

1. (a) Right ventricle; 1

(b)

Valve	Open	Closed
1		✓
2	✓	
3		✓
4	✓	

Valves 1 and 2 correct - 1 mark

Valves 3 and 4 correct- 1 mark

2

- (c) Peaks coinciding; 2  
All higher than peaks and troughs for pulmonary artery;

[5]

2. (i) 3

Letter
<b>Q;</b>
<b>S;</b>
<b>P;</b>

- (ii) 75; 1

[4]

3. (a) (i) Blood pressure in ventricle higher than in atrium; 2  
(Causes) atrioventricular / mitral / (bi)cuspid / valve between atrium and ventricle to shut;

- (ii) Line labelled **B** from 0.2 to 0.7s; 1  
(Ignore line from 1.0 to 1.4s.)

- (b) (i) Line labelled **C** from 0.2 to 1.0s, 1  
(Accept any other line between equivalent points in consecutive cycles.)

- (ii)  $\frac{60}{0.8} = 75$  beats per minute - method mark 60 2  
length of cycle given by candidate;  
- answer mark - calculation giving correct answer;

- (c) (i) 6600; 1
- (ii) Increased heart rate;  
Increased stroke volume / proportion of blood pumped out of ventricle;  
More blood retained in veins;  
More adrenaline;  
Increased stimulation by sympathetic (nerve);  
SAN discharges faster; 2
- (d) 1 SAN initiates / sends heart beat;  
2 Myogenic / beats spontaneously / does not require nerve impulse;  
3 Rate of beating influenced by nerves;  
4 Wave of electrical activity / impulses / excitation passes over atrium;  
5 Triggers contraction of atrium;  
6 Electrical activity can only pass to ventricles / along bundle of His by way of AVN  
7 Fibrous tissue prevents passage elsewhere;  
8 Delay at AVN;  
9 Allows blood to empty into ventricles / atria to empty; max 6
4. (a) Diaphragm/intercostal muscles contract;  
Increases volume of thorax/chest/lungs;  
Negative/lower pressure in lungs; 3  
*[Ignore: references to internal and external intercostal muscles]*
- (b) (i) Allows stabilisation/becomes steady/adapts; 1
- (ii) 41.7 (dm<sup>3</sup>/litres); 1
- (iii) Tidal volume increases steadily then levels out;  
Breathing rate changes little until highest exercise rate/180 reached then increases; 2  
*[Note: Consider giving credit to answers where a specific part of the range is defined and described accurately]*
5. (a) (i) the atrioventricular/mitral/bicuspid/tricuspid valves (closing); 1
- (ii) pressure in artery greater than pressure in ventricle; 1

[15]

[7]

- (b) correct answer  $5250 = 3$  marks;  
*where answer incorrect:*  
 one heart beat identified as taking 0.8 s;  
 heart rate calculated as 75 (beats per minute);  
 cardiac output = heart rate x stroke volume; 3  
*marking points to be awarded independently but onus on candidate to show clearly what has been done*
- [5]**
6. (a) (i)  $60 \div 0.72 = 0.76$ ;  
 $79 - 83$ ; (Correct answer = 2 marks) 2
- (ii) Ventricular pressure increases above pressure in atrium ; 1
- (b) Left ventricle has thicker / more muscle; 1
- [4]**
7. (a) (i) 0.3 s; 1
- (ii) 0.2 - 0.4 s; 1
- (b) thicker / more muscle in the left ventricle; 1
- (c) Artery
1. thickest wall, enabling it to carry blood at high pressure / withstand pressure surges;
  2. most elastic tissue, which smoothes out flow / maintains pressure;
  3. most muscle which maintains pressure;
  4. muscle in wall to control blood flow;
- Vein
5. thin wall does not have to withstand high pressure;
- Capillary
6. thin wall, allowing diffusion/exchange;
  7. only endothelium present, allowing short diffusion pathway;
- All vessels
8. have endothelium that reduces friction;
- 6 max

8. (a) (i) Enzymes and (colourless) dye; *ignore wrong names of enzymes* 1
- (ii) Glucose oxidase;  
Peroxidase; *accept „peroxide reductase“* 2
- (iii) Enzymes are specific / glucose oxidase only reacts with glucose /  
Peroxidase only reacts with hydrogen peroxide  
*OR*  
A → H<sub>2</sub>O<sub>2</sub> and B → colour change; 1
- (b) No glucose in urine / person not diabetic / concentration  
normal in blood 1
- (c) Enzyme-based method is quantitative / more sensitive /  
specific to glucose / ora; 1
- [6]**
9. (a) (i) Delay in spread of electrical activity at AV node/from atria to ventricle; 1
- (ii) Rapid spread of activity down ventricular septum/to base of ventricles/  
along bundle of His/electrical activity travels up from base; 1
- (b) Ventricle contracts/systole;  
Pressure increases in ventricle/pressure in ventricle higher than in aorta;  
Valve between ventricle and aorta opens; 3
- [5]**
10. (a) Aortic valve / semilunar valve 1
- (b) Thicker wall of ventricle / reduced volume;  
Atrioventricular / bicuspid / mitral valve shut;  
Semi-lunar / aortic valve / valve X open. 2
- (c) More blood pumped out each beat / increase in stroke volume; 1
- (d) (i) Valid working which can be followed; 178%. 2
- (ii) Provides glucose and oxygen / provides oxygen and removes CO<sub>2</sub>;  
increased respiration / increases ATP yield. 2
- [8]**
11. (a) (i)  $60 \div 0.72 - 0.76$ ;  
 $79 - 83$ ; (*Correct answer = 2 marks*) 2

- (ii) Ventricular pressure increases above pressure in atrium ; 1
- (b) Left ventricle has thicker / more muscle; 1 **[4]**
- 12.** (a) less muscle / thin(ner) wall in left atrium; 1
- (b) (i) pressure of left ventricle higher than pressure of left atrium; 1
- (ii) closing of the semi-lunar valves/pocket valves;  
pressure in artery/aorta is higher than ventricle; 2 **[4]**
- 13.** (a) (i) 0.3 s; 1
- (ii) 0.2 - 0.4 s; 1
- (b) thicker / more muscle in the left ventricle; 1
- (c) Artery
1. thickest wall, enabling it to carry blood at high pressure / withstand pressure surges;
  2. most elastic tissue, which smoothes out flow / maintains pressure;
  3. most muscle which maintains pressure;
  4. muscle in wall to control blood flow;
- Vein
5. thin wall does not have to withstand high pressure;
- Capillary
6. thin wall, allowing diffusion/exchange;
  7. only endothelium present, allowing short diffusion pathway;
- All vessels
8. have endothelium that reduces friction; 6 max
- [9]**  
**QWC 1**
- 14.** (a) left ventricle; 1

- (b) (i) (left) ventricle/heart relaxes / diastole / filling / not contracting; 1
- (ii) elastic tissue/wall;  
recoils/springs back (to maintain pressure);  
(*“contraction / muscle causing recoil” negates second point*) 2
- (c) correct answer, 666 to 667 *gains 2 marks; allow 1 mark for principle;*  
correct time for 1 heartbeat as 90 (ms) or  $630 \div 7$  /  
 $60 \div$  incorrect time identified from graph; 2
- (d) correct answer, 0.03, *gains 2 marks;*  
(*allow 1 mark for correct working,  $16.6 \div 550$ , if answer wrong*) 2
- [8]**
15. (a) (i) atrioventricular valve/(bi)cuspid valve/mitral valve; 1
- (ii) (valves close) due to high blood pressure / when ventricles contract;  
Y prevent valve from being inverted / restricts/stops valve movement; 2  
(*allow AV valve, disqualify tricuspid*)
- (b) (i) B; 1
- (ii)  $\frac{5}{60} \times 60 = 37.5s$  correct method 1  
correct answer 2
- [6]**
16. (a) (i) 0.4(s); 1
- (ii)  $\left\{ \frac{60}{0.8} \right\} = 75$ ; 1
- (iii) 0.26 (between 0.4 – 0.14)  $\times$  75 (or from (a)(ii)) = 19.5(s)  
*OR*  
0.25 (between 0.4 – 0.15)  $\times$  75 (or from (a)(ii)) = 18.75(s) 1  
(*no double penalty*)(*allow rounding only if working shown*)
- (b) (ii) right ventricle;  
same pattern / description (as left ventricle) but lower (pressure); 2

- (c) increase in volume / size of ventricles (*accept heart*) / hypertrophy of heart / increased strength of heart muscle / increased strength of contraction; more blood leaves heart in each contraction / increase in stroke volume; 2

[7]

17. (a) Fatty material within walls of arteries;  
Vessels narrow;  
Blood pressure rises;  
Weakened blood vessels may burst; 4

- (b) Carbon monoxide combines with haemoglobin/causes less oxygen to be transported;  
Decreases concentration of antioxidants in blood;  
Increases the damage done to artery walls;  
Blood clot may occur;\*  
Blood pressure increased\*  
Blocks flow of blood to heart/in carotid arteries;\* (4 max)

- Saturated fat associated with cholesterol;  
Cholesterol deposited in arteries;  
Atheroma formation;  
Blood clot may occur\*;  
Blood pressure increased\*  
Blocks flow of blood to heart/in carotid arteries\*;  
(4 max)

*\*Allow reference to these points only once.*

- Cholesterol / blood clot causes constriction of coronary arteries;  
Less oxygen transported to heart muscle tissue; 6 max

*Q Do not allow credit for such expressions as “furring up arteries”, “putting strain on the heart” and “bad cholesterol”*

[10]

18. (a) (i) protein / glycoprotein / glycolipid / polysaccharide / molecule;  
on surface / membrane (of cell);  
causes immune response / description / triggers antibody production; max 2
- (ii) reference to hybrid cell from tumour / cancer and B-lymphocyte/hybridoma;  
antibodies all the same / from one type of plasma cell;  
specific to / complementary to / fits only one antigen; max 2

- (b) (i) antibodies specific / only binds to PSA;  
PSA only associated with prostate cancer / not with other diseases; 2
- (ii) antibody with enzyme only attaches if PSA present / washed  
away if no PSA;  
no colour change without enzyme; 2
- [8]**
- 19.** (a) (i) Fatty substances/foam cells in artery wall/under endothelium; 1
- (ii) Narrows artery;  
Turbulence / uneven flow;  
Damage to endothelium;  
Thromboplastins released; max 2
- (b) (i) Correct area shaded (i.e. part supplied by vessels); 1
- (ii) Area deprived of oxygen; *Accept glucose* 1
- (c) Muscle in artery walls becomes thicker;  
Aneurysm / ballooning of artery walls may occur;  
Damage to endothelium (so foam cells enter); max 2
- [7]**
- 20.** (a) Smaller number of alveoli;  
Larger air space per alveolus;  
Thicker walls; 2 max
- Q Accept converse for normal cells*
- (b) Less surface area of alveoli;  
Diffusion of gases / gas exchange reduced / less oxygen enters blood;  
Narrower bronchioles reduce gas flow;  
Loss of elasticity reduces gas flow / unable to ventilate efficiently;  
Lungs permanently inflated;  
Less energy available / less respiration possible for muscles; 3 max
- Q Award maximum of two marks if candidate suggests energy is  
,used" in respiration.*
- [5]**



21. (a) Because arteries cannot dilate / dilate less;  
Heart must work harder to force blood through;  
Increases blood pressure; max 2

(b) Higher blood pressure causes damage to blood vessel lining / endothelium / collagen;  
Platelets stick together / form a plug / adhere to collagen fibres;  
Release of thromboplastin / thrombokinase;  
Fibrinogen converted to insoluble fibrin;  
Platelet plug trapped by fibrin mesh; max 3

[5]

22. Quality of written communication should be considered in crediting points in the marking scheme. In order to gain credit, answers must be expressed logically in clear, scientific terms.

(a) (i) Region around coronary arteries below clot is shaded;  
(*shading does not take in areas served by other blood vessels*) 1  
(ii) Region is deprived of (blood and therefore) oxygen;  
Cannot respire aerobically / must respire anaerobically;  
Lactate is formed;  
Muscle cannot contract / eq. ;  
Cell death / tissue death; (max 3)

(b) Plasma cholesterol:  
More laid down in lining of arteries;  
Walls of arteries damaged / weaken;  
Arteries are narrowed;  
Aneurysm forms;  
Clot forms; (max 2)

High blood pressure:  
Increases rate at which cholesterol is laid down;  
Higher fibrinogen levels;  
Clots form (once only); (max 2)

Smoking:  
Increases blood pressure:  
Muscle in artery becomes thicker / lumen narrower; (max 2)

(c) (i) Risk increases 3 times;  
Evidence of correct working (e.g. 7.5/2.5); 2  
(ii) Increasing cholesterol levels carries greater risk;  
Starting smoking increases risk from 2.5% to 3% ;  
Increasing cholesterol levels from 5 to 7 increases risk from 2.5% to 5% ; 3

[15]

23. (a) (Cancer = ) mass of cells that divide continuously / uncontrolled / faster;  
(Malignant = ) can spread (to other body parts); 2
- (b) (i) Higher incidence in females than males / females have higher risk;  
Correlation between changes in males and females / changes in both  
occur at same times;  
Change in rate between c1981-1986 / larger increase then; 2
- (ii) Male = 3 (per 100,000) and female = 5 (per 100,000);  
(5 x 3) + (5 x 5) = 40;  
*Reject correct answer based on wrong readings* 2
- (iii) Fair-skinned people contain less pigment / melanin / melanocytes;  
More UV light in sunny parts;  
*Reject lifestyle argument* 2
24. (a) (i) (Risk of):  
High blood pressure increases with age;  
Heart attack increases with age / no heart attacks before 35 years; 2
- (ii) *Females* (or reverse argument for males):  
More likely to develop high blood pressure;  
Have lower risk of heart attack (as they get older / post-55); 2
- (b) Male is (700 – 378 = 322, 322 / 700 = ) 46%;  
Female because (480 – 252 = 228 / 480 = ) 47.5%; 2

[8]

(c) *Principle:*

CHD = heart muscle receives inadequate amount of blood  
or oxygen / (coronary) blood supply reduced;

*Smoking:*

Raises concentration of fibrinogen (in blood) / increased risk of  
clotting;

Increases viscosity of blood;

(Nicotine) causes platelets to stick together / causes vasoconstriction;

Carbon monoxide associated with plaque formation;

Reduces ability of arteries to dilate / reduces elasticity;

*Cholesterol:*

Fatty streaks / deposits adhere to wall of arteries;

Atheroma / atherosclerosis / plaque;

Narrows lumen of artery;

Damages endothelium;

Can lead to formation of thrombus / blood clot;

6 max

*Clots need to be in context*

[12]

25. (a) Plaque/ fatty material/ cholesterol/ foam cells/ lipoprotein build up;  
In artery/ blood vessel wall; 2
- (b) Weakens artery wall;  
So that it swells/ bursts; 2
26. (a) Enables comparison to be made;  
Since increase in incidence with age/ older people have had more  
exposure to cigarettes; 2
- (b) No/ incorrect response with some attempt at calculation based on 556  
and 428 as numerators; = 1 mark  
No/ incorrect response with correct calculation; = 2 marks  
Correct response (non-smokers have greater risk than smokers)  
with calculation of  $556/7316 \times 100 = 7.6\%$  and  $428/4651 \times 100 =$   
 $9.2\%$  for smokers and non-smokers respectively; = 3 marks 3
- (c) (i) 2

- (ii) (Relative risk of) lung cancer decreases the longer it is since giving up smoking;  
(Relative risk of) lung cancer increases with the number of cigarettes smoked per day; 2
- 1.
  2. Mass of abnormal cells;
  3. Idea of spread/ metastasis;
  4. Altered DNA/ biochemical differences;
  5. Rapid rate of cell division/ uncontrolled cell division;
  6. Cigarette smoke contains carcinogens/ mutagens/ cancer-causing chemicals;
  7. Causes changes in DNA;
  8. Of genes that control cell division;
  9. Reference to oncogenes;
  10. Reference to tumour suppresser genes; max 6
- [15]**
27. (a) (i) Molecule/part of molecule/protein/glycoprotein;  
[Allow: polysaccharide]  
Stimulates immune response; 2
- (ii) These antigens/antibodies have complementary/particular shape;  
[Reject: Active site]  
Allow fitting/binding with (relevant) antibody/antigen; 2
- (b) Calichaemicin delivered specifically to cancer cells/less likely to/will not harm normal/healthy cells;  
Lower dose of calichaemicin needed to be effective; 2
- [6]**
28. (a)  $\frac{\text{measured diameter (mm)}}{1.94} = \text{magnification};$  1
- [Note: marks in this answer are awarded for explanation.  
The answer gains no marks]
- (b) (i) Lumen narrower (in diseased artery);  
Wall thicker (in diseased artery);  
Cholesterol/fatty tissue/plaque/lipids/atheroma/foam cells invading wall/in wall (i.e. not on endothelium); max 2  
[Note: If answers start "it" assume this refers to the diseased artery]

- (ii) Atheroma/fatty material deposited in wall of artery;  
Causes turbulence/damage to endothelium/raises blood pressure;  
Blood clot formation;  
Atheroma/blood clot lodges in narrowed blood vessel/coronary artery;  
Reduces oxygen (supply) to (region of) heart muscle/heart cells; max 3
- [6]**
29. (a) (i) benign does not cause cancer /  
does not invade other tissues causing damage /  
with benign cancer, pieces which break off do not start new tumours  
elsewhere in body/metastasis; 1
- (ii) may damage organ concerned;  
may cause blockages/obstructions;  
may damage/exert pressure on other organs; max 2
- (b) (i) because sun's radiation contains ultra violet radiation;  
this causes mutation of genes which control division; 2
- (ii) because fair skin has little melanin which protects against u.v. radiation; 1
- (iii) because cancer has genetic component / may have inherited  
(onco)gene / gene which gives predisposition to/causes cancer; 1
- [7]**
30. (a) (i) because there are big differences;  
any correct named example e.g. lung cancer/bronchitis much lower  
in women than in men; 2
- (ii) easier to compare if sample size effectively the same;  
different numbers of people in each group; 2
- (b) ANY TWO: more stress / more saturated fats in diet / less time to  
exercise / reliance on cars; 2
- [6]**
31. (a) (i) protein / glycoprotein / glycolipid / polysaccharide / molecule;  
on surface / membrane (of cell);  
causes immune response / description / triggers antibody  
production; max 2
- (ii) reference to hybrid cell from tumour / cancer and  
B-lymphocyte/hybridoma;  
antibodies all the same / from one type of plasma cell;  
specific to / complementary to / fits only one antigen; max 2

- (b) (i) antibodies specific / only binds to PSA;  
PSA only associated with prostate cancer / not with other diseases; 2
- (ii) antibody with enzyme only attaches if PSA present / washed  
away if no PSA;  
no colour change without enzyme; 2

[8]

32. (a) 1 fatty substance / foam cells / cholesterol in artery wall /  
under endothelium;  
2 atheroma creates turbulence / damage to lining of artery;  
3 formation of plaques / atherosclerosis / narrows lumen of artery;  
4 (turbulence) increases risk of blood clot / embolus;  
5 blood clot / thrombus breaks off;  
6 (blood clot) lodges in coronary artery;  
7 reduced blood supply to heart muscle;  
8 reduced oxygen supply;  
9 leads to death of heart muscle; max 6
- (b) (i) average number of admissions on ordinary day;  
when no football match being played;  
similar time of year / conditions; max 2
- (ii) large / significant difference for three days;  
then small difference; 2
- (c) increases heart rate;  
raises blood pressure / causes hypertension;  
blood supply to heart / oxygen use by heart increased;  
atheroma restricts blood / oxygen supply to heart muscle; max 2
- (d) reduces heart rate;  
beta-blocker fits receptor sites;  
on walls of heart / blood vessel;  
(receptor sites for) adrenaline / noradrenaline / stops adrenaline /  
noradrenaline binding; max 3

[15]

33. (a) 1. fatty material/foam cells/cholesterol in artery wall/under endothelium;  
 2. creates turbulence/damage to lining of artery;  
 3. formation of plaques/atherosclerosis/narrows lumen of artery;  
 4. (turbulence) increases risk of blood clot;  
 5. blood clot breaks off;  
 6. (blood clot) lodges in coronary artery;  
 7. reduces blood supply to heart muscle;  
 8. reduces oxygen supply;  
 9. results in death of heart muscle; 6 max
- (b) (i) equal chance of being assigned to either group; 1  
 (ii) to compare with warfarin to see if it has any effect; 1  
 (iii)  $14/255 \times 100 = 5.5\%$   
 $37/253 \times 100 = 14.6\%$   
 $14.6 \times 5.5 = 9.1(\%)/9.13(\%);$  2
- (c) (i) (Trend): as heparin concentration increases, clotting time increases;  
 (Pattern): reference to change after 0.2 arbitrary units; 2  
 (ii) blood clot from transfused blood could cause thrombosis/stroke/  
 embolism/ heart attack/myocardial infarction; 1
34. (a) (i) protein/immunoglobulin;  
 specific to antigen;  
 idea of "fit"/complementary shape; 2 max
- (ii) 1. virus contains antigen;  
 2. virus engulfed by phagocyte/macrophage;  
 3. presents antigen to B-cell;  
 4. memory cells/B-cell becomes activated;  
 5. (divides to) form clones;  
 6. by mitosis;  
 7. plasma cells produce antibodies;  
 8. antibodies specific to antigen;  
 9. correct reference to T-cells/ cytokines; 6 max
- (b) 1. antibody gene located using gene probe;  
 2. cut using restriction enzyme;  
 3. at specific base pairs;  
 4. leaving sticky ends/unpaired bases;  
 5. cut maize/DNA /vector using same restriction enzyme;  
 6. join using DNA ligase;  
 7. introduce vector into maize/crop/recombinant DNA into maize; 4 max

[13]

(c) passive;  
 person is not making own antibodies/antibodies not replaced;  
 memory cells not produced; 2 max

(d) fewer ethical difficulties/less risk of infection; 1

[15]

35. (a) 1. High fat diet/high salt diet/lack of exercise/age/gender;

*TWO risk factors for one mark*

*Not hypertension as this is given later*

2. Atheroma forms under endothelium/in artery wall;

3. Atheroma may narrow lumen of artery;

4. Atheroma increases blood pressure;

5. Atheroma promotes clotting;

6. Details of effect of atheroma on clotting;

7. Blood clot lodges in coronary artery;

8. Reduced blood supply to heart muscle;

9. Reduced oxygen/glucose supply leading to cell death;

max 6

(b) (i) 1. Reduces heart rate;  
 2. Keeps heart rate stable/reduces variation in heart rate;  
 3. Nullifies external stimulus; 2

*Individual points must be supported with information from  
 the graph*

*If no information quoted max 1 mark*

(ii) To ensure change in heart rate due to beta blocker and not person's  
 behaviour/knowing may affect heart rate; 1

(c) (i) Beta blockers reduce mortality (following myocardial infarction)/  
 Greater reduction in the older group; 1

(ii)

$$\frac{\text{Deaths with placebo} - \text{deaths with beta blocker}}{\text{Deaths with placebo ;}}$$

x100;

$$\frac{\text{Extra deaths}}{\text{deaths with placebo}}$$

2

[12]



36. (a) Fatty material within walls of arteries;  
Vessels narrow;  
Blood pressure rises;  
Weakened blood vessels may burst; 4
- (b) Carbon monoxide combines with haemoglobin/causes less oxygen to be transported;  
Decreases concentration of antioxidants in blood;  
Increases the damage done to artery walls;  
Blood clot may occur\*;  
Blood pressure increased\* (4 max)  
Blocks flow of blood to heart/in carotid arteries\*;  
Saturated fat associated with cholesterol;  
Cholesterol deposited in arteries;  
Atheroma formation;  
Blood clot may occur\*;  
Blood pressure increased\* (4 max)  
Blocks flow of blood to heart/in carotid arteries\*;  
*\*Allow reference to these points only once.*  
Cholesterol / blood clot causes constriction of coronary arteries;  
Less oxygen transported to heart muscle tissue; 6 max

*Q Do not allow credit for such expressions as “furring up arteries”, “putting strain on the heart” and “bad cholesterol”*

[10]

37. (a) (i) Cholesterol/ lipoprotein/ fatty material/cells;  
*Reject fatty acid*  
In the artery wall/under lining/endothelium of artery/blood vessel; 2  
*Q Do not accept references to veins or capillaries as equivalent to blood vessels*
- (ii) (Trapped in) coronary artery/artery supplying heart muscle/ tissue/ cells;  
*i.e. material of heart wall*  
Prevents oxygen;  
Reaching (heart muscle/tissue);  
(Heart muscle) dies/stops respiring; 3 max
- (b) (i) Allows comparison;  
Different number of people in each country; 2

- (ii) Correlation does not show causation / graph only shows correlation  
 Something else/another named factor may be involved such as  
 lack of fibre/smoking/stress;;  
 Related to both CHD and dairy fat; 2 max

[9]

38. (a) Sends out electrical activity/ impulses;  
 Initiates the heartbeat / acts as a pacemaker / (stimulates) contraction  
 of atria; 2  
*Q Ignore reference to ventricles.*

- (b) Fluctuation and overall decrease;  
 Steep decrease first/after two years and then gradual decrease; 2

- (c) Diet low in cholesterol/LDLs;  
 Less absorbed into blood/ from intestines; 2

- (d) Diet has greater effect in decreasing blood cholesterol concentration;  
 Difficult to judge effect of drug as it is used at same time as diet / drug  
 is not used on its own;  
 Decrease in blood cholesterol concentration linked to reduced risk  
 of heart disease; 2 max

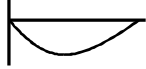
*Q Allow converse for third marking point.*

[8]

39. (a) (i) (wall of)alveoli / capillaries have single epithelial layer/  
 single layer of cells/  
 alveoli and capillaries close together;  
 epithelium flattened/pavement epithelium;  
 ventilation maintains high O<sub>2</sub>/low CO<sub>2</sub> concentration(in alveoli);  
 blood flow/circulation maintains high CO<sub>2</sub> /  
 low O<sub>2</sub> concentration(in blood); max. 3

- (ii) leaf very thin / only a few cells thick;  
 intercellular spaces exposes cell surface membrane/  
 wall directly to gases;  
 production of O<sub>2</sub> in photosynthesis maintains high oxygen concentration;  
 use of CO<sub>2</sub> in photosynthesis maintains  
 low carbon dioxide concentration; max. 3

- (b) (i) enclosed within body cavity/ limited contact with outside air;  
(ii) wax layer / (guard cells) close stomata; 2 [8]
40. (a) (i) 6 : 1 and 2 : 1  
(Accept 54:27;reject 6 and 2) 1  
(ii) 4.85 / 4.9 and 1.09 / 1.1 1
- (b) (i) Same volume of potato / only surface area different 1  
(ii) Potato (cubes) have lower/more negative water potential;  
so water enters cubes (by osmosis). 2  
(iii) Larger surface area (: volume ratio) of smaller cubes (for osmosis). 1 [6]
41. (a) Phagocytes engulf/ingest pathogens/microorganisms/bacteria/viruses;  
Phagocytes destroy pathogens/microorganisms/bacteria/viruses;  
Lung diseases are caused by pathogens/microorganisms/bacteria/viruses; 2 max  
*Q Allow description of process of engulfing*
- (b) (i) Alveoli/lungs will not inflate/deflate fully/reduced lung capacity;  
Breathing out particularly affected/no longer passive;  
Concentration/diffusion gradient / rate of diffusion reduced; 2 max
- (ii) Alveolar walls thicken;  
Longer diffusion pathway;  
Scarred/fibrous tissue;  
Reduces surface area (for gaseous exchange); 4  
*Q Diffusion is essential for 2<sup>nd</sup> point and surface area for 4<sup>th</sup> point.*
- (c) (i) Cancer develops 20 – 30 years after exposure (to asbestos); 1  
(ii) Smoking / air pollution / specified industrial source; 1 [10]

42. (a) One cell thick/thin (not thin membrane)/flattened cells for faster diffusion/shorter diffusion pathway;(Reject greater/more)  
Large surface area for faster diffusion;(Reject greater/more)  
Ventilation to maintain a diffusion/concentration gradient;  
NB TWO correct features = 1 mark maximum 2 max
- (b) (i) Decreases first from zero;  
Then increases to zero;  
„U“ shape (not starting at zero) = 1 mark maximum  2
- (ii)  $\frac{60}{3} = \underline{\underline{20}}$ ; 1
- [5]**
43. (a) intercostal muscle; (*internal/external neutral*) 1
- (b) (i) contracts;  
pulling ribs upwards / outwards; (*ribcage expands neutral*)  
(*accept answers in terms of antagonistic role of internal intercostals*);  
lung / chest / thorax volume increased, *or* lung / chest / thorax  
pressure decreased; 3 max
- (ii) maintain / greater diffusion / concentration gradient;  
continuous diffusion / faster diffusion; 2
- [6]**
44. (a) thin;  
therefore short diffusion distance (between air and blood); (*reject moist*) 2
- (b) 29.4 – 29.5 gains 2 marks  
ELSE evidence of  $3.14 \times 1.25^2 \times 100 \times 0.06$  gains one mark 2
- (c) increase surface area / SA/V ratio;  
more / faster / greater uptake of oxygen / gaseous exchange; 2
- [6]**
45. (a) contraction of (diaphragm) muscles flattens diaphragm;  
contraction of intercostal muscles raises ribcage;  
increase in volume decreases pressure; 3

- (b) (i) tidal volume increases steeply, then increase slows down after 10 to 15 kmh<sup>-1</sup>; 1
- (ii) breathing rate increases slowly then steeply after 10 to 15 kmh<sup>-1</sup>; 1  
*(max 1 if no reference to speed where change occurs in either (i) or (ii))*
- (c)  $20 \times 2.75 = 55 \text{ dm}^2$ ; 2  
*(award 1 mark for correct method i.e. tidal volume.  $\times$  rate);*
- [7]**
46. (a) (i) Tidal volume; 1
- (ii) Multiply **A** / tidal volume / volume of breath by number of breaths per minute / breathing rate; 1  
*Penalise error in (a) (i) once only*
- (b) (i) Diffusion; 1
- (ii) Not normally present / needed; 2  
 Any detected must have come from this test;
- (c) Longer diffusion pathway / takes longer to diffuse / slower rate of diffusion; 1
- [6]**
47. (a) Thin / single layer of cells / large surface area; 1  
*Do not accept references to „moist surface“.*
- (b) Smaller surface area; 2  
 For diffusion of carbon dioxide from blood / into lungs / diffusion slower;  
*Reject second point if answer referring to oxygen only.*
- (c) (i) Greater concentration / number of red blood cells; 2  
 More haemoglobin (to carry oxygen);
- (ii) (For the body to produce) more red blood cells; 2  
 Link established between red blood cells and transport of oxygen;
- [7]**

48. (a)  $\frac{A \times (C_1 - C_2)}{t}$  1

[Allow: words]

(b) (i) Large surface area for diffusion; 1

(ii) Red blood cells close to capillary wall/ thin capillary wall;  
Short diffusion path/ distance for oxygen to diffuse;  
Longer time for diffusion to take place/ diffusion is slow; 3

(c) Less oxygen/ concentration gradient lower;  
Therefore less diffusion; 2

[Accept: reverse argument for carbon dioxide]

[7]

49. (a) Diaphragm/intercostal muscles contract;  
Increases volume of thorax/chest/lungs;  
Negative/lower pressure in lungs; 3  
[Ignore: references to internal and external intercostal muscles]

(b) (i) Allows stabilisation/becomes steady/adapts; 1

(ii) 41.7 (dm<sup>3</sup>/litres); 1

(iii) Tidal volume increases steadily then levels out;  
Breathing rate changes little until highest exercise rate/180 reached  
then increases; 2

[Note: Consider giving credit to answers where a specific part of the range is defined and described accurately]

[7]

50. (a) (i) **Many** gill lamellae/gill filaments; (ignore refs to „highly divided“) 1

(ii) Counter-current mechanism/blood and water flow in opposite directions;  
Not enough time for equalisation of concentrations/maintains concentration gradient over length of gills/never reaches equilibrium; max 2

(b) Humidity reduces difference in concentration of water (vapour) between body and air;  
reduces rate of diffusion (of water vapour)(as are proportional); 2

[5]

51. (a) Muscles (associated with breathing) relax; 1
- (b) Produces lower pressure (and air moves in down pressure gradient); 1
- (c) (i) Rate of diffusion  $\propto \frac{\text{Surface area} \times \text{Difference in concentration / Cn. Gradient}}{\text{Thickness (of exchange surface)}}$  1
- (ii) Rate of diffusion is proportional to concentration gradient / difference in concentration;  
Breathing changes air / maintains gradient; 2
52. (a) Two marks for a correct answer of 0.1s;;  
*Q Other answers can be accepted if distance clearly estimated as differing from 20 $\mu$ m. Credit is for method, not measuring ability.*  
One mark for an incorrect answer where attempt has been made to divide distance by rate of blood flow; 2  
*Mark can only be awarded if approach is clearly shown*
- (b) (i) Replaces it with blood with a low oxygen concentration / removes blood with high oxygen concentration; 1
- (ii) Asthma attack narrows airways;  
*Ignore trachea and aveoli*  
Air in alveoli not replaced (as efficiently) /less air/oxygen to alveoli;  
Difference in concentration lower so rate of diffusion lower; 2 max
- (c) (i) To make sure that nothing else might have produced the results / that patients didn't improve anyway /to allow comparison (with expt group); 1
- (ii) Inhaler with dummy drug / placebo / with old drug / with no drug;  
*Q No need for phrase "dummy drug" as long as idea conveyed.*  
Otherwise treated exactly the same; 2

[5]

[8]

53. (a) Phagocytes engulf/ingest pathogens/microorganisms/bacteria/viruses;  
Phagocytes destroy pathogens/microorganisms/bacteria/viruses;  
Lung diseases are caused by pathogens/microorganisms/bacteria/viruses; 2 max  
*Q Allow description of process of engulfing*
- (b) (i) Alveoli/lungs will not inflate/deflate fully/reduced lung capacity;  
Breathing out particularly affected/no longer passive;  
Concentration/diffusion gradient / rate of diffusion reduced; 2 max
- (ii) Alveolar walls thicken;  
Longer diffusion pathway;  
Scarred/fibrous tissue;  
Reduces surface area (for gaseous exchange); 4  
*Q Diffusion is essential for 2<sup>nd</sup> point and surface area for 4<sup>th</sup> point.*
- (c) (i) Cancer develops 20 – 30 years after exposure (to asbestos); 1  
(ii) Smoking / air pollution / specified industrial source; 1
- [10]**
54. not enough O<sub>2</sub>;  
for increased respiration / for ATP needed for exercise; 2  
reference to decreased surface area of alveoli/ longer diffusion pathway; less gas exchange/less diffusion/less oxygen passes into the blood;  
*OR*  
reference to decreased elasticity/reduced elastic recoil;  
meaning breathing becomes more difficult/laboured/shallower/lungs do not empty; 2
- [4]**