

# The Heart

## Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Transport in mammals
Sub Topic	The Heart
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : 69 minutes

Score : / 57

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) 1 renal/Bowman's, capsule ;  
2 ref. podocytes ;  
3 (proximal convoluted tubule/distal convoluted tubule/capsule) in cortex ;  
4 proximal convoluted tubule ;  
5 loop of Henle ;  
6 (loop) in medulla ;  
7 distal convoluted tubule ;  
8 afferent arteriole ;  
9 glomerulus ;  
10 efferent arteriole ;  
11 capillary network around/proximal convoluted tubule/loop/distal convoluted tubule ;  
12 collecting duct ;

*accept points on a labelled diagram*

[7 max]

- (b) 13 endothelium of, blood capillaries/glomerulus ;  
14 more/large, gaps between endothelial cells ;  
15 podocytes ;  
16 large gaps between podocytes/filtration slits ;  
17 basement membrane, selective barrier/acts as a filter ;  
18 prevents, large protein/RMM > 68 000, passing through ;  
19 no cells pass through ;  
20 named molecule which is filtered ; e.g. urea/water/glucose/uric acid/creatinine/  
Na<sup>+</sup>/K<sup>+</sup>/Cl<sup>-</sup> ;  
21 high, blood/hydrostatic, pressure in glomerulus ;  
22 afferent arteriole wider than efferent arteriole ;  
23 lower pressure in, renal/Bowman's, capsule ;  
24 fluid forced into capsule/ultrafiltration ;

[8 max]

**[Total: 15]**

2	(a)	<b>event</b>	<b>three marks</b>	<b>two marks</b>	<b>one mark</b>
		impulses pass down septum through conducting fibres known as the bundle of His	<b>4</b>	any four / five correct ;;	any two / three correct ;
		atrioventricular node sends out impulses	<b>3</b>		
		impulses travels across atrial walls	<b>2</b>		
		impulses reach base of ventricles (apex of heart)	<b>5</b>		
		impulses pass up through Purkyne fibres in ventricle walls	<b>6</b>		
		sinoatrial node sends out impulses	<b>1</b>		

[3]

- (b) following ventricular systole / contraction  
or  
when ventricles in diastole / relaxation ;

when pressure in arteries higher than that of ventricles  
or  
when pressure in ventricles lower than in arteries ;  
**A** aorta / pulmonary artery

[2]

- (c) *in blood*

*idea that* red blood cells too large to leave capillaries ;  
*idea that* (some plasma) proteins too large to leave capillaries ;

higher concentration of oxygen, qualified ;  
e.g. from lungs  
not yet unloaded (from haemoglobin)  
not yet diffused out (from red blood cell)  
not yet forced out of capillary (in plasma)

(higher concentration of) glucose / nutrients / named nutrient, qualified ;  
e.g. to be delivered to cells / from absorption

*tissue fluid contains*

*ref. to* products excreted by cells (yet to enter blood) ;  
e.g. waste products / (more) carbon dioxide / lactate

[2]

**[Total: 7]**

3 (a) one mark each correct label to max 3;;; [max 3]

(b) X marked over coronary artery section before graft joins; [1]

(c) cure for, coronary artery disease / atherosclerosis in artery;

**A** arteriosclerosis

so less risk of, myocardial infarction / heart attack / AW;

*prevention of coronary artery disease to avoid bypass surgery*

one example; e.g.

no smoking

increase exercise

low, (saturated) fat / cholesterol, diet

reduce alcohol consumption

reduce salt intake

statins

avoid, excessive / AW, sugar

avoid obesity

ref. to difficulties in getting people to change lifestyle to prevent;

disadvantage of, surgical procedure / cure;

*accept ora prevention*

e.g. invasive / painful

costly medical

lost time / money, by absence from work

risk of complications / graft rejection / infection

risk / graft becoming diseased / collapsing

**AVP**; e.g. *idea that* as cure is available, more difficult to encourage prevention

[max 3]

**[Total: 7]**

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- 4 (a) (i) acts as a pacemaker / regulates heartbeat ;  
**A** ref. to myogenic / described e.g. as rythmn / AW  
 releases / AW, waves of excitation / depolarisation / (electrical) impulses / action potentials ;  
**R** nerve impulses / signals / messages / waves unqualified  
 atrial systole / atrial contraction(s) ; **A** initiates, heart beat / cardiac cycle  
 ref. to nervous innervation allowing changes ; [max 2]
- (ii) delays, impulse / AW ;  
**R** nerve impulses / signals / messages / waves unqualified  
**A** *ecf* from (i)  
 sends impulse to, Purkyne fibres / Bundle of His / ventricles / septum ;  
 allows atrial systole to complete before ventricular, systole / contraction(s) ;  
**A** *idea that* allows ventricles to fill (before they contract)  
**A** *idea that* allows atria to, empty completely / complete contraction [max 2]
- (iii) *either*  
 stops backflow (of blood) ;  
 (stops backflow) from ventricle to atrium ; **R** if ref. to right  
*or*  
 allows one-way flow of blood ;  
 allows flow from atrium to ventricle ; **R** if ref. to right [max 2]
- (b) C ;  
 G ;  
 G ;  
 B / C ; [4]

[Total: 10]

- 5 (a) (i) **A** bp for blood pressure throughout
- 1 bp decreases with distance (from, heart/LV) ;  
**A** named vessels to indicate distance
  - 2 difference between minimum and maximum bp decreases (with distance) ;
  - 3 maximum and minimum bp are the same, at the capillaries/after arterioles ;
  - 4 (BP) reaches zero kPa, at large veins/vena cava(e) ; **A** after small veins  
**A** no blood pressure
  - 5 steepest decrease in bp between arterioles and capillaries ;
  - 6 correct data quotes ;  
e.g. mp 1 from 16 kPa to 0 kPa for maximum bp  
mp 1 from 10.6–10.8 kPa to 0 kPa for minimum bp  
mp 2 11.6/11.8 kPa, in aorta/nearest to left ventricle and 0 kPa at capillaries  
mp 3 (same bp of) 5 kPa [ 3]
- (ii) (presence of) valves ; **R** bicuspid/tricuspid, valves to stop backflow / allows one-way flow / flow only towards heart ; [max 2]
- (b) hydrolysis ; **A** breaking bond using water (of/breaking of) peptide bond ;  
between Phe and His/Phe-His bond ;  
removal of, two amino acids/His and Leu/dipeptide ; [max 3]
- (c) 1 (ACE) inhibitor/drug, has similar shape as, substrate/polypeptide ;  
2 complementary (shape) to active site (shape) ;  
3 binds to/fits into/enters, active site (of ACE enzyme) ;  
**A** forms enzyme-substrate complex  
4 substrate cannot, enter/bind ;  
**A** competes with substrate for active site  
**A** no/few/prevents formation of, ES complexes  
5 reduces rate of, reaction/formation of angiotensin/product formation ; [max 3]
- [Total: 11]**

6 (a) (i) **B** ; [1]

(ii) **D** ; [1]

(iii) **A** ; [1]

(b) (i) amylose / amylopectin / glycogen ; **A** starch [1]

(ii) part **1** is saturated / part **2** is unsaturated ;

part **1** has no double bonds / part **2** has one double bond ;

part **1** has 27 hydrogens and part **2** has 25 ;

**A** part **1** has more hydrogens **ora**

[max 1]

(iii) *any two from:*

ionic / electrovalent (bond) ;

hydrophobic (interaction) ;

hydrogen (bond) ;

disulfide (bond) ;

**A** Van der Waal's (forces)

[max 2]

**[Total: 7]**

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