alpha production
- C Inhibition of purine nucleoside synthesis
- D Acts as a calcineurin inhibitor
- E Inhibition of tetrahydrofolate dehydrogenase

14 A 5 year old girl of African descent presents to the paediatric outpatient clinic with pains in her legs.

Investigations:

Blood

vitamin D level 18 nmol/l (50 - 250 nmol/l)

calcium level 2.20 mmol/l (2.2 mmol/l - 2.7 mmol/l)

Which is the principal mechanism by which vitamin D maintains calcium homeostasis?

Select one answer only

(BO5 6187:2)

- A Increases calcium absorption from the gut
- B Increases phosphate absorption from the gut
- C Increases bone resorption
- D Increases calcium reabsorption from the kidney
- E Stimulates parathyroid hormone secretion

- 15** At his 8 week old baby check, a male infant was noted to have poor weight gain since birth and is not yet smiling. On examination, he was found to have a murmur, unusual facial features including short palpebral fissures, a thin vermilion border and a smooth philtrum.

Maternal exposure to which of the following teratogens is the most likely cause of these features?

Select one answer only

(BO5 6324)

- A Valproate
- B Phenytoin
- C Nicotine
- D Alcohol
- E Warfarin

- 16** An infant who is ventilated for respiratory distress syndrome has poor oxygenation.

Which of the following derived or set parameters will have the greatest influence on oxygenation?

Select one answer only

(BO5 147 SUR:2)

- A Inspiratory : expiratory ratio
- B Alveolar minute ventilation
- C Mean airway pressure
- D Inspiratory time constant
- E Tidal volume

17 What is the mode of action of atenolol as an anti-hypertensive agent?

Select one answer only

(BO5 97 SUR)

- A Angiotensin converting enzyme (ACE) inhibitor
- B Beta-adrenoreceptor antagonist
- C Calcium channel blocker
- D Alpha and beta-adrenoreceptor antagonist
- E Alpha adrenoreceptor antagonist

18 A new born boy presents with irritability and poor feeding. Gram negative bacilli are identified in his CSF.

Which is the most likely causative organism?

Select one answer only

(BO5 6009)

- A Pseudomonas aeruginosa
- B Escherichia coli
- C Haemophilus influenzae
- D Listeria monocytogenes
- E Neisseria meningitidis

- 19** A 3 year old boy returns from staying overnight with his grandparents who had given him antipyretics. He looks pale and ill with widespread bruising. He has been well in the past, apart from an upper respiratory tract infection over the last week.

Investigations:

Blood

haemoglobin	80 g/l	(130 - 175 g/l)
platelets	$15 \times 10^9/l$	($150 - 450 \times 10^9/l$)
APTT	75 seconds	(28.0 - 45.0 s)
APTT ratio	2.5	
fibrinogen	0.5 g/l	(1.5 - 4.0 g/l)
sodium	130 mmol/l	(133 - 146 mmol/l)
potassium	5.8 mmol/l	(3.5 - 5.5 mmol/l)
chloride	100 mmol/l	(95 - 106 mmol/l)
bicarbonate	15 mmol/l	(19 - 28 mmol/l)
urea	5.0 mmol/l	(2.5 - 6.5 mmol/l)
creatinine	69 μ mol/l	(13 - 39 μ mol/l)

What is the most likely cause of the laboratory abnormalities in this patient?

Select one answer only

(BO5 630:2)

- A Disseminated intravascular coagulation
- B Haemolytic uraemic syndrome
- C Haemophilia
- D Immune thrombocytopenic purpura
- E Salicylate ingestion

20 A 6 year old child is referred with loud snoring and pauses in breathing during sleep.

During which phase of sleep are these events most likely to occur?

Select one answer only

(BO5 31 SUR)

- A Slow-wave sleep
- B Stage 1 sleep
- C Stage 2 sleep
- D Rapid eye movement sleep
- E At any time