Body Fluids and Circulation

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The pacemaker of the heart is the:

(a) bundle of His **(b)** Purkinje fibres

(c) atrio-ventricular node **(d)** sino-atrial node (SAN)

2. A heart beats 88 times a minute with a stroke volume of 65 mL. The cardiac output is:

(a) 5.72 L per minute **(b)** 0.15 L per minute

(c) 57.2 L per minute **(d)** 11.44 L per minute

3. At 106 beats a minute, one cardiac cycle lasts about:

(a) 0.28 s **(b)** 1.13 s **(c)** 0.57 s **(d)** 1.77 s

4. Can a person of blood group A donate red cells to a person of group AB?

(a) Only if both are Rh-negative **(b)** Only plasma, never cells

(c) No **(d)** Yes

5. A blood sample has 7,500 white blood cells per mm^3, and 7% of them are monocytes. The number of monocytes per mm^3 is:

(a) 525 **(b)** 1,275 **(c)** 6,975 **(d)** 53

6. Which part of an ECG represents depolarisation of the ventricles?

(a) The P wave **(b)** The QRS complex

(c) The T wave **(d)** The S–T segment

7. The bicuspid (mitral) valve:

(a) guards the opening between the right atrium and right ventricle

(b) carries oxygenated blood from the left ventricle to the body

(c) guards the opening between the left atrium and left ventricle

(d) carries blood from the intestine to the liver

8. Assertion (A): A person of blood group A has anti-B antibodies in the plasma.
Reason (R): The plasma contains antibodies against the person's own red-cell antigens.

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. What is double circulation?

10. A person's cardiac output is 5.5 L per minute at 83 beats a minute. Find the stroke volume. (2 decimal places)

11. A heart beats 87 times a minute. How long is each cardiac cycle, and how many times does it beat in 1 minute?

12. What antigens are on the red cells, and what antibodies are in the plasma, of a person with blood group O?

13. A person has 8,000 white blood cells per mm^3. Taking eosinophils as 3% and neutrophils as 62%, how many of each are there per mm^3?

14. What does the QRS complex of an ECG represent? If the QRS complexes come 80 times a minute, what is the heart rate?

15. Which structure or structures carries oxygenated blood from the left ventricle to the body?

16. What kind of heart do birds have, and what type of circulation?

Section C — Word problems — 4 × 4 = 16 marks

17. Describe the composition of blood.

18. A person's heart beats 87 times a minute with a stroke volume of 70 mL. (a) Find the cardiac output. (b) How long is each cardiac cycle? (c) How much blood does the heart pump in an hour? (d) If the body has 5 L of blood, about how long does all of it take to pass through the heart once?

19. Patient P has blood group AB and donor D has group O. (a) Give the antigens and antibodies of each. (b) Can D's red cells be given to P? Explain. (c) Which group is the universal donor and which the universal recipient?

20. A healthy person has 7,600 white blood cells per mm^3. Using neutrophils 62%, lymphocytes 22%, monocytes 7%, eosinophils 3% and basophils 1% (the rest unaccounted), find the number of each per mm^3 and give the main job of each.

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Answer key

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Q	Answer	Working
1	**(d) sino-atrial node (SAN)**	it starts each beat (70–75 times a minute)
2	**(a) 5.72 L per minute**	65 × 88 mL
3	**(c) 0.57 s**	60 s ÷ 106
4	**(d) Yes**	donor A red cells carry A antigens; recipient AB plasma has no anti-A or anti-B antibodies
5	**(a) 525**	7,500 × 7/100
6	**(b) The QRS complex**	—
7	**(c) guards the opening between the left atrium and left ventricle**	—
8	**(c) A is true, but R is false.**	A is true: group A red cells carry A antigens, so the plasma has anti-B antibodies. R is false.
9	**Blood passes through the heart twice in one complete circuit: the pulmonary circulation (right ventricle → lungs → left atrium) and the systemic circulation (left ventricle → body → right atrium).**	—
10	**66.27 mL**	5500 mL ÷ 83
11	**0.69 s; 87 times**	60 ÷ 87; 87 × 1
12	**No A or B antigens; anti-A and anti-B antibodies**	—
13	**eosinophils 240; neutrophils 4,960**	—
14	**Depolarisation of the ventricles; 80 beats a minute**	each QRS complex is one ventricular contraction
15	**Aorta**	—
16	**Four-chambered; complete double circulation**	—
17	**Plasma (about 55%): about 90–92% water and 6–8% proteins (fibrinogen for clotting, globulins for defence, albumin for osmotic balance), plus glucose, amino acids, lipids, minerals and clotting factors. Formed elements (about 45%): red blood cells (5–5.5 million per mm^3, with haemoglobin, living about 120 days), white blood cells (6000–8000 per mm^3) and platelets (1.5–3.5 lakh per mm^3, for clotting).**	—

Q	Answer	Working
18	**(a) 6.09 L per minute; (b) 0.69 s; (c) 365.4 L; (d) about 49.26 s**	70 × 87 mL; 60 ÷ 87; × 60; 5 ÷ 6.09 minutes
19	**(a) P: A and B antigens, no anti-A or anti-B antibodies; D: no A or B antigens, anti-A and anti-B antibodies. (b) Yes: D's red cells carry no antigen that P's antibodies attack. (c) O is the universal donor; AB the universal recipient.**	—
20	**neutrophils 4,712 (phagocytes that destroy foreign organisms); lymphocytes 1,672 (responsible for immune responses (B and T cells)); monocytes 532 (phagocytes); eosinophils 228 (resist infections and take part in allergic reactions); basophils 76 (secrete histamine, serotonin and heparin, involved in inflammation)**	—