PTS Phase 1 Mock SAQ 2023

Paper 1 – [Answers]

Examiner Instructions:

- Time allocated for examination: 2 hours.
- You are **not permitted** to leave the examination hall in the first 90 minutes and last 10 minutes.
- You are permitted to use a Sheffield University approved calculator should you wish.
- The use of mobile phones or other electronic devices is **strictly prohibited** in this exam and should be handed in or switched off for the duration of the exam.
- Please complete all 12 questions
- The paper consists of 120 marks total.

Disclaimer:

The following paper has been written **for students by students** and bares no reflection on the real exam. This is a learning tool that has not been reviewed by the University of Sheffield and therefore the use of this paper for learning are at the student's discretion.

Chief Exam Editor:

Raneem Alhalabi

Any questions:
ralhalabi1@sheffield.ac.uk
peerteaching@sheffield.ac.uk

(Question 1)
Mr Smith is a 57 year old man who comes to see you, his GP, complaining of epigastric pain after eating. This has been going on for around 3 months. After taking a thorough history, you diagnose Mr Smith with gastro-oesophageal reflux (GORD) and commence the appropriate treatment.

1. **What is the histological change Mr Smith is at risk of, and what is the potential change seen? (3 Marks)**
   Barrett's Oesophagus (1 mark) and stratified squamous to simple columnar (2 marks)

2. **What do D cells produce and their function? (2 Marks)**
   Somatostatin and inhibits HCl (1 mark each)

3. **Name 2 forms of mucosal defence (2 Marks)**
   Alkaline mucus, tight junctions, rapid cell replacement, feedback loops of gastric acid secretion

4. **Which artery supplies the greater curvature of the stomach? (1 Mark)**
   Gastro-epiploic

5. **Name 2 risk factors for GORD?**
   Stress and anxiety, smoking and alcohol, coffee, chocolate, alpha-blockers, NSAIDS, pregnancy, hiatus hernia (Any appropriate Answer)

(Question 2)
Miss Green is a 23 year old female coming to see her GP with a 6 month history of diarrhoea, blood and mucus in her stool, weight loss and fatigue. After the appropriate tests, Miss Green is diagnosed with Crohn's disease and commenced on the appropriate treatment.

1. **Miss Green was found to have extensive disease in her small bowel, particularly her ileum. She is at risk of vitamin B12 deficiency, how is this vitamin absorbed, and name one function? (3 Marks)**
   Vitamin B12, in the TERMINAL Ileum (1 mark) and needs to be bound to intrinsic factor (1 mark), Erythrocyte formation, DNA synthesis, brain development (1 mark for any).

2. **Name 3 macroscopic differences between the large and small bowel (3 marks)**

Small Bowel	Large Bowel
With exception of D1, mobile	AC and DC are fixed; rest are mobile
Smaller	Larger
Longitudinal muscle layer in wall is continuous	Longitudinal muscle s NOT continuous but is 3 muscles called TENAE COLI (except appendix)
No appendices epiploe	Has appendices epiploe
Wall smooth	Sacculated (haustrations)
Internal membrane has plicae	No plicae
Mucos membrane has villi	No villi
Peyers patches	No peyers patches
No haustrations	Has haustrations

3. **Name 3 structures which make up the hind gut (3 marks)?**

   Left 1/3 of transverse colon, descending colon, sigmoid, rectum, anal canal

4. **Which vessel supplies the ascending colon? (1 Mark)**

   Right Colic (from superior mesenteric) (no marks for SMA only)

(Question 3)

Mr Smith is a 87 year old man with rigidity, bradykinesia and tremor presents to the neurology clinic.

1. **Which parts of the basal ganglia comprise the striatum? (2 Marks)**
   Caudate and putamen

2. **Name 2 cortical loops of the basal ganglia. (2 Marks)**
   caudate nucleus, putamen, globus pallidus, subthalamic nucleus, and substantia nigra

3. **Which neurotransmitter is produced in the substantia nigra? (1 Mark)**
   Dopamine

4. **What pigmented hormone is present in the skin and what type of cell is it produced by? (2 Marks) Melanin - melanocytes**

5. **Name 2 motor related conditions and 1 psychiatric condition associated with the basal ganglia. (3 Marks) Parkinsons, Huntingtons and OCD, schizophrenia, depression, addictive disorders**

(Question 4)

Miss Green is a 32 year old woman presenting with occasional vision loss, which is particularly worse after a hot shower, fatigue and numbness in her arms and legs. Following an MRI scan, she is diagnosed with Multiple Sclerosis.

1. **What is the role of the myelin sheath. (2 Marks) facilitate the conduction of electrical impulses through the nerve cells by insulation of axon**

2. **Which cells are responsible for myelination in the peripheral nervous system and the central nervous system? (4 Marks)**
   PNS – Schwann cells (2 marks)
   CNS – oligodendrocytes (2 marks)

3. **Multiple sclerosis occurs due to a loss in the myelin sheath of neurons. Describe how this can cause symptoms to occur. (2 Marks) Slows or halts nerve conduction, resulting in loss of function/numbness.**

4. **What could be seen on MRI to diagnose MS? (2 Marks)**
   Oligoclonal Bands

(Question 5)
A 75-year-old lady presents with progressive shortness of breath, ankle swelling and chest pain on exertion. She is diagnosed with heart failure.

1. **Define preload (1)**
   The load present in the left ventricle before contraction occurs. (End diastolic volume alone is not enough)

2. **Define Starling's law (2)**
   The force of contraction of myocytes (1) is proportional to the end diastolic length of cardiac muscle fibre (1); or
   Increased end diastolic volume causes increased stretch in the myocytes (1) leading to increased contraction of the heart (1)

3. **How is cardiac output calculated? (1)**
   Heart Rate x Stroke Volume

4. **Name the two main arteries that branch directly from the left coronary artery (2)**

- **Left anterior descending artery (1 mark)**
- **(Left) Circumflex artery (1 mark)**

No marks for left marginal artery

5. **Describe the normal conduction pathway through the heart, including contraction of the atria and ventricles (3)**
   Sino-Atrial node --> Contraction of the atria --> Atrioventricular node --> Bundle of His --> Purkinje fibres --> Contraction of the ventricles
   1 mark - all in correct order
   1 mark - SAN, AVN, Bundle of His and Purkinje fibres all included
   1 mark - include atrial + ventricular contraction

6. **What is the effect of the parasympathetic nervous system on cardiac output (1)**
   Decreases cardiac output (1)

(Question 6)

Mr Green presents with oedema of his ankles and feet, increased frequency of passing urine and haematuria, he is subsequently diagnosed with Chronic kidney disease.

- **Define glomerular filtration rate (GFR). (3 Marks).** Volume of fluid filtered from glomeruli into bowman's space per unit time
- **Name 3 molecules absorbed in the ascending loop of Henle. (3 Marks)** Sodium, potassium and chloride
- **Name the two different cells that make up the collecting tubule and their function. (4 Marks)**

Principal cells - reabsorb water and sodium from lumen and secrete potassium

Intercalated cells - reabsorb potassium ions and secrete hydrogen ions into tubular lumen

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(Question 7)
Mr Ronald, a 75 year old man, goes to see his GP as he has been going to the toilet a lot more frequently. A blood test reveals that his HbA1c is 75, indicating that he has diabetes mellitus.

1. **At what anatomical level can the pancreas usually be found? (1)**
- L1/transpyloric plane

2. **What cell type in the pancreas is responsible for the secretion of insulin? (1)**
- Beta cells

3. **What are the two stages in the biphasic secretion of insulin? (2)**
- Phase 1: stored insulin is released rapidly
- Phase 2: slower release of insulin that is synthesised (in response to increased blood sugar)

4. **Binding of insulin to receptors on the surface of muscle and fat cells stimulates mobilisation to the plasma membrane of what transporters? (1)**
- GLUT-4

5. **What two processes does glucagon stimulate in the liver? (2)**
- Glycogenolysis (stimulates conversion of glycogen into glucose) (1)
- Gluconeogenesis (forming glucose from other substrates e.g. Lactic acid, or amino acids) (1)

6. **Describe the effect of cortisol on insulin + glucagon, and the consequent effect on blood glucose (3)**

- **Insulin: inhibits**
- **Glucagon: activates**
- **Overall increases blood glucose**

1 mark for each

(Question 8)
Adam Stratford is a 27 year old man with a history of IV drug use. He has come to the GP after experiencing symptoms of fever, vomiting, and pain in the upper right quadrant of the abdomen. You also notice yellowing of the skin and eyes. You order a blood test which confirms a diagnosis of hepatitis B.

1.What compound causes the yellowing of the skin seen in jaundice and how is it synthesised? (3 marks)

Bilirubin (1) synthesised from breakdown of haemoglobin -> haem (1) which is converted to biliverdin -> bilirubin (1)

2.What are 5 functions of the liver? (5 marks)

Albumin production (1) bile production (1) glycogen storage (1) removes toxins (1) stores vitamins (1) cholesterol synthesis (1) iron storage (1) amino acid synthesis (1)

3.What vessel supplies the liver with the majority of its blood supply? (1)

Hepatic portal vein (1)

4.What ligament connects the liver to the anterior abdominal wall? (1)

Falciform ligament (1)

(Question 9)

Mr Ahmed is a 45 year old man who has recently been in a work accident where he was hit on the head. He has not attended A&E as he "did not have the time to wait" but he has presented to A&E with numerous symptoms 2 days later. An X-ray suggests he has damage to his cribriform plate and superior orbital fissure.

1.What nerve may be affected if the cribriform palate is damaged and what would the effect of this nerve damage be? (2 marks)

Olfactory nerve/ CN I (1) and loss of sense of smell (1)

2.What 4 nerves pass through the superior orbital fissure? (4 marks)

Oculomotor/ CN III (1) Trochlear/ CN IV (1) ophthalmic nerve/ ophthalmic branch of trigeminal nerve/ CN V1 (1) abducens nerve/ CN VI (1)

3a. What nerve is responsible for elevating the eyelid and what muscle is used to elevate the eyelid? (2)

Oculomotor nerve/ CN III (1) and levator palpebrae superioris (1)

3b. What are 2 other nerves associated with the eye?

Trochlear nerve/ IV (1) abducens nerve/ VI (1)

(Question 10)

Mrs Collins has recently given birth to her daughter who she has now brought into the GP practice to investigate a wheezing episode. She is diagnosed with asthma and given inhalers to help manage her symptoms.

1. **Define FEV1 (2)**

The maximum volume of air that can be forcibly exhaled from a point of maximal inspiration (1) in one second (1)

2. **What ratio does the GP expect her FEV1/FVC to be? (1)**

<0.7 (1) - NOTE: Asthma is an obstructive disease

3. **Describe the first breath (4)**

Fluid is removed from the lungs (1)
Adrenaline increases surfactant release (1)
Air is inhaled (1)
Oxygen vasodilates pulmonary vessels (1)
Umbilical arteries and ductus arteriosus constricts (1)

4. **What are two functions of surfactant (2)**

Reduce surface tension (1)
Allows homogenous aeration (1)
Allows maintenance of functional residual capacity (1)

(Question 11)

Mrs Jones is a 71 year old lady who fell at home. She had an x-ray which showed a neck of femur fracture. She is referred for a DEXA scan, which results in her being diagnosed with osteoporosis.

1. **What cell type is responsible for bone resorption? (1)**

   Osteoclasts (1)

2. **Most tissues grow by interstitial growth. What growth type is exhibited during bone formation? (1)**

   Apositional growth (1)

3. **An increase in serum calcium causes an increase in what hormone from the thyroid gland? What cells produce this hormone? (2)**

   Calcitonin (1). C cell/prarafollicular cells (1).

4. **Name 2 proteins that regulate phosphate in the body. (2)**

   1 mark for each max 2: FGF-23, 1,25 dihydroxyvitamin D, Parathyroid hormone

5. **What is the major mineral found in the bone? (1)**

   Calcium hydroxyapetite (1)

6. **What type of cell senses microcracks at its location in the bone. What does it do following this? (3)**

   Osteoblasts (1) produce RANKL (1) to stimulate osteoclasts (1)

(Question 12)

A 5 year old girl attends the general practice with her Mother, complaining of itchy skin. There are dry, red patches on her hands, back of her knees and her face. The GP diagnoses her with eczema.

1. **Give 2 functions of the skin. (2)**

   Any 2 of:

   It is a barrier between the body and the environment.

   Protects against trauma

   Protects against UV rays

   Regulates water loss

   Vitamin D synthesis

   Thermoregulation

   Immunomodulation

   Sensation

2. **Thick skin is found on the palms of the hands and the soles of the feet. What makes it different from normal skin? (1)**

   It has stratum lucidum layer

3. **Melanin is a pigment responsible for skin colour. In what type of cell is it synthesised? (1)**

   Melanocytes

4. **What is the name of the cell type found in the basal epidermis that detects light touch? (1)**

   Merkle cells

5. **Name the 5 layers of the epidermis in order from outermost to innermost (5):**

   1 mark for each layer in the correct position

   1. Stratum corneum

   2. Stratum lucidum

   3. Stratum granulosum

   4. Stratum spinosum

   5. Stratum basale