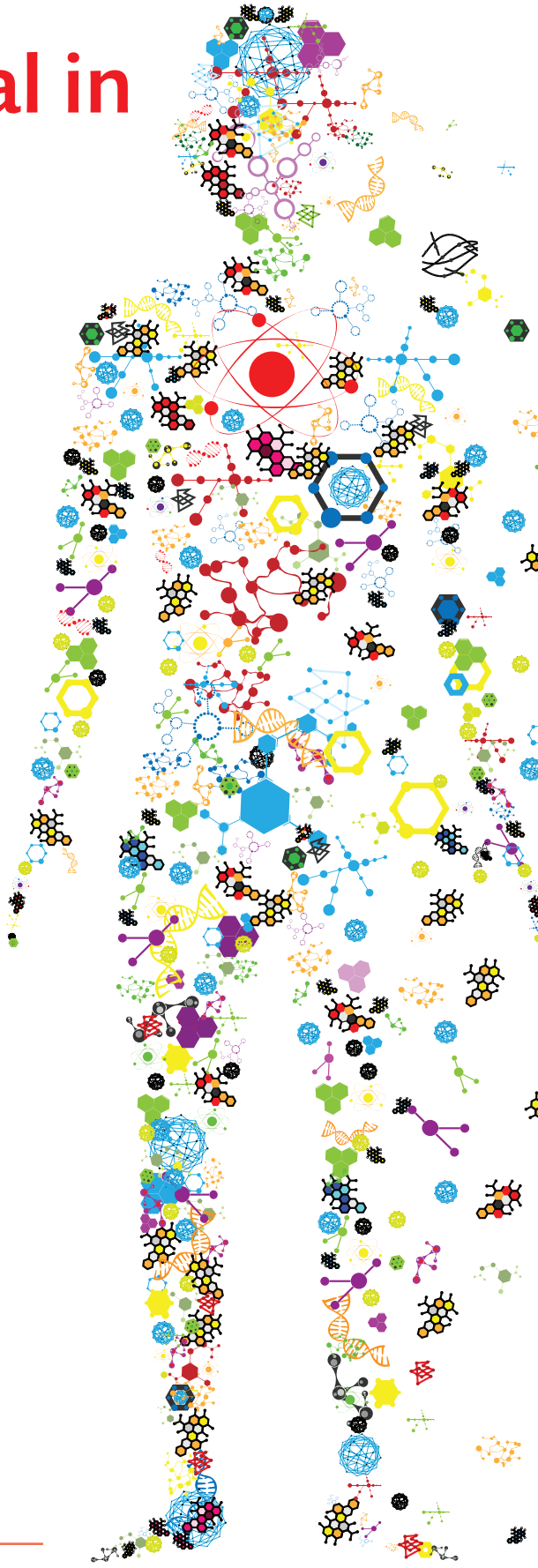
BTEC

Pearson BTEC Level 3 National in Applied Human Biology

Unit 1: Principles of Applied Human Biology



Sample Assessment Materials (SAMs)

For use with Certificate and Extended Certificate in Applied Human Biology

First teaching from September 2018 Issue 1

Pearson

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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson BTEC Level 3 Nationals

Centre Number | | | | | | |

Learner Registration Number | | | | | | | | |

Sample assessment material for first teaching Xxxxxxx 2018

Time: 1 hour 30 minutes | Paper Reference **XXXXX/XX**

Applied Human Biology

Unit 1: Principles of Applied Human Biology

You must have:
A ruler and a calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S62846A

1/1/1

S 6 2 8 4 6 A 0 1 1 9

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Figure 1 shows part of the plasma membrane of a cell.

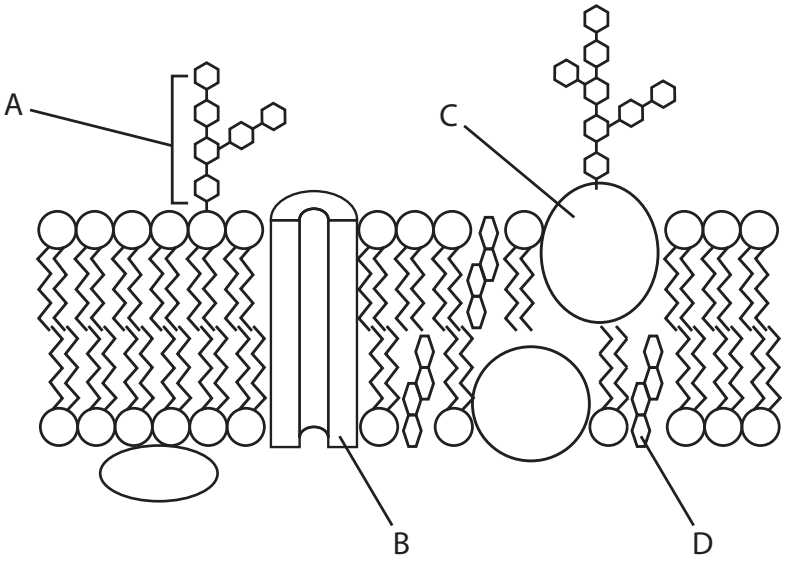

Figure 1

(a) Which molecule labelled in Figure 1 is a channel protein?

(1)

☒	**A**
☒	**B**
☒	**C**
☒	**D**

(b) Proteins contain peptide bonds between amino acids.

Complete the structure of a peptide bond.

(1)

(c) Collagen is a structural protein.

Explain **two** ways in which collagen is suited to its role.

(4)

1 .....

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.....

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2 .....

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(Total for Question 1 = 6 marks)

2 Transcription is the first step of gene expression in cells.

(a) Here is a short sequence of DNA

AGCCTA

Which of the following would be the correct mRNA sequence when transcribed?

(1)

☒	**A** AGCCTA
☒	**B** UCGGAU
☒	**C** GCAAUG
☒	**D** TCGGAT

(b) A sequence of DNA contains 35% guanine.

Show that the proportion of alanine is 15%

(2)

% = ...

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) Describe how a gene is transcribed from DNA in the nucleus.

(4)

(Total for Question 2 = 7 marks)

3 (a) Cystic fibrosis (CF) is an inherited condition. Approximately 1 in every 25 people in the United Kingdom carries the allele for CF.

A woman can be tested during pregnancy to see if the fetus has CF.

Describe the chorionic villus sampling test carried out on a pregnant woman.

(3)

(b) People with cystic fibrosis need a diet that has a higher energy content than people who do not have cystic fibrosis.

Explain why people with cystic fibrosis need to have a diet with a higher energy content.

(6)

(Total for Question 3 = 9 marks)

4 The immune system responds to pathogens by producing antibodies.
The human body can also respond to the presence of allergens.

(a) Give the name of the type of white blood cell that allows rapid production of antibodies in a secondary immune response.

(1)

(b) Explain how antibodies are involved in the destruction of a specific pathogen.

(3)

(c) Prescriptions of adrenaline autoinjectors are recommended for patients with severe allergies that may result in anaphylaxis.

One symptom of anaphylaxis is the swelling of tissues.

(i) Explain how swelling is triggered in an anaphylactic reaction.

(2)

(ii) Explain **two** ways in which adrenaline can help to reduce other immediate symptoms of anaphylaxis.

(4)

1

2

(Total for Question 4 = 10 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

5 The monitoring of heart and lung structure and function is important for diagnosing health issues.

Figure 2 shows a cross-section through the human heart.

(a) Which order of the chambers would a red blood cell go through on its way from muscle tissue to the brain?

(1)

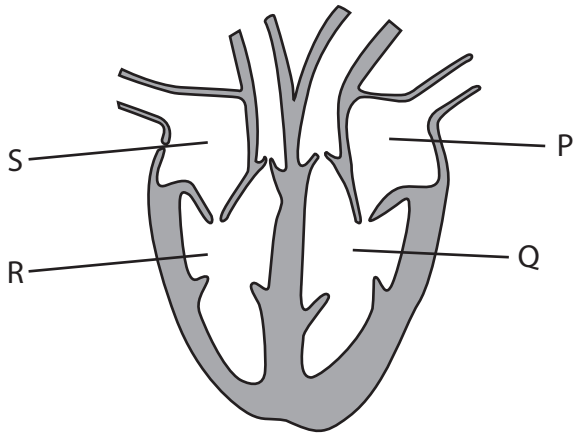

Figure 2

☒	**A** P, Q, R, S
☒	**B** Q, P , S, R
☒	**C** R, S, Q, P
☒	**D** S, R, P, Q

Figure 3 shows how the pressure changes in the ventricles of a normal human heart over time.

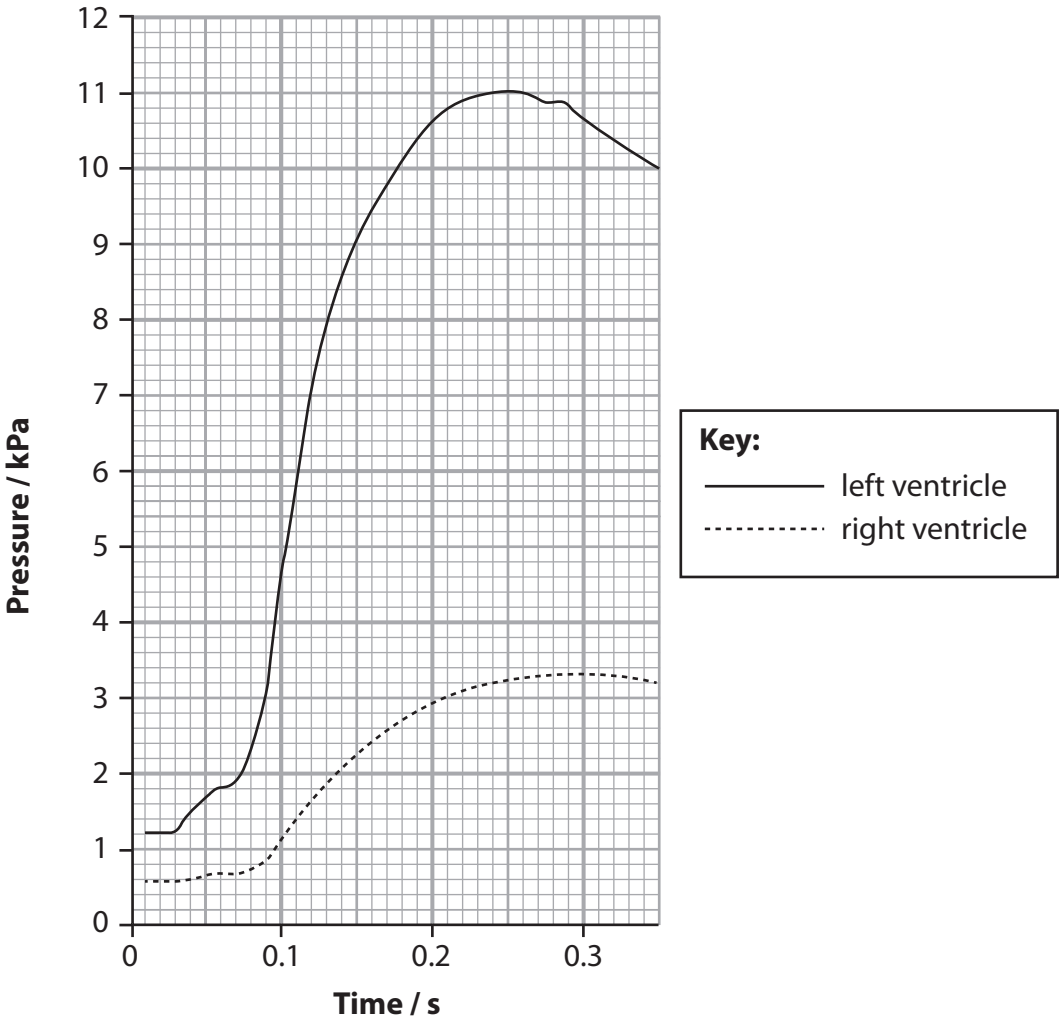

Figure 3

(b) (i) Describe the changes in the left ventricle wall that lead to an increase in pressure in the left ventricle.

(2)

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) (ii) Explain why the pressures shown for each ventricle are different.

(3)

(c) Table 1 shows the volume of blood in the lung capillaries of a healthy individual at rest and during exercise.

Activity	Volume of blood in lung capillaries (ml)
At rest	140
During exercise	250

Table 1

Emphysema is a condition where the walls of the alveoli in the lungs are broken down.

One symptom of this disease is that patients often become increasingly short of breath.

Explain **two** reasons for this symptom.

(4)

1

2

(Total for Question 5 = 10 marks)

BLANK PAGE

QUESTION 6 BEGINS ON THE NEXT PAGE.

6 The role of the dietician is increasingly important in helping to educate people about what is good and bad for their dietary health.

One indicator of health used by dieticians is the body mass index (BMI) of an individual.

(a) (i) Which classification would be indicated by a BMI of 26?

(1)

☒	**A** Underweight
☒	**B** Normal
☒	**C** Overweight
☒	**E** Obese

(a) (ii) Explain why one person with a mass of 90 kg can be classified as severely obese and another person with the same mass can be classified as having a healthy weight.

(3)

(b) A 27-year-old overweight female has been referred to a dietician for diet management advice.

She has brought two diet plans that she has been considering following.

Figure 4 shows a meal plan for one day from each diet.

The dietician recommends that the patient has a total of around 1900 calories each day until they reach their recommended healthy weight.

Diet A

Meals		Approximate calorie totals
Breakfast	Porridge oats, fat-free natural yoghurt, banana	262
Snacks	Two biscuits	160
Lunch	Jacket potato with lettuce, carrot and sweetcorn	332
Snacks	Small chocolate bar	100
Dinner	Vegetable curry with rice	330
Drinks	Three cups of black coffee with no sugar One measure of gin with diet tonic Two litres of water	200
	Total	1384

Diet B

Meals		Approximate calorie totals
Breakfast	Two eggs fried in olive oil, 50 g cheddar cheese	460
Snacks	Protein shake	150
Lunch	Grilled chicken breast, 100 g green beans, 50 g cheddar cheese	450
Snacks	Celery and cucumber	50
Dinner	Large steak cooked in butter, 250 g mixed broccoli and spinach	500
Drinks	Three cups of black coffee with no sugar Two litres of water	0
	Total	1610

Figure 4

Evaluate which diet is more likely to provide the patient with better long-term health outcomes.

(9)

(Total for Question 6 = 13 marks)

7 When cells divide uncontrollably, tumours can develop in tissues.

(a) Which term describes an increase in cell numbers?

(1)

☒	**A** Atrophy
☒	**B** Hyperplasia
☒	**C** Hypertrophy
☒	**D** Metaplasia

(b) Benign and malignant tumours have different characteristics.

Give **two** features of malignant tumour growth.

(2)

1 .....

.....

2 .....

.....

(c) Chemotherapy may cause damage to blood vessels. It is thought that this is why cancer sufferers are more likely to develop blood clots.

Damage to blood vessels releases clotting factors and activates platelets.

Describe how this leads to formation of a blood clot.

(3)

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(d) Tumour cells are better able to survive under hypoxic conditions than somatic cells.

Explain **two** reasons why this allows tumour formation and growth.

(4)

1 .....

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2 .....

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(e) Sometimes a liver transplant may be carried out for liver cancer sufferers.

Explain **one** reason why liver transplant patients need to take medication to suppress the immune system.

(2)

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(Total for Question 7 = 12 marks)

8 (a) Blood pressure is monitored regularly for patients attending a GP surgery. This may be done manually or using a machine.

Table 2 shows the average blood pressure measurements for three patients over time.

Patient	Average blood pressure (mm Hg)
A	110/70
B	80/60
C	140/90

Table 2

State, with a reason, which patient is closest to the most normal range of blood pressure.

(1)

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(b) Blood pressure is affected by the secretion of antidiuretic hormone (ADH) from the hypothalamus.

Explain why secretion of ADH can affect blood pressure.

(3)

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(c) Persistent hypertension can increase the risk of a stroke.

Discuss how hypertension contributes to a patient suffering from a stroke.

(9)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

Unit 1: Principles of Applied Human Biology – sample mark scheme

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Learners must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme, not according to their perception of where the grade boundaries may lie.
- All marks on the mark scheme should be used appropriately.
- All marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should be prepared to award zero marks if a learner's response is not worthy of credit, according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a learner's response, the team leader must be consulted.
- Crossed-out work should be marked UNLESS the learner has replaced it with an alternative response.

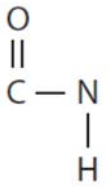
Specific marking guidance for levels-based mark schemes

Levels-based mark schemes (LBMS) have been designed to assess learners' work holistically. They consist of two parts: indicative content and levels-based descriptors. Indicative content reflects specific content-related points that learners might make. Levels-based descriptors articulate the skills that learners are likely to demonstrate in relation to the skills being assessed in the question. The levels represent the progression of these skills.

When using a levels-based mark scheme, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches learners' response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the level descriptor, and will be modified according to how securely all traits are displayed at that band.

Question number	Answer	Mark
1(a)	B	**(1)**

Question number	Answer	Mark
1(b)	Award 1 mark for completion of diagram. 	**(1)**

Question number	Answer	Mark
1(c)	Award **1** mark for identification and **1** mark for linked expansion up to a maximum of **4** marks. • Insoluble in tissue fluid (1) so that it does not dissolve (1). • Fibrils are rigid/strong (1) because of tightly coiled multiple helices (1). • Allows strength across tissues (1) because it can form cross-linkages forms collagen fibres (1). Accept any other appropriate response.	**(4)**

Question number	Answer	Mark
2(a)	B (UCGGAU)	**(1)**

Question number	Answer	Mark
2(b)	A calculation that shows the following • 100 – (2 × 35) = 30 (1) • ÷ 2 = 15 (1)	**(2)**

Question number	Answer	Mark
2(c)	Award **1** mark for each logically ordered point up to a maximum of **4** marks. • DNA is unzipped/template strand is exposed (1) • when an enzyme/DNA helicase breaks the hydrogen bonds between bases (1) • allowing RNA polymerase to form/assemble mRNA (1) • through complementary base pairin /A-U and C-G (1). Each point should be in a logical sequence to be awarded a mark. Accept any other appropriate response.	**(4)**

Question number	Answer	Mark
3(a)	Award **1** mark for each logically ordered point up to a maximum of **3** marks. • sample of cells is taken from the placenta (1) • using a needle inserted through the uterus (1) • DNA from sample is tested for the presence of cystic fibrosis allele (1). Each point should be in a logical sequence to be awarded a mark. Accept any other appropriate response.	**(3)**

Question number	Answer	Mark
3(b)	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers. • thick sticky mucus produced • in the pancreas/pancreatic duct • this reduces the release of digestive enzymes into small intestine • therefore less of the food in the diet will be broken down • increased mucus increases diffusion pathway of nutrients to intestinal lining • fewer named energy containing molecules (e.g. glucose, fatty acids) will be absorbed into the blood/cells to be used for respiration • so food taken in will therefore provide proportionally lower energy to a CF sufferer than a non-CF sufferer • to overcome this there needs to be a higher concentration of carbohydrates or fats or lipids in the diet.	**(6)**

Mark scheme (award up to 6 marks). Refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
Level 0	0	No rewardable material.
Level 1	1–2	• Demonstrates isolated knowledge and understanding, there be major gaps or omissions • Generic statements may be presented rather than linkages being made so that lines of reasoning are not present • Limited explanation which is not logically ordered and with significant gaps.
Level 2	3–4	• Demonstrates mostly accurate knowledge and understanding, with few minor omissions/any gaps or omissions are minor • Some linkages are made so that lines of reasoning are partially present • Displays a partially developed explanation that has a structure which is mostly clear, coherent and logical with only minor omissions.
Level 3	5–6	• Demonstrates accurate and thorough/detailed knowledge and understanding • Linkages are consistently made so that lines of reasoning are sustained • Displays a well-developed explanation that has a structure which is clear, coherent and logical.

Question number	**Answer**	**Mark**
4(a)	Award **1** mark for any one of the following: • Memory cell • B-memory cell • T-memory cell • Plasma cell • Effector cell	**(1)**

Question number	Answer	Mark
4(b)	Award **1** mark for identification and up to **2** marks for a linked expansion. • antibodies have an antigen binding site (1) • this attaches to a specific part of the pathogen (1) • which enables phagocytosis/destruction by macrophages (1) Accept any other appropriate response.	**(3)**

Question number	Answer	Mark
4(c)(i)	Award **1** mark for identification and **1** mark for linked expansion up to a maximum of **2** marks. • Allergen reacts with the IgE (Immunoglobulin E) antibody (1) causing histamine release by cells and tissues (which causes swelling) (1). Accept any other appropriate response.	**(2)**

Question number	Answer	Mark
4(c)(ii)	Award **1** mark for identification of a way and **1** mark for linked expansion up to a maximum of **4** marks. • Adrenalin constricts blood vessels (1) and so counteracts the drop in blood pressure (1). • Adrenalin relaxes smooth muscle in the lungs (1) and so counteracts airway constriction (1). Do not accept 'swelling' as a symptom. Accept any other appropriate response.	**(4)**

Question number	Answer	Mark
5(a)	D – S, R, P, Q	**(1)**

Question number	Answer	Mark
5(b)(i)	Award **1** mark for each logically ordered point to give a description up to a maximum of **2** marks. • Muscle cells (in ventricle wall) contract (1) from base of the heart towards the aorta/pulmonary artery (1) Each point should be in a logical sequence to be awarded a mark. Accept any other appropriate response.	**(2)**

Question number	Answer	Mark
5(b)(ii)	Award **1** mark for identification and up to **2** marks for a linked expansion. • The left ventricle generates greater pressure (1) because the muscle layer is much thicker (1) and so contracts more strongly (1) Accept any other appropriate response including answers to the converse.	**(3)**

Question number	Answer	Mark
5(c)	Award **1** mark for identification and **1** mark for linked expansion, up to a maximum of **4** marks. • Damaged alveoli are unable to recoil (1) and so oxygen-poor/carbon dioxide-rich air is not completely expired (1). • Loss of alveoli walls leads to reduced surface area (1) therefore less gaseous exchange/ diffusion of oxygen into the blood (1) • (Constant) increased volume in lungs at rest (1) may lead to shortening of diaphragm (1). Accept any other appropriate response.	**(4)**

Question number	Answer	Mark
6(a)(i)	C (Overweight)	**(1)**

Question number	Answer	Mark
6(a)(ii)	Award **one** mark for identification and up to **two** marks for a linked expansion • the obese person has a higher BMI (1) • because they are shorter than the other (1) • because a short person with a high BMI must have more mass due to body fat rather than bone / muscle. (1) Accept any other appropriate response.	**(3)**

Question number	Indicative content	Mark
6(b)	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers. Diet A • Proportions: high in carbohydrates, which could cause spikes in insulin secretion. • Low fat may mean that patient does not gain essential fatty acids; very low protein may lead to issues with cell and tissue repair, hormone production and regulation. • High vegetable proportion should meet most mineral requirements to avoid deficiencies, but if she is menstruating then this diet may lead to iron deficiency/anaemia. • Alcohol has low nutritional value with empty calories Diet B • Proportions: extremely limited sources of carbohydrate may lead to tiredness and dizziness, because limited substrate availability for aerobic respiration. • Low fibre sources may lead to issues with digestive throughput, e.g. constipation. • Meat and cheese means that calcium and iron requirements more likely to be met but may restrict other vitamins and minerals, e.g. vitamin C, leading to potential deficiencies and resulting issues. • Saturated fat leads to cholesterol formation / heart disease • Red meat is a good source of iron Conclusions • Water recommendation is good for both diets for cellular activities to take place and avoid dehydration. • Neither diet meets probable nutritional needs or the recommended calorie intake, though B is closer (A: 1384, B: 1600).	**(9)**

Mark scheme (award up to 9 marks). Refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
Level 0	0	No rewardable material.
Level 1	1–3	• Demonstrates isolated elements of knowledge and understanding, there will be major gaps or omissions. • Few of the points made will be relevant to the context in the question. • Limited evaluation that contains generic assertions, leading to a conclusion that is superficial or unsupported.
Level 2	4–6	• Demonstrates some accurate knowledge and understanding, with only minor gaps or omissions. • Some of the points made will be relevant to the context in the question, but the link will not always be clear. • Displays a partially developed evaluation that considers some different competing points, although not always in detail, leading to a conclusion that is partially supported.
Level 3	7–9	• Demonstrates mostly accurate and thorough/detailed knowledge and understanding. • Most of the points made will be relevant to the context in the question, and there will be clear links. • Displays a developed and logical evaluation that clearly considers different aspects and competing points in detail, leading to a conclusion that is fully supported.

Question number	Answer	Mark
7(a)	B (Hyperplasia)	**(1)**

Question number	Answer	Mark
7(b)	Award **1** mark for each of the following, up to a maximum of **2** marks. • Invade the basement membrane (1). • Are able to spread/reference to metastasis (1) • Set up secondary tumours. Accept any other appropriate response.	**(2)**

Question number	Answer	Mark
7(c)	Award **1** mark for each logically ordered point, up to a maximum of **3** marks. • Activated platelets aggregate/stick to each other (1) • forming a plug of platelets and red blood cells (1) • thrombin converts (soluble) fibrinogen to (insoluble) fibrin (1) • fibrin strands form a mesh and red blood cells / platelets are caught up in the mesh (1). Each point should be in a logical sequence to be awarded a mark. Accept any other appropriate response.	**(3)**

Question number	Answer	Mark
7(d)	Award **1** mark for identification and **1** mark for linked expansion, up to a maximum of **4** marks. • Somatic cells need oxygen to carry out aerobic respiration (1) and so need to be close to blood vessels for gas exchange (1). • Tumour cells need less oxygen to carry out cellular activities (1) and so allows tumours to grow where somatic cells cannot (1). • Tumour cells may have more expression of genes to make proteins that allow glycolysis (1) and so they are able to respire anaerobically more efficiently (1). Accept any other appropriate response.	**(4)**

Question number	Answer	Mark
7(e)	Award **1** mark for the identification and **1** mark for linked expansion up to a maximum of **2** marks. • Prevent the liver being rejected (1) Donor cells may be attacked by the recipient's immune system/cells are recognised as 'non-self' (1) • Prevent rejection (1) because antigens on the transplant cells could provoke an immune response from the recipient (1) Accept any other appropriate response.	**(2)**

Question number	Answer	Mark
8(a)	Patient A as their blood pressure is closest to the normal range of 120/80	**(1)**

Question number	Answer	Mark
8(b)	Award **1** mark for identification and **2** marks for linked expansion. ADH stimulates the kidneys to retain more water/excrete less water (1), this means blood volume is increased (1) and so blood pressure also increases (1). Accept any other appropriate response.	**(3)**

Question number	Indicative content	Mark
8(c)	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers. • High blood pressure weakens the walls of blood vessels. • Brain blood vessels may burst at weak points. • Severity of the burst directly related to severity of the stroke. • Blood no longer entirely contained within artery so concentration gradient of oxygen and	**(9)**

	nutrients between the artery and tissue is not maintained. • Fluid entering tissue not removed at the same rate, leading to swelling and pressure on the brain tissue. • Lower levels of diffusion and therefore exchange of oxygen, nutrients and waste products is decreased. • Cells are unable to carry out effective aerobic respiration. • Conditions are hypoxic, resulting in ischaemic injury, which can become irreversible and atrophy if not treated. • Symptoms are related to lack of effective specialised cell function, e.g. nerve paralysis, vision problems, loss of consciousness. Accept other appropriate responses.	

Mark scheme (award up to 9 marks) refer to the guidance on the cover of this document for how to apply levels-based mark schemes*.		
Level	**Mark**	**Descriptor**
Level 0	0	No rewardable material.
Level 1	1–3	• Demonstrates isolated elements of knowledge and understanding, there will be major gaps or omissions. • Few of the points made will be relevant to the context in the question. • Limited discussion that contains generic assertions rather than considering different aspects and the relationship between them.
Level 2	4–6	• Demonstrates some accurate knowledge and understanding, with only minor gaps or omissions. • Some of the points made will be relevant to the context in the question, but the link will not always be clear. • Displays a partially developed discussion that considers some different aspects and some consideration of how they interrelate, but not always in a sustained way.
Level 3	7–9	• Demonstrates mostly accurate and detailed knowledge and understanding. • Most of the points made will be relevant to the context in the question, and there will be clear links. • Displays a well-developed and logical discussion that clearly considers a range of different aspects and how they interrelate, in a sustained way.

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