

Glasgow University Medical Education Society (GUMES)



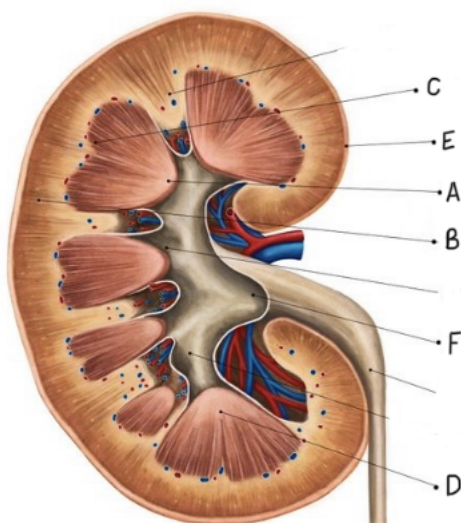
Year 1 Mock MEQ 2025/2026 (Modified Essay Questions)

Notes/Instructions:

- 1) Please download this paper to your own computer to type in your answers.
- 2) This mock paper consists of 6 questions.
- 3) Each question is worth 30 marks.
- 4) This mock paper is for you to practice and get a feel of what the questions are like in the exam.
- 5) An answer scheme has been provided for you to mark yourselves.
- 6) Please note that while every effort has been made to ensure the questions reflect how the real exam will be, there may still be errors in the paper. We are medical students just like yourselves, and will not be able to think of every possible answer. Always refer back to your own notes and what you've been taught.
- 7) We would greatly appreciate it if you could take a few minutes to fill out a feedback form, which has been linked below and at the end of the paper. This helps us gauge the quality/difficulty of the questions, and also gives us insight into the usefulness of these mock papers. If you have any specific queries about the questions/answers, you can also drop these here.
- 8) Link to feedback form: <https://forms.gle/8tRxfuffCdc6DTtk9>

MODIFIED ESSAY QUESTION 1

Sarah is a 31-year-old who has presented to A+E with a 3-day history of fever, nausea, chills and lower left flank pain. She complains of a burning sensation when urinating along with needing to urinate more often. She mentions she thought she had a UTI last week but thought it would go away on its own.



Question 1a) label the following diagram of the kidney (3 marks)

A	Renal papillae
B	Renal cortex
C	Renal pyramid
D	Renal medulla
E	Renal capsule
F	Renal pelvis

Question 1aii) Describe two main functions of the kidneys (2 marks)

Excretion of waste products – remove urea, creatinine, drugs, and toxins from the blood through urine formation.

Regulation of fluid balance – maintain body water levels and blood volume.

Regulation of electrolytes – control levels of sodium, potassium, calcium, and other ions.

Acid–base balance – regulate blood pH by excreting hydrogen ions and reabsorbing bicarbonate.

Blood pressure regulation – control blood pressure via the renin–angiotensin–aldosterone system (RAAS).

Erythropoietin production – produce erythropoietin to stimulate red blood cell formation in the bone marrow.

Vitamin D activation – convert vitamin D into its active form (calcitriol) for calcium absorption and bone health.

Osmoregulation – maintain the osmolarity of body fluids.

A urine dipstick is performed

Question 1b) State an expected positive finding in the urinalysis (1 mark)

Nitrates/leukocytes/blood +++

Sarah is subsequently diagnosed with an acute kidney infection and started on gentamicin for a duration of 4 days. It is later discovered after ultrasound that a kidney stone has caused the infection.

Question 1c) State 2 features of acute pyelonephritis (1 mark)

Fever/Chills/Flank Pain/Dysuria/Frequency/Nausea

Question 1d) Explain how bacteria reach the kidneys in acute pyelonephritis (1 mark)

Ascend from urethra to the bladder to the ureter to the kidney

Question 1e) Describe the mechanism of action of gentamicin (1mark)

Binds to the 30s subunit of the bacterial ribosome interfering with protein synthesis

Question 1dii) Explain why kidney stones may increase the risk of pyelonephritis (1 mark)

Kidney stone obstructs the ureter causing urinary stasis, allowing bacteria to multiply and ascend more easily to the kidneys

10 marks

David is a 26-year-old man who has presented to clinic with a 2-month history of fatigue, generalised muscle aches, and swollen lymph nodes. He reports unprotected sexual intercourse with multiple partners in the past 4 months. After testing, David is diagnosed with HIV.



Question 2a) Complete the the following diagram of the HIV structure (2 marks)

A	Envelope
B	Viral proteins (gp120+41)
C	RNA
D	Nucleocapsid

Question 2aii) Outline the name and function of the three viral enzymes encapsulated within the HIV structure (3 marks)

Reverse transcriptase: converts viral RNA into DNA

Integrase: inserts viral DNA into host genome

Protease: cleaves viral proteins for maturation of new virions

After talking with David, he asks how this will affect him going forward and if there is anything he can do to help prevent transmission going forward

Question 2b) Explain the clinical progression of HIV within the host (3 marks)

Acute HIV syndrome: the primary infection- HIV virus replicates rapidly and attacks CD4+ cells which decrease slightly in numbers giving the first general illness symptoms like malaise, fever etc. this then subsides in a few days as CD4+ increase in number and fight the HIV virus.

Clinical latency: progressive loss of CD4+ cells and destruction of lymphoid tissue architecture allows HIV virus numbers to continuously rise unopposed.

Clinical AIDS: CD4 count gets below 200 cells/mm³ which will cause symptoms such as rapid weight loss and fatigue and predispose to opportunistic infections.

Question 2bii) Describe how HIV infection can lead to a functionally impaired innate and adaptive immune response over time. (1 mark)

As HIV destroys CD4+ T. helper cells which are central coordination cells of the immune system, activating macrophages (innate immunity) and B cells/T cells (adaptive immunity) without CD4+ signalling both arms of immunity become functionally impaired leading to broad immune failure

Question 2biii) State a piece of advice you would offer to David to prevent future transmission

Use of condoms/Take ART consistently to achieve viral suppression

Question 3 MEQ Phase 1

A 22 year old presents to A+E following a deep lacerations to both legs after after falling from his motorbike. Paramedics have applied a tourniquet pressure to the wound however it is still bleeding excessively.

Question 3a) Describe the 3 phases of primary homeostasis (3 marks)

- **Vascular spasm (vasoconstriction)** – Immediately after vessel injury, smooth muscle in the vessel wall contracts, reducing blood flow and limiting blood loss. This is mediated by local reflexes and vasoactive substances such as endothelin.
- **Platelet adhesion and activation** – Damage to the endothelium exposes subendothelial collagen. Platelets adhere to the damaged surface through von Willebrand factor (vWF) binding to platelet receptors. The platelets then become activated and release mediators such as ADP, serotonin, and thromboxane A₂.
- **Platelet aggregation (platelet plug formation)** – Released mediators recruit additional platelets to the site. Platelets bind together via fibrinogen bridges between GPIIb/IIIa receptors, forming a temporary platelet plug that seals the injury until secondary haemostasis occurs.

Question 3aii) Explain how applying pressure promptly to the wound would slow the bleeding (1 mark)

When you apply pressure, you compress the injured blood vessels, especially small arteries, arterioles, and capillaries. This reduces the vessel diameter, which lowers blood flow to the area (less blood can pass through a narrowed or partially collapsed tube). In simple terms: less space → less flow → less bleeding.

Pressure also helps the body's normal clotting process work more effectively. Normally, platelets need time to stick to exposed collagen and form a stable plug. If blood is flowing too fast, they get "washed away." By slowing the flow, pressure gives platelets time to adhere, activate, and aggregate, and it allows the coagulation cascade to build a stable fibrin clot

There's also a mechanical effect: pressure helps keep the torn vessel edges closer together, which reduces the gap that blood is escaping through and makes clot formation easier.

It is estimated he has lost 800ml of blood. His observations are taken and are as follows:

Respiratory Rate: 22

Pulse: 109

BP:118/79

Question 1b) Define the term shock (1 mark)

Life threatening generalised form of acute circulatory failure with inadequate oxygen delivery and utilisation by cells

Question 3bii) State type of of shock he is most likely experiencing (1 mark)

Hypovolaemic/Haemorrhagic shock

Question 3biii) Explain why heart rate increases in acute blood loss (2 marks)

Baroreceptors detect decreased blood pressure

Sympathetic nervous system activated

Increases heart rate to maintain cardiac output

Blood are taken and a clotting screen returns with the patients APPT and PT times

Question 3c) explain what APTT measures (1 marks)

measures the time taken for blood to clot via the intrinsic and common coagulation pathways.

Question 3cii) State one condition APPT is prolonged (1 mark)

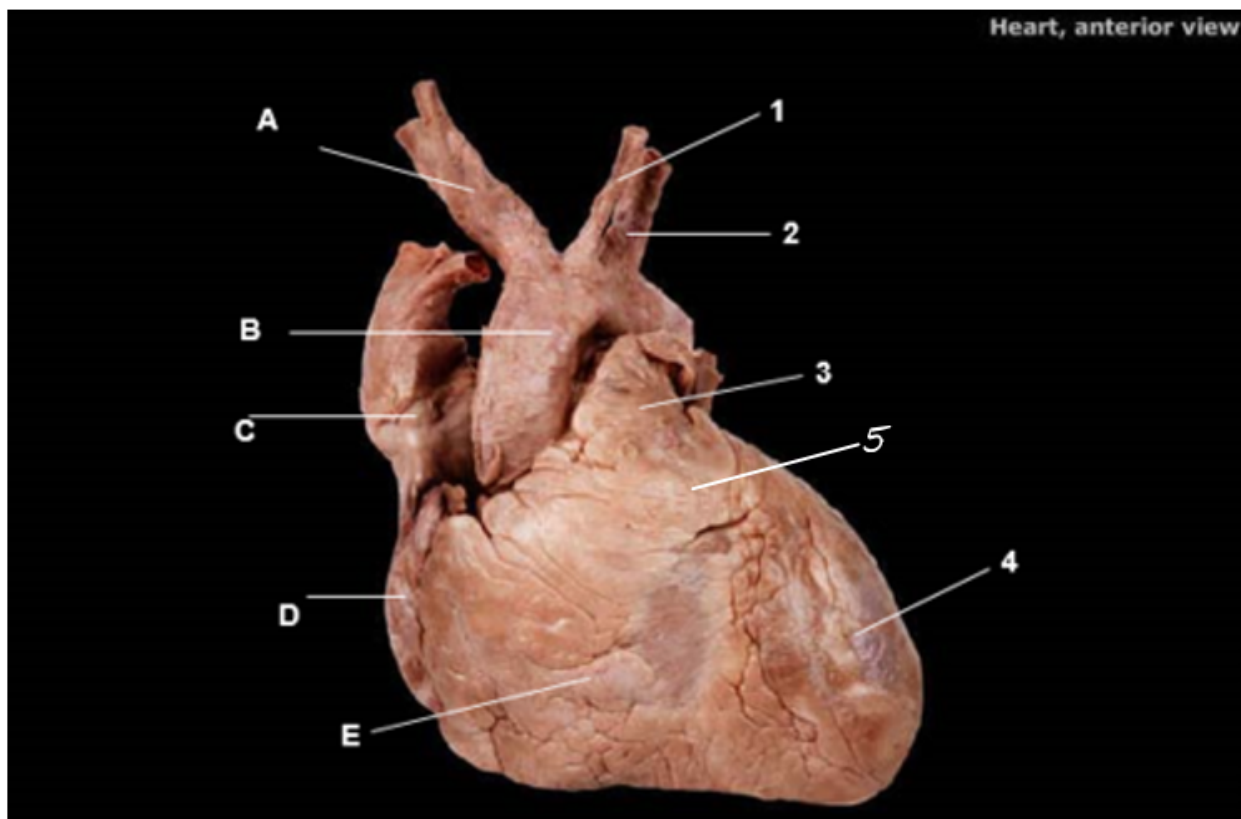
- Haemophilia A
- Haemophilia B
- Von Willebrand disease
- Disseminated intravascular coagulation (DIC)
- Liver disease
- Vitamin K deficiency
- Heparin therapy
- Lupus anticoagulant / Antiphospholipid syndrome

(TOTAL: [30] marks)

MODIFIED ESSAY QUESTION 2

A 58-year-old man, Mr. Andrew Stevenson, presents to the emergency department with central chest tightness and shortness of breath which started earlier that day while walking uphill. He also reports wheeze and increasing fatigue over the past week.

- a) 1. Label the following diagram, by filling in the blanks. (5 marks)



A	Brachiocephalic Trunk	1	Left Common Carotid Artery
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B	Aorta	2	Left Subclavian Artery
C	Superior Vena Cava	3	Pulmonary Trunk
D	Right Auricle	4	Left Ventricle
E	Right Ventricle	5	Left Atrium

- a) From which vessel do the coronary arteries arise, and what is their function? (2 marks)

Answer

The coronary arteries arise from the ascending aorta/aortic sinuses. (1 mark)

Their function is to supply oxygenated blood to the myocardium. (1 mark)

- b) What is the function of the atrioventricular (AV) node in the cardiac cycle? (1 mark)

Answer

The AV node delays conduction from the atria to the ventricles, allowing ventricular filling before contraction. (1 mark)

The patient's blood pressure remains elevated during follow-up. Repeated clinic readings confirm hypertension. He is 58 years old, does not have type 2 diabetes mellitus and identifies as White British.

- c) According to NICE guidelines, what is the first-line pharmacological treatment for hypertension in this patient? Give one example of a drug from this class and briefly describe its mechanism of action. (3 marks)

Correct Answer

Calcium channel blocker (1 mark)

Example: Amlodipine / Nifedipine (any one) (1 mark)

Mechanism:

Blocks calcium entry into vascular smooth muscle, causing vasodilation and reduced blood pressure. (1 mark)

- d) Describe how statins lower blood cholesterol levels. (2 marks)

Answer

Statins inhibit HMG-CoA reductase, the rate-limiting enzyme in cholesterol synthesis. (1 mark)

This increases hepatic uptake of LDL cholesterol from the blood, lowering circulating cholesterol levels. (1 mark)

The following ECG was recorded from the patient:



- e) Identify the abnormality shown on this ECG. (1 mark)

Answer

ST-elevation myocardial infarction (STEMI) MI

The patient becomes increasingly tachypnoeic in the emergency department. Arterial blood gas analysis demonstrates raised arterial PCO_2 and reduced PO_2 . The doctor explains that changes in blood gases are detected by central and peripheral chemoreceptors, which alter ventilation in response.

- f) Compare the roles of central and peripheral chemoreceptors by stating what they detect and where they are found. (4 marks)

Answer

Central chemoreceptors, in the Brainstem (1 mark), primarily detect Hypercapnia (increases in PCO_2). (1 mark)

Peripheral chemoreceptors, in the carotid sinus and aortic arch (1 mark), primarily detect Hypoxia (decreases in PO_2). (1 mark)

- g) Which nucleus in the brainstem receives input from peripheral chemoreceptors? (1 mark)

Answer

Nucleus Tractus Solitarius (NTS). (1 mark)

- h) Describe the three main ways carbon dioxide is transported in the blood and any enzymes (if) involved. (3 marks)

Answer

A small amount of CO₂ is transported dissolved in plasma. (1 mark)

Some CO₂ binds to haemoglobin forming carbaminohaemoglobin. (1 mark)

Most CO₂ is converted to bicarbonate ions (HCO₃⁻) (0.5 marks) in red blood cells by carbonic anhydrase. (0.5 marks)

While in the emergency department, the patient develops worsening wheeze, chest tightness and shortness of breath after walking outside in cold weather. On examination, widespread expiratory wheeze is heard bilaterally. He is given salbutamol via inhaler with symptomatic improvement.

- i) Describe the pathophysiology of asthma. (2 marks)

Answer

Asthma is characterised by airway inflammation. (1 mark)

Bronchoconstriction and increased mucus production narrow the airways. (1 mark)

- j) Identify one possible trigger for this patient's asthma symptoms and outline the first-line management of an acute asthma exacerbation. (2 marks)

Answer

Cold weather/exercise/smoke/allergen/infection (any one). (1 mark)

Salbutamol inhaler (short-acting β_2 agonist). (1 mark)

The patient is started on several new medications during admission. The doctor explains that many drugs are metabolised in the liver before being excreted from the body.

- k) State which enzyme plays a key role in Phase I drug metabolism in the liver. (1 mark)

Answer

Cytochrome P450 enzymes. (1 mark)

- l) Describe what happens in phase II of drug metabolism and its purpose. (2 marks)

Answer

Phase II metabolism involves conjugation reactions (1 mark) which make drugs more water-soluble for excretion. (1 mark)

A biopsy taken from the patient's trachea is examined under the microscope

- m) State the type of Epithelium found in the Upper Respiratory tract. (1 mark)

Answer

(non-keratinised) Pseudostratified ciliated columnar epithelium with Goblet cells (1 mark)

(TOTAL: [30] Marks)

MODIFIED ESSAY QUESTION 3

A 55-year-old man presents to his GP with right shoulder pain on movement. Upon further questioning and examination, the GP suspects that the patient has a rotator cuff injury.

After discussion with the patient, the GP prescribes some pain relief and makes a referral to physiotherapy.

- a) What type of joint is the glenohumeral joint? (1)

Synovial ball and socket joint

- b) List the rotator cuff muscles and their nerve supply (4)

- **Supraspinatus (0.5): suprascapular nerve (0.5)**
- **Infraspinatus (0.5): suprascapular nerve (0.5)**
- **Subscapularis (0.5): subscapular nerves (0.5)**
- **Teres minor (0.5): axillary nerve (0.5)**

- c) State an examination test which assesses rotator cuff muscles and which muscle they assess (2)

Any of the following (1 mark for test, 1 mark for muscle):

- **Empty can/Jobe's test: supraspinatus**
- **Painful arc: supraspinatus**
- **External rotation against resistance: infraspinatus and teres minor**
- **Internal rotation against resistance (Gerber's lift-off test): subscapularis**

- d) Describe the role of the physiotherapist (2)

The physiotherapist provides structured exercised programmes tailored to the patient (1) which aims to reduce pain, improve mobility and strengthen the joint (1)

Before the next patient arrives, the GP decides to use this case as an opportunity to discuss the process of muscle development in the embryo with the shadowing medical student.

- e) Explain how muscle development is regulated by genes and myogenic factors (3)

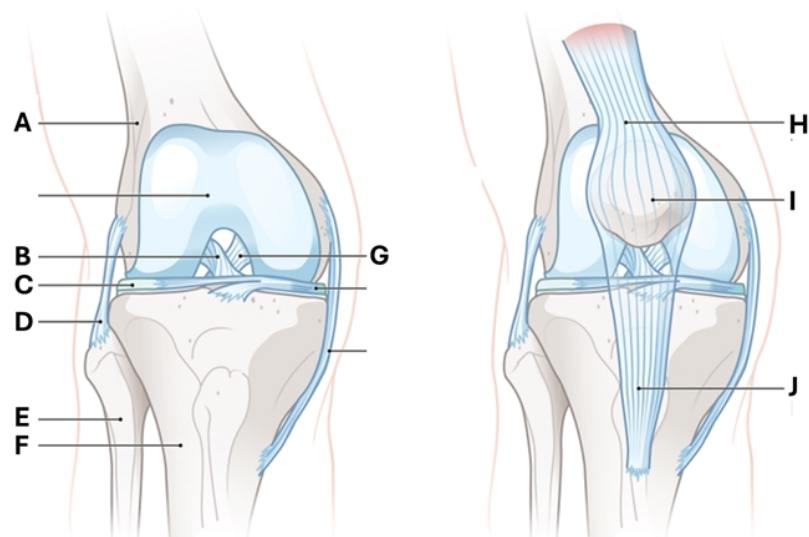
Any three of the following:

- **In the neural tube, WNT proteins and BMP combine to activate MYOD (transcription factor) in the dermomyotome**
- **Activation of MYOD in dermomyotome creates a group of muscle cell precursors, which express MYF5 (transcription factor)**
- **In the lateral plate mesoderm, WNT and BMP activates MYOD/MYF5**
- **MYOD/MYF5 activate muscle specific genes**

- A combination of Myf5, Myf6, and MyoD induces commitment of cells to the myoblast lineage
- Myogenin, MyoD, and Myf6 are required for terminal differentiation to form myocytes

The next patient in the clinic is a 63-year-old woman who complains of worsening pain in her right knee. She has attended the GP with similar symptoms in the past and was referred for an x-ray which confirmed osteoarthritis.

f) Identify the labelled structures on the following knee diagram (5)



A	Femur (0.5)
B	Anterior cruciate ligament (0.5)
C	Meniscus (lateral) (0.5)
D	Collateral ligament (lateral) (0.5)
E	Fibula (0.5)
F	Tibia (0.5)
G	Posterior cruciate ligament (0.5)
H	Quadriceps tendon (0.5)
I	Patella (0.5)
J	Patella ligament (0.5)

- g) What type of cartilage comprises the surface of the knee joint (1)

Type II hyaline cartilage (articular cartilage)

- h) State the features of osteoarthritis on an x-ray (2)

0.5 marks for each of the following:

- Loss of joint space
- Osteophyte formation
- Subchondral sclerosis
- Subchondral cysts

- i) Describe how the clinic features of osteoarthritis differentiate from the clinic features of inflammatory arthropathies (4)

Up to 2 mark for OA and 2 mark for inflammatory using the following:

- Osteoarthritis pain worsens with activity and movement (1). It is often asymmetrical (1). It commonly affects joints like the knee, hip, spine, wrist (1). Affects the DIPs (1).
- Inflammatory arthritis is worse in the morning, with stiffness lasting >30 minutes (1). Symptoms can also be worse after sitting still for a long period of time (gelling) (1). It is often symmetrical (1). Commonly affects smaller joints of the hands and feet (1). Sparing the DIPs (1).

The patient had previously trialled topical ibuprofen but remains symptomatic, so the GP prescribed oral ibuprofen

- j) State the mechanism of action and two side effects (other than gastrointestinal upset) of ibuprofen (2)

- MOA: non-selective cyclo-oxygenase (COX) inhibitor which decreases synthesis of prostaglandins, so reducing inflammation (1)
- SEs: peptic ulcer, renal impairment, hyperkalaemia, worsening of asthma (0.5 for each, max 1 mark)

- k) When prescribing NSAIDs, what other medication should be prescribed and why? (2)

- Proton pump inhibitor (or example) (1)
- For gastroprotection (1)

- l) What non-pharmacological management may be advised for this patient? (2)

1 mark for any of:

- Weight loss
- Local muscle strengthening exercise
- Walking aids

- General aerobic fitness
- Supervised therapeutic exercise sessions
- Psychosocial support
- Physiotherapy

(TOTAL: [30] Mark)

MODIFIED ESSAY QUESTION 4

GUMES MEQ RDH

A 13-year-old girl, Emma, is brought to her GP by her mother because she has not yet started puberty. Her mother is worried because many of Emma's classmates have already developed breasts and started menstruating. Emma is otherwise well, but her height is below the 5th centile.

Her family history reveals that her maternal aunt had infertility issues. Emma's BMI is within normal range

Question 1a) Define delayed puberty in females (1 mark)

Delayed puberty in females is defined as the absence of breast development by age 13 years or failure to start menstruation by age 16 years.

Question 1ai) Describe the role of kisspeptin in regulating puberty (2 marks)

- Is produced in the hypothalamus
- Stimulates GnRH release
- Activates the HPG axis
- Is influenced by leptin and sex hormones

Question 1aii) describe the role of the HPG axis during puberty (3 marks)

Hypothalamus → GnRH → Pituitary → LH/FSH → Ovaries → Oestrogen production and puberty progression.

Question 1aiii) List 2 possible causes of delayed puberty (2 marks)

Constitutional delay/hypogonadotropic hypogonadism/ hypergonadotropic hypogonadism/ inactive kisspeptin receptor/ chronic illness/ Turner's syndrome

Emma undergoes genetic testing and is found to have Turner's syndrome

Question 1b) define the chromosomal abnormality seen in Turner's syndrome (1 mark)

XO

Question 1bii) State 2 features of Turner's syndrome (1 mark)

- Short stature
- Infertility
- Delayed puberty
- Webbed neck
- Streak ovaries

Emma's mother asks about national screening programs. She is told mammograms are offered to women as part of breast cancer screening on scotland.

Question 2a) State the age range when women are invited forward for this screening? (1 mark)

50-70 years old

Question 2aii) State how often is this screening offered? (1 mark)

Every 3 years

Question 2aiii) Describe 3 criteria of an effective screening programme according to Wilson and Jungner (3 marks)

- The condition should be an important health problem.
- There should be an accepted treatment for patients with recognised disease.
- Facilities for diagnosis and treatment should be available.
- There should be a recognisable latent or early symptomatic stage.
- There should be a suitable test or examination.
- The test should be acceptable to the population.

- The natural history of the condition should be adequately understood.
- There should be an agreed policy on whom to treat as patients.
- The cost of case-finding (including diagnosis and treatment) should be economically balanced in relation to overall healthcare expenditure.
- Case-finding should be a continuing process and not a “once and for all” project.

Emma's mother has had a bad experience with screening programs as she said in her 40s she was told she might have cervical cancer after her routine smear appointment which eventually found to be normal

Question 2b) Explain the difference between sensitivity and specificity (2 marks)

Sensitivity: how many people who
test true positive (true positive/all
positives) = $a/(a+c)$

Specificity: how good test is at
identifying people without disease
(disease absent divided by all who
test negative (both false & true
negatives) = $d/(b+d)$

Question 2bii) Calculate the sensitivity and specificity of the following screening results (2marks)

Sensitivity =88.9%

Specificity =81.8%

	Disease present	Disease absent
Test positive	30	20
Test negative	10	90

Questions 2biii) Calculate the positive predictive value of the screening test results (1 mark)

80%

Question 3 MEQ RDH

A 29-year-old woman, Laura, attends her antenatal clinic appointment at 28 weeks gestation. This is her first pregnancy. She asks the midwife what the placenta does to support her baby.

State 2 functions of the placenta (1 marks)

- Nutrient transfer
- Gas exchange
- Waste removal
- Hormone secretion
- Immune/infection protection

Question 3aii) Explain the remodelling process of the spiral arteries during placenta formation (2 marks)

During placenta formation, trophoblast cells invade the maternal spiral arteries and remodel them by replacing the muscular and elastic walls. This converts the arteries into wider, low-resistance vessels that can deliver a large, steady blood supply to the placenta and fetus.

Question 3aiii) State a hormone secreted by the placenta and its function (1 mark)

- **Progesterone** — maintains the uterine lining and prevents uterine contractions.
- **Oestrogen (Estrogen)** — stimulates growth of the uterus and breasts during pregnancy.
- **Human chorionic gonadotropin (hCG)** — maintains the corpus luteum in early pregnancy so progesterone continues to be produced.
- **Human placental lactogen (hPL)** — helps prepare the breasts for milk production and alters maternal metabolism to provide nutrients for the fetus.
- **Relaxin** — relaxes pelvic ligaments and softens the cervix for childbirth.

- **Placental growth hormone** — helps regulate fetal growth and maternal metabolism.
- **Corticotropin-releasing hormone (CRH)** — involved in timing of labour and fetal development.
- **Inhibin** — inhibits secretion of follicle-stimulating hormone (FSH).
- **Leptin** — helps regulate energy balance and fetal growth.
- **Prostaglandins** — help stimulate uterine contractions during labour.

Laura feels anxious as she has heard on the news that paracetamol can cause birth defects and wants to know if this is true.

Question 3b) List 2 examples of a teratogen (2 marks)

Drugs-methotrexate/tetracyclines/chemicals/alcohol/environmental pollutants/hormones(androgens)

Question 3bii) State which weeks during development a foetus is most sensitive to teratogens (1 mark)

Week 3-8

After birth Laura returns to her GP and asks about vaccine schedules for her newborn baby.

Question 3c) Complete the following table (3 marks)

Age	Vaccines offered
8 weeks	5 in 1 Men B Rotavirus
12 weeks	5 in 1 (2 nd dose) Rotavirus (2 nd dose) Men B (2 nd dose)
16 weeks	5 in 1 vaccine (3 rd dose) Pneumococcal

