

Past-paper walk-through

The circulatory system ■ 8.1

eXercise

Questions in this set

- 9700/11 N25 Q30 ■ 1 mark
- 9700/11 N25 Q33 ■ 1 mark
- 9700/12 N25 Q32 ■ 1 mark
- 9700/13 N25 Q31 ■ 1 mark
- 9700/14 N25 Q31 ■ 1 mark
- 9700/23 N25 Q6 ■ 20 marks
- 9700/24 N25 Q5 ■ 6 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 30

9700/11 N25 ■ Q30 ■ 1 mark

30 Which statement correctly compares blood plasma and tissue fluid in a healthy person?

- A** Blood plasma contains more protein than tissue fluid.
- B** Both blood plasma and tissue fluid contain red blood cells.
- C** Tissue fluid contains white blood cells whereas blood plasma does **not** contain lymphocytes.
- D** Tissue fluid is formed from blood plasma and is **not** returned to blood plasma.

Solution 30

Answer: **A**

Why

- Tissue fluid is formed by filtration, and plasma proteins are too large to pass through the capillary wall.
- So the plasma keeps its proteins and the tissue fluid has very few.
- Red blood cells stay in the capillary too; only white cells can squeeze out.

Question 33

9700/11 N25 ■ Q33 ■ 1 mark

33 How many times must a carbon dioxide molecule pass through a cell surface membrane to travel from the tissue fluid into the blood plasma?

(Assume there are no pores between the cells the carbon dioxide molecule must pass through.)

A 1

B 2

C 3

D 4

Solution 33

Answer: **B**

Why

- Tissue fluid sits outside the capillary and plasma inside it.
- The molecule has to cross the endothelial cell: in through one membrane and out through the other.
- That is two cell surface membranes.

Question 32

9700/12 N25 ■ Q32 ■ 1 mark

32 Which blood vessel carries blood with the lowest pressure?

- A** aorta
- B** pulmonary artery
- C** pulmonary vein
- D** vena cava

Solution 32

Answer: **D**

Why

- Blood pressure falls steadily as blood travels away from the heart.
- The vena cava is the last vessel before the blood returns to the heart.
- So it carries blood at the lowest pressure of the four.

Question 31

9700/13 N25 ■ Q31 ■ 1 mark

31 The table shows the comparison of blood pressure in three main blood vessels during diastole.

	vessel 1	vessel 2	vessel 3
blood pressure in the vessel during diastole	low	very high	high

Which row identifies the three blood vessels?

	vessel 1	vessel 2	vessel 3
A	pulmonary vein	pulmonary artery	aorta
B	vena cava	aorta	pulmonary vein
C	pulmonary vein	aorta	pulmonary artery
D	pulmonary artery	pulmonary vein	vena cava

Question 31



Solution 31

Answer: **C**

Why

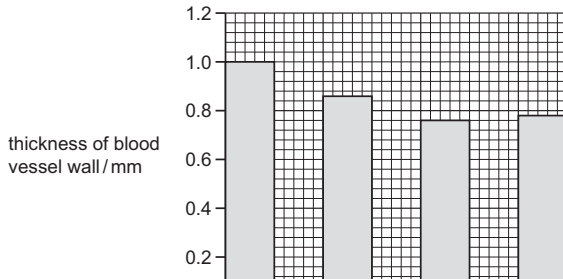
- Arteries carry blood at high pressure, veins at low pressure.
- During diastole the aorta still holds high pressure because of elastic recoil.
- The pulmonary artery is high but lower than the aorta, and veins are lowest.

Question 31

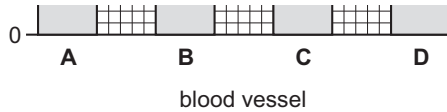
9700/14 N25 ■ Q31 ■ 1 mark

- 31** The graph shows the thickness of the walls of the main blood vessels to and from a mammalian heart.

Which blood vessel is the pulmonary artery?



Question 31



Solution 31

Answer: **B**

Why

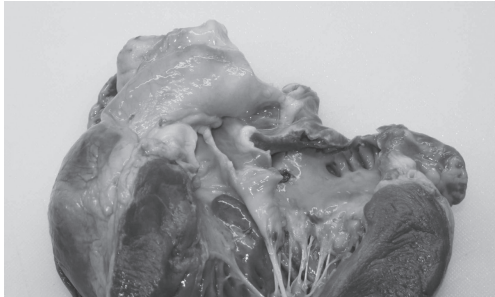
- A pulmonary artery carries blood only as far as the lungs, at a much lower pressure than the aorta.
- So its wall is thicker than any vein but thinner than the aorta.
- Look for the second-thickest wall among the four vessels.

Question 6

9700/23 N25 ■ Q6 ■ 20 marks

- 6 (a) A student studied the structure of a mammalian heart.

The student took a photograph of the left side of a dissected heart as shown in Fig. 6.1.



Question 6

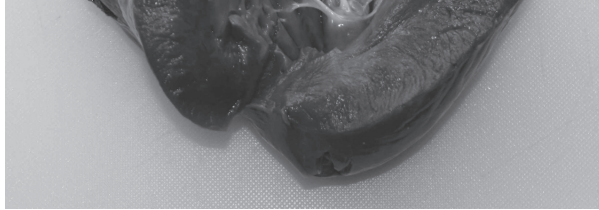


Fig. 6.1

Identify **two** features of the left side of the heart visible in Fig. 6.1 **and** explain how each feature is adapted to the function of the heart.

Question 6

[4]

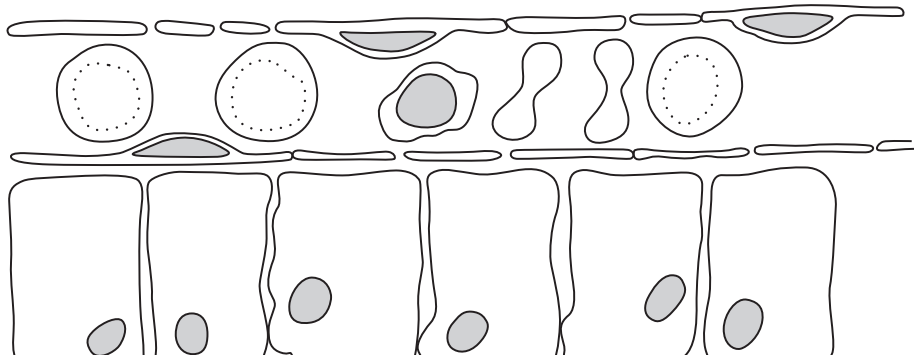
- (b)** Cardiac muscle is described as myogenic. This means the electrical activity controlling the rhythm of a regular heartbeat begins within the muscle tissue of the heart.

Describe how electrical activity within the heart controls each heartbeat.

Question 6

(c) Tissue fluid is formed from blood plasma as it flows through capillaries.

Fig. 6.2 is a diagram of a capillary and some adjacent tissue cells in a capillary network.



Question 6

Question 6



Fig. 6.2

- (i) Describe **two** functions of tissue fluid.

Question 6

- (ii) With reference to Fig. 6.2, describe how tissue fluid is formed.

Question 6

(d) Measles is a common disease caused by a virus. Vaccination to prevent the disease has been very successful.

(i) A child receives a vaccine for measles.

Explain why only some of the T-lymphocytes in the child respond to the measles vaccine.

Question 6

- (ii) Describe the events that occur in an immune response to a vaccine that result in lymphocytes that provide long-term immunity to measles.

Question 6

[Total: 20]

Solution 6

(a) Mark scheme

- any two of these pairs, feature and explanation
- 1
- thick wall of (left) ventricle ; R if right
- 2
- pumps blood at high pressure to, reach (all of) systemic circulation / overcome resistance in systemic circulation /
- over a long distance / AW ;
- A if thick wall unqualified A generate high force

Solution 6

- R 'withstands high pressure'
- 3
- thin wall of (left) atrium ;
- 4
- pumps blood at low pressure, into ventricle / over a short distance ;
- either
- 5
- (named) valves ; R tricuspid / pulmonary
- 6
- prevent, backflow of blood / maintains one-way flow of blood (through heart) ;

Solution 6

- ecf if right atrioventricular / tricuspid
- or
- 5
- (left) atrioventricular / mitral / bicuspid, valve ; R right
- 6
- prevents, backflow of blood / blood flowing from ventricle to atrium ;
- A maintains one-way flow of blood (through heart)
- or
- 5
- (left) semi-lunar, valve ;

Solution 6

- 6
 - prevents, backflow of blood / blood flowing from, aorta / artery, to ventricle ;
 - A maintains one-way flow of blood (through heart)
- 7
 - chordae tendinae / tendons / tendinous cords / AW ; I ligaments
- 8
 - hold the valve in position, during systole / when ventricle contracts / AW ;
 - A prevents blowback / turning inside out
 - I high tensile strength unqualified
- 9,10

Solution 6

- AVP ;; e.g
- papillary muscle ;
- contracts to hold, tendons / valve, when heart contracts / during systole ; ora
- 4
- 9700/23
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Solution 6

(b) Mark scheme

- any four from:
- if AVN used penalise once and then use ECF
- 1
- sinoatrial node releases, waves of excitation / waves of depolarisation / (electrical) impulses / action potential(s) ; AW
- 2
- impulses / AW, stimulate, (both) atria to contract / atrial systole ;
- 3

Solution 6

- impulses / AW, prevented from reaching ventricles by, fibrous ring / non-conducting tissue / insulating tissue /
- (between atria and ventricles) ; A annulus fibrosus
- 4
- atrioventricular node, delays impulse (by 0.1 s) ;
- 5
- atrioventricular node, sends impulse to, Purkyne tissue (in septum) ; A bundle of His
- allow ecf for abbreviating AVN
- 6

Solution 6

- Purkyne tissue conducts impulse to, base of ventricles / apex of heart, so they contract ;
- 4

Solution 6

(c)(i) Mark scheme

- any two from: if transport is used in MP2 to MP8, penalise once and mark to a max of 1 for those MPs
- provides, aqueous / watery, (external) environment / surroundings, for cells
- 1
- to maintain correct water potential
- to prevent, cell dehydration / excessive water loss from cells ;
- idea that provides medium for exchange of substances
- 2

Solution 6

- supply of oxygen / oxygen diffuses from blood into tissue fluid ;
- 3
- removal of carbon dioxide / carbon dioxide diffuses from tissue fluid into blood ;
- A exchange of (respiratory) gases as alternative to MP2 and MP3
- 4
- supply of named nutrient e.g. glucose, amino acids, (named) ion(s) ;
- 5
- removal of, metabolic / toxic, waste or urea ;
- 6

Solution 6

- location / movement, of (tissue) macrophages / neutrophils / phagocytes (for defence) ; 1 white blood cell
- 7
- allows movement of / medium for passage of, (named) cell signalling molecules / hormones / ligands ;
- A ref. to cells signalling nearby cells / paracrine signalling
- 8
- AVP ; e.g. contributes to formation of lymph / contains antibodies
- e.g. allows movement of lymphocytes into lymph
- 2
- 9700/23

Solution 6

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Solution 6

(c)(ii) Mark scheme

- any three from:
- 1
- (at arteriole end of capillary) high, hydrostatic / blood, pressure ;
- 2
- (ultra)filtration / described ;
- e.g. fluid / plasma / water and solutes, forced / comes, out of, capillaries / blood
- 3

Solution 6

- glucose / amino acids / ions, leave blood R if stated, red blood cells / platelets, leave
- or
- (large) plasma proteins remain in blood ;
- 4
- through, fenestrations / fenestrae / endothelial pores
- or
- through, pores / gaps / spaces, in, capillary wall / endothelium / between cells ;
- 5
- AVP ; e.g. ref. to hydrostatic pressure gradient

Solution 6

- hydrostatic pressure of blood is greater than hydrostatic pressure of tissue fluid
- 3

Solution 6

(d)(i) Mark scheme

- I pathogen A epitope for antigen
- any two from:
 - some (T-lymphocyte) have (T-cell) receptors, specific / complementary, to a particular antigen ; ora
 - antigen (in vaccine) binds to these T-lymphocytes ;
 - idea that only these T-lymphocytes are, activated / stimulated / selected ; I respond
- AVP ; e.g. some T-lymphocytes do not become exposed to limited quantity of antigen in vaccine

Solution 6

- 2
- 9700/23
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Solution 6

(d)(ii) Mark scheme

- max four if no correct ref. within response to, memory cells / immunological memory
- any five from:
 - context of primary immune response
 - 1
 - antigen presentation by macrophages ;
 - 2

Solution 6

- (T- / B-) lymphocyte, binding / recognition / clonal selection / activation / described in terms of receptor ;
- 3
- clonal expansion / cell divides by mitosis many times (to produce a clone) / AW ;
- 4
- cytokines released by T-helper, cells / lymphocytes ;
- 5
- (stimulate) formation of memory, (T- / B-) lymphocytes / cells ;
- 6
- (memory cells) remain in, circulation / body, for a long time / AW ; A remain in lymph nodes

Solution 6

- or
- memory cells are long-lived ;
- context of secondary immune response
- 7
- large numbers of (specific), memory cells / lymphocytes ; I more memory cells
- A memory cells have a higher chance of encountering antigen
- 5

Question 5

9700/24 N25 ■ Q5 ■ 6 marks

5 Veins transport blood towards the heart. The structure of a vein is adapted to its function.

- (a)** The inner layer of a vein is the tunica intima, composed of a single layer of endothelial cells that form a protective barrier.

When the tunica intima of a blood vessel is damaged, endothelial cells can carry out mitosis to allow tissue repair to occur.

- (i)** The spindle that is formed during mitosis is composed of spindle fibres.

Name the cell structures that are organised to form spindle fibres during mitosis.

Question 5

(ii) Describe the **telophase** stage of mitosis.

Question 5

(b) Explain how the structure of a vein is related to its function.

You **do not** need to include details of the structure of the tunica intima and its function.

Question 5

[Total: 6]

Solution 5

(a)(i)

Mark scheme

- microtubules ;
- 1

Solution 5

(a)(ii) Mark scheme

- any two from:
- ref. to (daughter) chromosomes at poles ; R move to poles I ends
- A (sister) chromatids at poles
- A two separate groups of (daughter) chromosomes
- A two nuclei form (enclosing chromosomes) I there are two nuclei R if in context of cell dividing
- in context of at each pole, so R if context implies only a single nucleus
- nuclear envelope, reassembles / (re-)forms / AW (around chromosomes) ;

Solution 5

- A nuclear membranes reassemble
- nucleolus / nucleoli, reappear(s) / re-form(s) ;
- (daughter) chromosomes, become diffuse / become long and thin / decondense / uncoil ;
- A become chromatin
- I chromosomes disappear
- spindle, disassembles / AW ; A spindle breaks down
- accept ref. to microtubules in a correct context
- 2
- 9700/24

Solution 5

- October/November 2025

Solution 5

(b) Mark scheme

- any three from:
- two structural features named ;
- valves do not count as a feature if described as semilunar
- tunica, externa / adventitia A outer layer with collagen
- tunica media A middle layer with smooth muscle and elastic tissue
- thin wall
- large lumen (relative to wall thickness)
- feature matched to function

Solution 5

- valve I semilunar
- to, prevent backflow / help blood move back towards the heart / help move blood in one direction ;
- tunica, externa / adventitia
- contains collagen / thick(est) layer / outer layer, to protect / prevents collapse (from external forces) / helps to maintain
- shape ; AW
- tunica media
- smooth muscle, for (mechanical) support / to change diameter of lumen / to help move (low / zero, pressure) blood back
- towards heart ;

Solution 5

- elastic fibres to accommodate changes in, blood volume / lumen diameter ;
- A allows, vein / blood vessel, to, stretch / recoil
- R stretch and recoil to prevent bursting
- thin walls with large lumen
- holds large(r), volume / quantity / amount, of (low / zero, pressure) blood | more blood
- or
- (large lumen) ref. to minimises / reduces, resistance (from walls) ;
- 3
- 9700/24

Solution 5

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