

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For the following qualifications :-

M.B., B.S.

MBBS: Written Paper (year 1)

COURSE CODE : **MBBS1003**

DATE : **21-MAY-02**

TIME : **10.00**

TIME ALLOWED : **3 hours**

02-N0208-3-360

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TURN OVER

Phase 1, Year 1: May 2002

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Modified Essay Question paper

3 hours are allowed for this paper.

- **You should attempt all 26 questions, answering each one on the page for that question – if you need more space, continue on the reverse of the page for that question only. Pages will be separated and given to different people to mark.**
- **You are provided with a sheet of bar-code labels. Place one label in the space marked on the computer-readable card and one label on the page for each question except questions 3, 8, 9, 10, and 24 – these questions are answered on the computer-readable card.**
- **For questions 3, 8, 9, 10 and 24 you must transfer your answers to the appropriate numbered lines of the mark-sense (computer-readable) card that is provided.**
- **Read the instructions for question 8 very carefully.**
- **You should read through all parts of each question before you begin to answer it – the number of marks for each part question is shown.**
- **Most questions are linked to clinical scenarios. Information about the patient is shown at the top of each question; this may differ from one question to another, as additional information is relevant to the question being asked.**
- **This question paper must not be removed from the examination room.**

Place your bar-code label here

Question 1

Fred Wills is a 55 year old man who was complaining of severe chest pains and shortness of breath on mild exercise. He was examined in A & E and subsequently admitted to hospital for further tests.

He was found to have a resting blood pressure of 200/110 mm Hg, a raised central venous pressure and a pulse rate of 90 beats min⁻¹.

What do you consider to be an acceptable resting heart rate and arterial blood pressure for a 55 year old man?

(1 mark for each)

	value	units
resting heart rate		
arterial blood pressure - systolic		
arterial blood pressure - diastolic		

What do you understand by the term preload?

(2 marks)

What do you understand by the term afterload?

(2 marks)

	Yes	No
Is the preload on his heart normal		
Is the afterload on his heart normal		

(1 mark for each)

	value	units
What is his mean arterial blood pressure?		
His resting cardiac output is found to be normal. What would you expect this value to be?		

(1 mark for each)

Is his heart doing more work than that of a man with a lower mean arterial pressure? Explain your answer.

(2 marks)

Place your bar-code
label here

Question 2

Fred Wills is a 55 year old man who was complaining of severe chest pains and shortness of breath on mild exercise. He was examined in A & E and subsequently admitted to hospital for further tests.

Further tests showed that he had an enlarged heart (i.e., showed signs of hypertrophy). Why is his heart enlarged?

(3 marks)

What might be the cause of his shortness of breath on mild exercise?

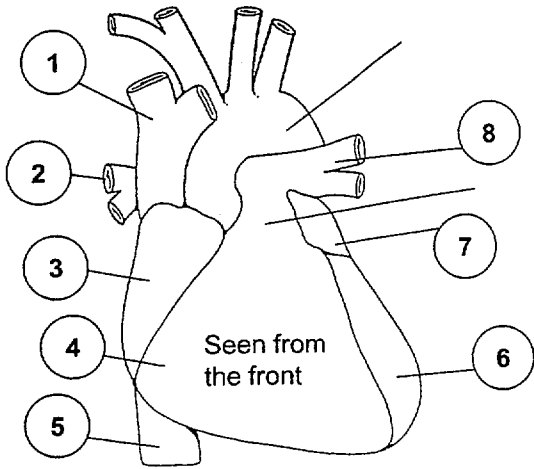
(3 marks)

What might be the cause of the chest pains on mild exercise?

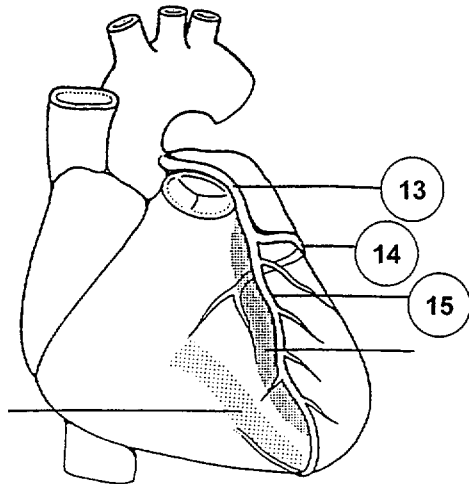
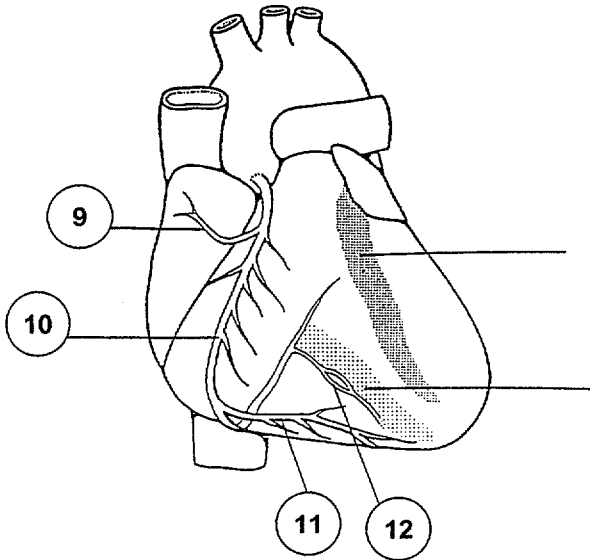
(3 marks)

Question 3

Answer this question on **lines 1 – 15** of the computer-readable card
 For each numbered item in the diagrams below select the **one** appropriate label (A – P) from the list below.
 Only one answer is correct for each number.
 Some labels may be used more than once, and some may not be used at all.



- A) Anterior interventricular artery
- B) Circumflex artery
- C) Inferior vena cava
- D) Left atrium
- E) Left auricular appendage
- F) Left coronary artery
- G) Left pulmonary artery
- H) Left ventricle
- I) Marginal artery
- J) Posterior interventricular artery
- K) Right atrium
- L) Right coronary artery
- M) Right pulmonary artery
- N) Right ventricle
- O) Sinus branch to SA node
- P) Superior vena cava



Answer this question on line 16 of the computer-readable card.

Mark one of the following statements correct.

The sinoatrial node is supplied by a branch of the right coronary artery in:

- A) 10% of cases
- B) 20% of cases
- C) 30% of cases
- D) 40% of cases
- E) 50% of cases
- F) 60% of cases
- G) 70% of cases
- H) 80% of cases
- I) 90% of cases

Place your bar-code label here

Question 4

Fred Wills is a 55 year old man who was complaining of severe chest pains and shortness of breath on mild exercise. He was examined in A & E and subsequently admitted to hospital for further tests.

The results of a blood test showed that his plasma cholesterol was 8.5 mmol/L, compared with a desirable range of < 5 mmol/l.

Cholesterol is carried by plasma lipoproteins – describe briefly the functions of:

Very low density lipoprotein (VLDL)

(2 marks)

Low density lipoprotein (LDL)

(2 marks)

High density lipoprotein (HDL)

(2 marks)

List four functions of cholesterol in the body?

(2 marks)

Place your bar-code
label here

Question 5

Fred Wills is a 55 year old man who was complaining of severe chest pains and shortness of breath on mild exercise. He was examined in A & E and subsequently admitted to hospital for further tests.

The results of a blood test showed that his plasma cholesterol was 8.5 mmol/L, compared with a desirable range of < 5 mmol/L.

He was advised to adopt a low-fat, cholesterol-free diet in order to lower his plasma cholesterol levels. However, his plasma cholesterol decreased only marginally after 3 months (7.7 mmol/L). Subsequently, he was treated with an HMG CoA reductase inhibitor, which successfully lowered his plasma cholesterol to < 6 mmol/L.

What is the purpose of treating the hypercholesterolaemia in this patient?

(1 mark)

How is it possible for a patient to continue to have high plasma cholesterol after being on a cholesterol-free diet for 3 months?

(1 mark)

Why would administering an HMG CoA reductase inhibitor lead to a fall in plasma LDL concentration?

(3 marks)

Place your bar-code label here

Question 6

Fred Wills is a 55 year old man who was complaining of severe chest pains and shortness of breath on mild exercise. He was examined in A & E and subsequently admitted to hospital for further tests.

After his discharge from hospital following his myocardial infarction, Mr Wills visits his general practitioner. He has been a lifelong smoker and currently smokes 20 cigarettes a day. The hospital doctors have strongly advised him to stop smoking.

What are the main barriers which may prevent Mr Wills from successfully quitting smoking ?

(5 marks)

How could his GP help him to stop smoking?

(5 marks)

Place your bar-code
label here

Question 7

Fred Wills is a 55 year old man who was complaining of severe chest pains and shortness of breath on mild exercise. He was examined in A & E and subsequently admitted to hospital for further tests.

Mr Wills' employers are concerned about his health in relation to his job as a van driver. They write to his GP asking for a report.

How should the GP respond?

(2 marks)

Mr Wills says that he has 'a right to confidentiality'. Discuss this in relation to the GP's duty as a doctor.

(8 marks)

Question 8

Gita P is a 20 year old medical student. She presents with vomiting and abdominal pain, initially central but now with localised tenderness in the right iliac fossa. She is visited by her GP who diagnoses acute appendicitis.

One of the following statements A – E is true; the correct answer is worth 3 marks.

Answer this question on lines 17 - 19 of the computer-readable card.

If you are sure of your answer, then mark the same letter (A – E) on all 3 lines, 17, 18 and 19

If you are fairly sure of your answer, then mark the same letter on lines 17 and 18, leaving line 19 blank

If you are unsure of your answer, then mark only line 17 leaving lines 18 and 19 blank.

The base of the appendix has an important surface marking. Mark the one correct statement from the list below:

(3 marks)

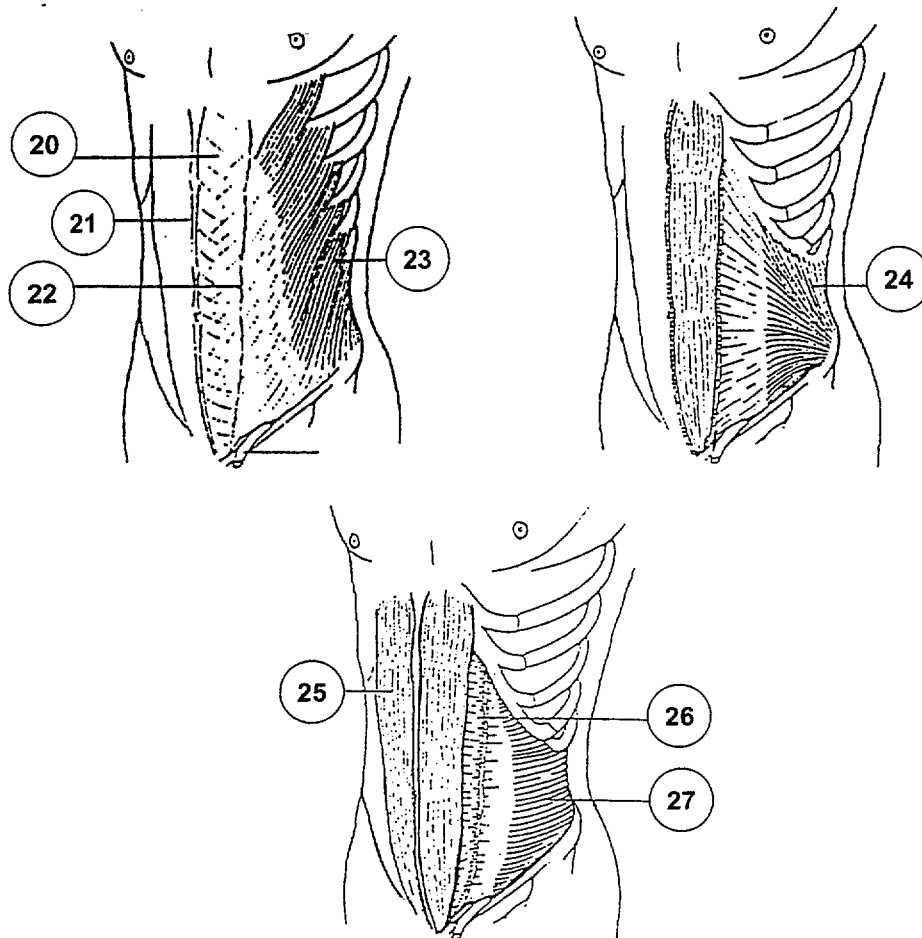
- A) The surface marking is known as Mc Murray's point and is found on the anterior abdominal wall midway between the umbilicus and anterior superior iliac spine
- B) The surface marking is known as Mc Burney's point and is found on the anterior abdominal wall midway between the umbilicus and anterior superior iliac spine
- C) The surface marking is known as Mc Burney's point and is found on the anterior abdominal wall one third of the way along a line between the umbilicus and anterior superior iliac spine
- D) The surface marking is known as Mc Burney's point and is found on the anterior abdominal wall two thirds of the way along a line between the umbilicus and anterior superior iliac spine
- E) The surface marking is known as Mc Murray's point and is found on the anterior abdominal wall one third of the way along a line between the umbilicus and anterior superior iliac spine

The surgeon who is to operate on Gita happens to be teaching a group of medical students. She asks them a series of pertinent questions relating to the abdominal wall and blood supply of the appendix – see questions 10 and 11 overleaf.

Question 9

Answer this question on lines 20 – 27 of the computer-readable card

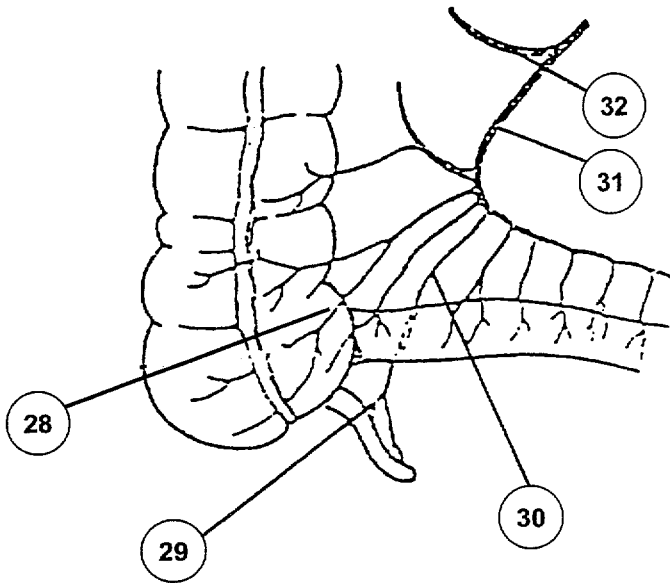
For each numbered item in the diagrams below select the one appropriate label (A – J) from the list below.
Only one answer is correct for each number.
Some labels may be used more than once, and some may not be used at all.



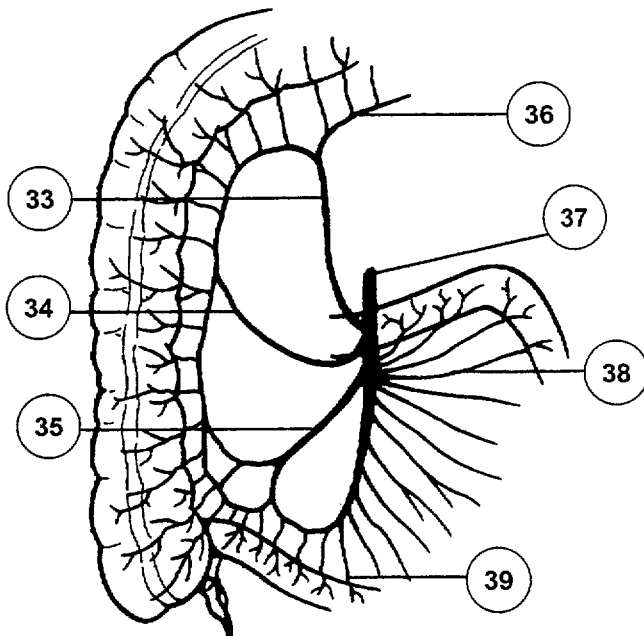
- A) External oblique
- B) Gluteus maximus
- C) Inguinal ligament
- D) Internal oblique
- E) Linea alba
- F) Linea semilunaris
- G) Quadratus lumborum
- H) Rectus abdominis muscle
- I) Rectus sheath
- J) Transversus abdominis muscle

Question 10

Answer this question on **lines 28 – 39** of the computer-readable card
 For each numbered item in the diagrams below select the **one** appropriate label (A – P) from the list below.
 Only one answer is correct for each number.
 Some labels may be used more than once, and some may not be used at all.



- A) Anterior caecal branch
- B) Appendicular artery
- C) Ileal branch
- D) Ileocolic artery
- E) Inferior mesenteric artery
- F) Inferior rectal artery
- G) Internal iliac artery
- H) Jejunal branch
- I) Left colic artery
- J) Marginal artery
- K) Middle colic artery
- L) Posterior caecal branch
- M) Right colic artery
- N) Sigmoid artery
- O) Superior mesenteric artery
- P) Superior rectal artery



Question 11

Place your bar-code
label here

Sarah G is a 15-year old girl who was taken by her mother to her GP. She had suffered from diarrhoea and flatulence for some time, and had also recently lost a considerable amount of weight, and felt weak most of the time.

You are the medical student attached to Sarah's general practice. She is waiting in the room next door. The general practitioner asks you to examine Sarah's abdomen. Describe what you would do.

(5 marks for communications skills
5 marks for describing the examination of the abdomen)

Place your bar-code label here

Question 12

Sarah G is a 15-year old girl who was taken by her mother to her GP. She had suffered from diarrhoea and flatulence for some time, and had also recently lost a considerable amount of weight, and felt weak most of the time.

Sarah said her faeces were bulky and greasy. She was referred to a gastroenterologist: faecal analysis showed steatorrhoea, and blood tests indicated iron-deficiency anaemia, folate deficiency and calcium deficiency.

Urine and faecal tests were negative for haemoglobin. A subsequent biopsy revealed villous atrophy.

The consultant advised that wheat, rye, barley and oat flours be excluded from Sarah's diet and she was prescribed iron, folate and vitamin D supplements. After six weeks, all of the symptoms, including tiredness, had disappeared.

What condition was Sarah suffering from?

(1 marks)

Explain why this condition usually leads to diarrhoea and flatulence.

(2 marks)

Why did the exclusion of cereal-based products from the diet alleviate her symptoms?

(2 marks)

What is the pathological mechanism involved in her condition?

(2 marks)

What is steatorrhoea?

(1 mark)

Place your bar-code label here

Question 13

Sarah G is a 15-year old girl who was taken by her mother to her GP. She had suffered from diarrhoea and flatulence for some time, and had also recently lost a considerable amount of weight, and felt weak most of the time.

Describe briefly the mechanisms involved in the absorption of fat digestion products across the small intestinal mucosa.

(3 marks)

Differentiate between a) an emulsion and b) a micellar solution.

(2 marks)

What is the role of the liver in the production of an emulsion and a micellar solution?

(2 marks)

What are the roles of an emulsion and micelles in the intestinal processing of dietary fat?

(2 marks)

Place your bar-code label here

Question 14

Sarah G is a 15-year old girl who was taken by her mother to her GP. She had suffered from diarrhoea and flatulence for some time, and had also recently lost a considerable amount of weight, and felt weak most of the time.

What is meant by the term villous atrophy?

(1 mark)

List 3 types of cell that are present in the villus epithelium, state where are they produced and describe the function of each.

(9 marks)

Cell type	Where produced	Function

Place your bar-code label here

Question 15

Sarah G is a 15-year old girl who was taken by her mother to her GP. She had suffered from diarrhoea and flatulence for some time, and had also recently lost a considerable amount of weight, and felt weak most of the time.

Blood tests indicated iron-deficiency anaemia, folate deficiency and calcium deficiency.

Urine and faecal tests were negative for haemoglobin. Prothrombin clotting time was within the normal range.

Explain what is meant by prothrombin clotting time.

(2 marks)

Why was Sarah's prothrombin clotting time measured?

(2 marks)

Describe in outline the processes involved in blood clotting when a blood vessel is cut.

(5 marks)

Explain why citrate is added to blood being taken for transfusion.

(2 marks)

Place your bar-code label here

Question 16

Sarah G is a 15-year old girl who was taken by her mother to her GP. She had suffered from diarrhoea and flatulence for some time, and had also recently lost a considerable amount of weight, and felt weak most of the time.

Over the month before she was diagnosed, Sarah had lost 5 kg in weight.

At the time she was diagnosed, Sarah weighed 35 kg (the 95% reference range for girls of 15 is 37.4 – 78.3 kg) and was 162 cm tall (the reference range for girls of 15 is 148.3 – 175.3 cm).

What was Sarah's body mass index (BMI) = weight (kg) / height² (m)

(1 mark)

Because of her weakness, Sarah was not very active – her physical activity level (PAL) was only about 1.2 x BMR (the average for girls of her age is 1.5 – 1.6 x BMR).

(2 marks)

Energy expenditure completely at rest, but awake, post-absorptive state, thermal neutrality

Before her condition was diagnosed, Sarah's BMR was estimated by measuring her oxygen consumption; at rest she consumed 5.44 L oxygen in 30 minutes. What was her BMR (MJ / day) [1 L of oxygen consumed is equivalent to 20 kJ energy expenditure]

(3 marks)

A 7-day weighed dietary intake record showed that Sarah was consuming an average of 6.3 MJ per day. From her BMR and her PAL = 1.2, what energy intake should be sufficient for her to maintain body weight?

(2 marks)

Why was she losing weight?

(2 marks)

Place your bar-code
label here

Question 17

This question does not apply to a specific patient

In 1999, 16 per cent of the population of Great Britain was aged 65 and over.

With reference to the 'squaring of the rectangle of survival' explain the nature of the 'demographic transition'.

(10 marks)

Place your bar-code label here

Question 18

During a respiratory physiology practical a resting medical student is monitored and shown to take 12 breaths per minute with a tidal volume (V_T) of 500 ml.

The volume of her anatomical dead space (V_D) is shown to be 150 ml.

Her alveolar levels of oxygen and carbon dioxide are shown to be $PO_2 = 100$ mmHg and $PCO_2 = 40$ mmHg.

At rest, what will be her minute alveolar ventilation? (you must show the units and your workings!) (3 marks)

For each of the following questions, tick the box for the one correct answer: (1 mark each)

She is asked to change her pattern of breathing so that her tidal volume is now 1 litre but keeping her rate of breathing the same. Compared with her rest value, her minute alveolar ventilation:

Will increase to less than double its resting value	
Will be double its resting value	
Will increase to more than double its resting value	

She is then asked to double her rate of breathing to 24 breaths per minute but keeping her tidal volume at the original 500 ml. Compared with her rest value, her minute alveolar ventilation :

Will increase to less than double its resting value	
Will be double its resting value	
Will increase to more than double its resting value	

When she doubles her alveolar ventilation her alveolar PCO_2

will increase from 40 mm Hg to 60 mm Hg	
will be unaltered	
will decrease from 40 mm Hg to 30 mm Hg	
will decrease from 40 mm Hg to 20 mm Hg	

When she doubles her alveolar ventilation her alveolar PO_2

will increase from 100 mm Hg to 120 mm Hg	
will increase from 100 mm Hg to 150 mm Hg	
will increase from 100 mm Hg to 200 mm Hg	
will decrease from 100 mm Hg to 80 mm Hg	

Place your bar-code
label here

Question 19

Mr Hobbins was involved in a road traffic accident about 2 years ago. His spinal cord was damaged severely between 7th cervical and 1st thoracic segments. All ascending and descending nerve tracts across this region have been cut.

Although he has some sensation and motor control in his arms, he is unable to move his torso and lower limbs, and these areas are devoid of sensation. Mr Hobbins is able to control his breathing and breathes spontaneously.

What is the name of, and at what spinal levels does the nerve innervating the diaphragm arise?
(2 marks)

Name the division of the peripheral nervous system to which they belong.
(1 mark)

Sometimes when his bladder is full his arterial blood pressure increases dramatically, sometimes to a mean of 200 mm Hg. His heart rate slows in response to the rise.

What receptors sense the increase in blood pressure and where are they located?
(2 marks)

In which nerves are the impulses arising from these receptors carried to the brain?

During the increase in arterial blood pressure what happens to parasympathetic nerve activity to the heart and why?
(2 marks)

Place your bar-code label here

Question 20

Mr Hobbins was involved in a road traffic accident about 2 years ago. His spinal cord was damaged severely between 7th cervical and 1st thoracic segments. All ascending and descending nerve tracts across this region have been cut.

Although he has some sensation and motor control in his arms, he is unable to move his torso and lower limbs, and these areas are devoid of sensation. Mr Hobbins is able to control his breathing and breathes spontaneously.

What happens to his sympathetic activity to the heart and why?

(2 marks)

What are the effects of noradrenaline (norepinephrine) released from sympathetic nerves on the heart? What type(s) of adrenoceptor mediate these responses?

(3 marks)

Atenolol is a reversible competitive antagonist against the effects of noradrenaline in the heart. What do you understand by the term "reversible competitive antagonist"?

(5 marks)

Place your bar-code label here

Question 22

Michael Morgan is a 45 year old man who is suffering from chronic renal failure and is pale and tired all the time. He is anaemic, with a blood haemoglobin concentration of 7 g /100 ml

Michael's plasma and urine creatinine concentrations were 0.5 mmol /L and 4 mmol /l respectively, at a urine flow rate of 2 ml /min.

Calculate his plasma clearance of creatinine

(3 marks)

His inulin clearance was 12 ml / minute. Explain briefly the difference between the inulin and creatinine clearance rates

(2 marks)

What is the metabolic source of urinary creatinine?

(1 mark)

Explain why creatinine excretion is normally relatively constant from day to day in any one person.

(1 mark)

What use can be made of urinary creatinine measurement in normal subjects?

(1 mark)

Michael was unable to concentrate urine above 300 mosmol /kg. Explain why he was unable to produce hypertonic urine.

(2 marks)

Place your bar-code label here

Question 23

Michael Morgan is a 45 year old man who is suffering from chronic renal failure and is pale and tired all the time. He is anaemic, with a blood haemoglobin concentration of 7 g /100 ml

His doctor is aware that a class of drugs called ACE (angiotensin converting enzyme) inhibitors are supposed to prevent end-stage renal failure occurring.

The relative risk (RR) of end stage renal failure has been estimated as 0.70 for patients using ACE inhibitors, compared with those not treated with ACE inhibitors. The 95% confidence interval for the RR has been estimated as 0.51 – 0.97.

If ACE inhibitors had no effect, what would the RR be?

(2 marks)

Explain what is meant by the term “null hypothesis”

(3 marks)

Are the data presented compatible with the null hypothesis? You must explain your answer.

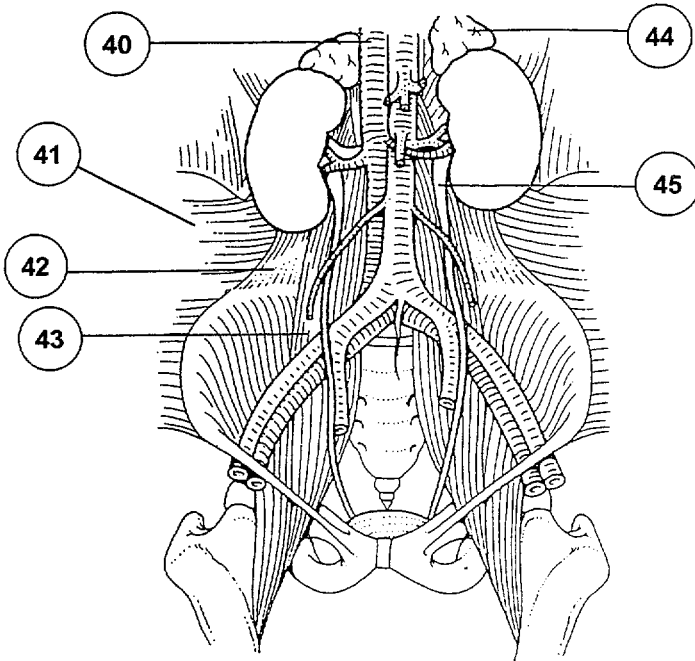
(5 marks)

Question 24

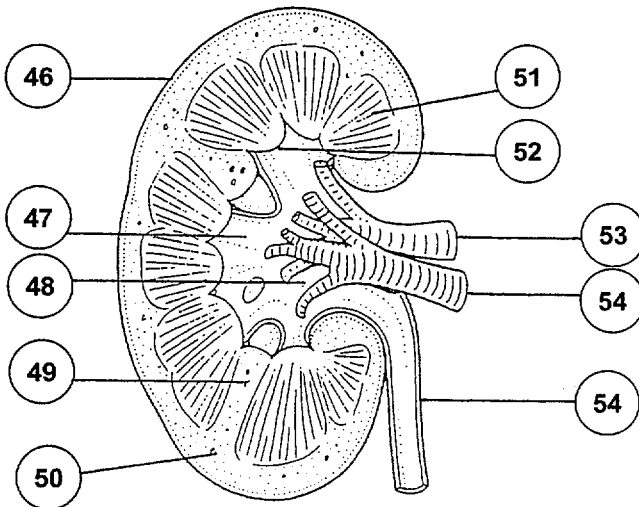
Answer this question on **lines 40 – 55** of the computer-readable card

For each numbered item in the diagrams below select the **one** appropriate label (A – P) from the list below. Only one answer is correct for each number.

Some labels may be used more than once, and some may not be used at all.



- A) Aorta
- B) Cortex
- C) Fibrous capsule
- D) Inferior vena cava
- E) Left suprarenal gland
- F) Major calyx
- G) Psoas
- H) Quadratus lumborum
- I) Renal artery
- J) Renal column
- K) Renal papilla
- L) Renal pelvis
- M) Renal pyramid
- N) Renal vein
- O) Transversus abdominus
- P) Ureter



Place your bar-code
label here

Question 25

David B went to the dentist, and had to have a filling. He received an injection of a local anaesthetic, prilocaine.

How does prilocaine produce local anaesthesia?

(4 marks)

The dentist gave prilocaine combined with adrenaline. Why?

(3 marks)

Name a local anaesthetic which is used for epidural anaesthesia?

(1 mark)

Why are local anaesthetics given by the epidural route?

(2 marks)

Place your bar-code label here

Question 26

Cathy McEwan, a 25 yr old homeless Glaswegian, presents with a fever and large injection abscess from which Staph aureus was isolated. On further examination she had leucopenia and an apical shadow with a cavity on her chest X-ray.

What virus infection is the most underlying cause of her condition?

(2 marks)

What laboratory tests would you carry out to confirm your suspicion?

(2 marks)

What are the likely causes of her lung shadowing?

(2 marks)

How would you treat her Staph aureus abscess?

(2 marks)

Why is she more likely to get opportunistic infections as her CD4 count drops?

(2 marks)

END OF PAPER