Answers to EOCQs

Chapter 8

The mark schemes, suggested answers and comments that appear in this CD-ROM were written by the author(s). In examinations, the way marks would be awarded to answers like these may be different.

Notes about mark schemes

A or **accept** indicates an alternative acceptable answer.

R = reject. This indicates a possible answer that should be rejected.

; The **bold** semi-colon indicates the award of 1 mark.

/ This indicates an alternative answer for the same mark. The alternatives may be separated from the rest of the answer by commas.

( ) Text in brackets is not required for the mark.

Underlining This is used to indicate essential word(s) that must be used to get the mark.

AW means 'alternative wording'. It is used to indicate that a different wording is acceptable provided the essential meaning is the same, and is used where students' responses are likely to vary more than usual.

AVP means 'additional valid point'. This means accept any additional points given by the student that are not in the mark scheme, provided they are relevant. But accept only as many additional points as indicated by the bold semi-colons, e.g. **AVP;;** means award a maximum of 2 extra marks.

ORA means 'or reverse argument' and is used when the same idea could be expressed in the reverse way. For example: 'activity increases between pH 2 and pH 5 **ORA**' means accept 'activity decreases between pH 5 and pH 2'.

max. This indicates the maximum number of marks that can be given.

1 C**;** [1]

2 C**;** [1]

3 D**;** [1]

4 B**;** [1]

5 *Information for constructing this table can be found on pages 158–163* [6]

6 *Information for constructing this table can be found on pages 164–166* [6]

7 the haemoglobin molecule is a protein with quaternary structure**;**
hydrogen bonds, ionic bonds and van der Waals forces hold the protein in its three-dimensional shape**;**
the primary structure of each polypeptide chain determines how the chain will fold / where the bonds will form (thus determining its three dimensional shape)**;**
the haemoglobin molecule has R groups with small charges on its outer surface (hydrophilic R groups), which help to make it soluble in water**;**
this allows it to dissolve in the cytoplasm of a red blood cell**;**
each haemoglobin molecule is made up of four polypeptide chains, each with a haem group at its centre**;**
each haem group can bind reversibly with one oxygen molecule**;**
when one oxygen molecule binds with one of the haem groups, it slightly changes the shape of the haemoglobin molecule**;**
so that it becomes easier for more oxygen molecules to bind with the other haem groups**;** [max. 6]

8 **a** (the word 'gradually' is not correct)
the partial pressure of oxygen is high in the lungs and low in muscle and does not change gradually as the blood flows from the lungs to the muscle, (because it is only when it gets to the muscle that the blood is in contact with anything that is using oxygen)**;**

while it is inside an artery, it remains fully oxygenated;
the blood is only exposed to a low partial pressure of oxygen once it enters a capillary inside a respiring tissue, such as a muscle;
capillary walls, unlike those of arteries, are thin and easily permeable to oxygen; [max. 2]

b (arteries do not pump blood)
elastic artery walls enable the artery to expand and recoil as pulses of high-pressure blood pass through;
recoil of the artery wall does help to give the blood a further 'push' in between these pulses;
but this is not 'pumping' and is due only to elasticity, not to muscle contraction; [max. 2]

c each haemoglobin molecule can combine with eight oxygen atoms;
one red cell contains well over 200 million haemoglobin molecules;

d (red blood cells do have a large surface area, but oxygen does not attach to their surface)
the large surface area allows more oxygen to diffuse in and out at any one time;
therefore increasing the rate at which the cell can take up and release oxygen;
once inside the cell, the oxygen does not attach to its surface, but to the haemoglobin molecules within its cytoplasm; [max. 2]

[Total: 8]

9 a reference to diffusion;
down concentration gradient;
through the wall of a capillary; [max. 2]

b lower pressure;
lower concentration of oxygen;
lower concentration of glucose;
lower water potential;
lower concentration of proteins / amino acids / fatty acids / other named nutrient;
higher concentration of urea; [max. 3]

c i carbonic anhydrase; [1]

ii hydrogencarbonate ions diffuse out of red blood cells;
(hydrogencarbonate ions) are transported in solution in blood plasma;
conversion of CO_2 to hydrogencarbonate reduces concentration of CO_2 in the blood;
which maintains diffusion gradient for CO_2 to diffuse into the blood from respiring tissues; [max. 3]

d i 73%, 62%; [1]

ii presence of carbon dioxide causes affinity of haemoglobin for oxygen to decrease;
hydrogen ions (from the dissociation of H_2CO_3) bind with haemoglobin;
cause change in shape of Hb molecule; [max. 2]

iii Bohr effect; [1]

iv causes more release of oxygen (than if this effect did not occur);
in respiring tissues;
where demand for oxygen is high / where production of carbon dioxide is high; [3]

[Total: 16]

10 a blood goes through heart twice on one complete circuit of the body; [1]

b has more smooth muscle / elastic tissue;
to withstand higher (blood) pressure;
to withstand fluctuating (blood) pressure; [max. 2]

c to prevent blood flowing into the capillary bed / to divert blood to other capillary beds; [1]

d permeable walls / reference to pores in walls;
allow water / dissolved ions / dissolved substances (from plasma) to pass out;
do not allow large protein molecules / cells to pass out;
reference to greater hydrostatic pressure inside capillary than in tissue fluid; [max. 3]

e i (plasma contains) more proteins;
has lower water potential;
has lower, carbon dioxide / HCO_3^- concentration;
has greater glucose concentration;
has greater oxygen concentration; [max. 3]

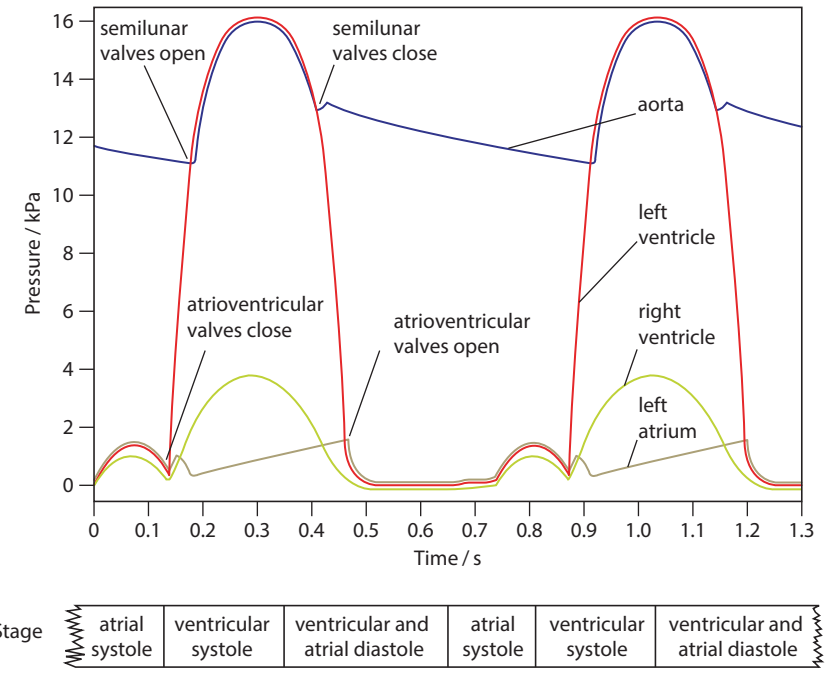
ii lymph; [1]

[Total: 11]

11 a i about 0.75 seconds;

ii $60 \div 0.75 = 80$ beats per minute;

For **b**, **c**, **d**, **e** and **f**, see figure below.



Stage	atrial systole	ventricular systole	ventricular and atrial diastole	atrial systole	ventricular systole	ventricular and atrial diastole

12 **a** **i** right ventricle**;**
pulmonary vein**;** [2]

ii they open to allow blood to flow from atria to ventricles**;**
they close during ventricular systole / when ventricles contract**;**
reference to closure being caused by differences in pressure in atria and ventricles**;** [max. 2]

b

Event during the cardiac cycle	**Number**
atrioventricular (bicuspid) valve opens	6
ventricular systole	1**;**
semilunar (aortic) valve closes	5**;**
left ventricle and left atrium both relaxing	2**;**
semilunar (aortic) valve opens	4**;**

[4]

c SAN produces rhythmic pulses of electrical activity**;**
which spread across the muscle in the atria**;**
causes muscle in atria to contract**;**
specialised tissue, in septum / near AVN, slows spread / delays transfer to ventricles**;**
Purkyne tissue conducts impulses down through septum**;**
impulses spread upwards through ventricle walls**;**
causing ventricles to contract from bottom upwards**;**
delay of 0.1 to 0.2 s after atrial walls**;** [max. 5]
[Total: 13]