**HUMAN BIOLOGY**

**Unit 1**

**2015**

**Marking Guide**

**Section One: Multiple-choice 30% (60 Marks)**

|  |  |
| --- | --- |
| 1 | C |
| 2 | C |
| 3 | B |
| 4 | A |
| 5 | A |
| 6 | D |
| 7 | C |
| 8 | C |
| 9 | A |
| 10 | C |
| 11 | A |
| 12 | C |
| 13 | A |
| 14 | A |
| 15 | A |
| 16 | C |
| 17 | B |
| 18 | D |
| 19 | C |
| 20 | C |
| 21 | A |
| 22 | B |
| 23 | A |
| 24 | B |
| 25 | D |
| 26 | A |
| 27 | D |
| 28 | C |
| 29 | D |
| 30 | C |

**Section Two: Short answer 50% (100 Marks)**

**Question 31 (13 marks)**

(a) (i) Draw a diagram on an erythrocyte.

(1 mark)

need to draw biconcave surface/ no nucleus



 (ii) Explain two ways in which the structure of an erythrocyte is well suited to its function.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| No nucleus – more space for haemoglobin | 1 |
| Biconcave disc increases surface area allowing more rapid exchange of gases across the surface | 1 |

(b) Describe the main function of:

(i) leucocytes:

|  |  |
| --- | --- |
| **Description (any 1 of the following)** | **Marks** |
| Remove dead/ injured cells/ pathogens | 1 |

 (ii) plasma proteins:

|  |  |
| --- | --- |
| **Description (any 1 of the following)** | **Marks** |
| blood clotting | 1 |
| Antibodies – immune response | 1 |
| Alter osmotic pressure of blood | 1 |

(c) Explain why it would be a problem for your body if the water levels of plasma increased to 95%.

|  |  |
| --- | --- |
| **Description (any 2 of the following)** | **Marks**  |
| It would change the concentration gradient between the cells and plasma | 1 |
| Too much water would leave the plasma and enter body cells | 1 |
| Result in lysis of cells/ organ failure | 1 |

(d) How does the composition of lymph differ from that of blood (as shown in the table)?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| It lacks the presence of formed elements /WBC/ RBC/ Platelets/ | 1 |

(e) Describe TWO functions of the lymphatic system.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Return excess fluid from body tissues to blood | 1 |
| Lymph nodes involved in the body’s immune response/ filtering lymph | 1 |

(f) Explain why it is important that blood type is known before receiving a blood transfusion. In your answer include what happens when blood types are mixed.

|  |  |
| --- | --- |
| **Description (any 3)** | **Marks** |
| **When this happens it results in agglutination of RBC which blocks capillaries and result in death (must have)** | **1**  |
| RBC have an antigen present on its surface (A/ B/ AB/ None) | 1 |
| Plasma has antibodies present which can bind to an antigen (anti A to antigen A etc) | 1 |
| Therefore need to ensure transfusion does not contain the complementary antibody to the person’s RBC antigens | 1 |

**Question 32 (19 marks)**

(a) (i) State the function of the following structures:

|  |  |
| --- | --- |
| **Description** | **Marks** |
| C – involved in mitosis and meiosis/ cell division / form spindles to which chromosomes attach | 1 |
| D –controls all protein production by the cell/ control centre of the cell | 1 |
| L – provides a surface for chemical reactions/ channels transport or store materials | 1 |

(b) Describe how proteins are arranged in a plasma membrane and the part they play in transporting substances into and out of cells.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **They are embedded in the phospholipid bilayer on either surface (must have)** | **1**  |
| **pass from one side to the other (must have)** | **1**  |
| Channel proteins allow the movement of ions and water  | 1 |
| By diffusion/ passively/ without the use of energy | 1 |
| Carrier proteins specific to the shape of larger molecules | 1 |
| They bind to the molecule causing a change in the shape  | 1 |
| So moving substance by facilitated diffusion/ active transport | 1 |

(c) Within organelles and in the cytoplasm of this cell there are many different enzymes.

(i) Why are enzymes necessary for the survival of any cell?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| They lower the activation energy of chemical reactions | 1 |
| Allowing reactions to occur at a faster rate  | 1 |

(ii) What lettered structure in the diagram of the unspecialized cell indicates where enzymes are made?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| F | 1 |

(iii) Why are many different enzymes needed in one cell?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Each enzyme is specific to its substrate | 1 |

(d) Cellular respiration is the process whereby food molecules are broken down in a series of reactions to release energy in the form of ATP molecules.

1. State which letter in the diagram represents ATP.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| C | 1 |

(ii) State TWO places in the cell where ATP molecule is produced.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cytoplasm | 1 |
| mitochondria | 1 |

(e) (i) To which of the four main tissue types does it belong?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Connective tissue | 1 |

(ii) Provide a reason for your answer in part (i).

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Cells surrounded by a non-cellular matrix | 1 |

(iii) Describe one way in which the structure of this tissue suits it to its function.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| It provides support to other tissues/ organs by binding with protein fibres | 1 |

**Question 33 (23 marks)**

(a) Label the diagram of the human digestive system in the spaces provided.

(4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| A – Salivary glands | 1 |
| D – pancreas  | 1 |
| E – small intestine | 1 |
| F – liver | 1 |

 (b) (i) Identify P.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Villi | 1 |

(ii) In which region of the digestive tract is P found?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Small intestine | 1 |

(iii) Name the major function of P and give TWO reasons why it is suited to this function.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Absorption of nutrients | 1 |
| Large surface area – rapid absorption | 1 |
| Highly vascular – transports absorbed nutrients maintaining concentration gradients | 1 |

(c) Name TWO substances produced by D and give the substrate on which each acts and the product of this reaction.

Any 2 examples

|  |  |
| --- | --- |
| **Description** | **Marks** |
| **Substance** | **Substrate** | **Product** |  |
| Amylase  | Starch/ disaccharides | Disaccharides/ monosaccharides | 3 |
| Protease  | Proteins/ peptides/ polypeptides | Polypeptides/ amino acids | 3 |
| Ribonuclease  | RNA  | nucleotides | 3 |
| Deoxyribonuclease  | DNA  | nucleotides | 3 |
| Lipases  | lipids | fatty acid + glycerol | 3 |

 (d) Name the fluid stored in G. What is the function of this fluid?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Bile | 1 |
| Emulsifies fat into smaller droplets/ increase surface area: volume ratio of lipids | 1 |

(e) Complete the following table.

1 mark each correct answer in table

|  |  |  |  |
| --- | --- | --- | --- |
|  | Carbohydrates | Proteins | Lipids |
| Simple unit of which food group is composed | Monosaccharide/ eg: glucose  | Amino acids | Fatty acids + glycerol |
| Major use in body of this unit | Cellular respiration/ energy | Protein synthesis | Glycerol broken down by glycolysis to be used for respiration/ fatty acids |

**Question 34 (20 marks)**

(a) Describe the functions of:

|  |  |
| --- | --- |
| **Description** | **Marks** |
| B – lubricates the joint / nourishes the cells of the articular cartilage | 1 |
| E –reduce friction between articulating bones | 1 |
| F –secretes synovial fluid | 1 |

(b) There are 3 main types of joints, one of which is shown in part (a). Name the three types and give an example of each.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Fibrous/ fixed joints – sutures in skull/ teeth and jaw | 1 |
| Cartilaginous - pubic symphysis/ adjacent vertebrae | 1 |
| Synovial joints – named example of any of the following:* shoulder/ hip
* knee
* between carpals/ metacarpals/ phalanges
* between radius and ulna
* etc
 | 1 |

(c) Name the following bones

|  |  |
| --- | --- |
| **Description** | **Marks** |
| A - scapula | 1 |
| C - humerus | 1 |
| E - ulna | 1 |
| F -radius | 1 |

(d) Describe the type of movement possible at joint H.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Freely moveable/ adduction and abduction/ rotation/ flexion and extension | 1 |

(e) How is the shape of the bones at joint D related to the movement it can perform?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Convex surface of one bone fits against concave of the other bone allowing movement in one plane only | 1 |

(f) Name the flexor and extensor muscles which move joint D.

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Flexor - biceps | 1 |
| Extensor - triceps | 1 |

(g) Using your understanding of the sliding filament model explain how the contraction of muscle G occurs.

|  |  |
| --- | --- |
| **Description (Any four of these points)** | **Marks** |
| A nervous impulse results in the release of calcium ions  | 1 |
| From the sarcoplasmic reticulum | 1 |
| Calcium binds to the actin filament changing its shape | 1 |
| This allows the myosin head to attach forming a cross-bridge | 1 |
| This ratchet motion pulls the actin past the myosin | 1 |
| Shortening the sarcomere (and causing muscle contraction) | 1 |

**Question 35 (11 marks)**

(a) Plot the results on the graph paper supplied. At day 18 insert a vertical dotted line to show where the diets were changed.

(5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Take a mark off for each of the following:* Unlabeled axes
* Units not included
* Incorrect scales used (graph must be at least half of the size of the grid)
* Title (must included dependent and independent variables)
* Incorrect plotting of data
* Variables on wrong axes
 | 1. marks
 |

(b) Name the

|  |  |
| --- | --- |
| **Description** | **Marks** |
| (i) the presence of milk supplement | 1 |
| (ii) average mass of the rats | 1 |

(c) Why did Gowland Hopkins use two groups of rats rather than two individuals?

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Increase the reliability of results (by eliminating outliers) | 1 |

(d) Describe two variables that were controlled in this experiment.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Rats from the same litter | 1 |
| The rest of the diet was exactly the same (types of nutrients and quantities) | 1 |

(e) Based on these results, what was the accessory factor that Gowland Hopkins would conclude was needed in the rats diet?

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Calcium/ vitamins that are present in milk | 1 |

**Question 36 (16 marks)**

1. What structure in the lungs is represented in the diagram above?

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Alveolus | 1 |

(b) State four ways in which this structure is well suited to the function of gas exchange.

(4 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Alveolus only one cell thick  | 1 |
| air constantly moved in and out | 1 |
| Moist surface | 1 |
| Highly vascular | 1 |
| Large surface area | 1 |
| Blood constantly flows | 1 |
| Capillary only one cell thick | 1 |
| Close association between alveolus and capillaries | 1 |

(c) (i) Name Gas A.

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Oxygen | 1 |

(ii) Name and explain what happens to Gas A once it has moved into the capillary.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| binds to haemoglobin to form oxyhaemoglobin | 1 |
| dissolves in plasma | 1 |

(iii) In what form(s) does gas B get transported in blood?

(3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| carbaminohaemoglobin | 1 |
| dissolved in plasma | 1 |
| bicarbonate ions | 1 |

(d) Using your understanding of movement across a cell membrane explain how the efficient exchange of gases A and B are maintained.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| constant movement of air into the lungs keeps oxygen concentration high and carbon dioxide low in the alveoli | 1 |
| constant blood supply to the alveoli removes oxygen from alveoli rapidly and delivers carbon dioxide to the alveoli | 1 |

(e) Smoking can cause the build up of irritating particles in the lungs, name the disease that this can result in and describe TWO ways in which it will affect the lungs normal function.

(3 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Emphysema | 1 |
| Loss of elasticity in the alveoli (which is replaced with fibrous tissue) decreasing surface area | 1 |
| Lungs are constantly inflated meaning breathing requires voluntary effort | 1 |

**End of Section Two**

**Section Three: Extended answer 20% (40 Marks)**

**Question 37**

(a) Name and describe how the THREE types of muscle tissue involved in: peristalsis within the alimentary canal, the beating of the heart muscle and the movement of your arms differ.

(9 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Smooth muscle* no striations
* single nucleus
* taper at ends
 | 1Any 2 (2 marks) |
| Cardiac muscle* striations
* branching fibres
* connect to other cells via an intercalated disc
* single nucleus per cell
 | 1Any 2 (2 marks) |
| Skeletal muscle* striated
* multinucleated (nuclei on periphery of cell)
* large/ long and cylindrical cells
 | 1Any 2 (2 marks) |

**To receive full marks students must compare the features of each muscle type**

(b) Using your understanding of antagonistic muscles, explain how flexion of the arm is brought about.

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| The muscle that contracts is called the agonist (prime mover) | 1 |
| As the agonist is contracting its paired muscle (the antagonist) relaxes | 1 |
| When flexing the arm the bicep would be the agonist | 1 |
| It is attached to scapula at the non –moving end by a tendon of origin | 1 |
| It is attached to the radius (moving end) by the tendon of insertion | 1 |
| So when the bicep contracts it pulls the radius towards the humerus resulting in flexion of the arm | 1 |
| When flexing the arm, the triceps would be the antagonist | 1 |
| Triceps must be relaxed when the bicep is contracting | 1 |

(c) Explain the differences in the ways energy is made available to the muscles of a sprinter and a marathon runner. Include a description of the form in which energy is supplied to the muscle fibres.

(5 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Energy is supplied to muscle in the form of ATP | 1 |
| In the marathon runner ATP is produced by:* aerobic respiration
* one glucose molecule undergoes glycolysis and is transported into the mitochondria
* here it undergoes the krebs cycle and electron transport system to produce 36 ATP
 | 1Any 1 of following for 1 mark |
| In the sprinter ATP is produced by:* anaerobic respiration
* the pyruvic acid that is produced by glycolysis is transformed into lactic acid
 | 1Any 1 of following for 1 mark |

**Question 38**

(a) Describe the mechanisms by which air is drawn into and forced out of the lungs during normal breathing.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
| Breathing involves the movement of air from areas of high air pressure to low air pressure | 1 |
| Inspiration* intercostal muscles contract pulling the ribcage up and out
* the diaphragm contracts and flattens
* this increases the volume of the thoracic cavity
* (the pleural membrane pulls the lungs) so the thoracic cavity increases its volume
* this results in a decrease in pressure allowing air to rush in (through mouth and nose)
 | 5 |
| Expiration* intercostal muscles relax allowing ribcage to move down and inwards
* the diaphragm relaxes causing it to bulge upwards
* this causes a decrease in the thoracic cavity/ lung volume
* increasing its air pressure resulting in air moving out through the mouth and nose
 | 4 |

(b) The system of vessels which distributes blood around the body is made up of THREE different types of vessels: arteries, veins and capillaries. Explain the difference in structure and function of each of these vessels.

(10 marks)

|  |  |
| --- | --- |
| **Description** | **Marks** |
|  | **Structure** | **Function** |  |
| Arteries | thick muscle wallscontain many elastic fibresnarrow lumen | able to change diameter/ vasoconstriction/ vasodilation/ take blood from heart to body cells | 3 structure1 function |
| Veins | thinner muscle wallsless elastic fibreslarge irregular shaped lumencontains valves | to prevent back flow of blood/ return blood to heart from body cells | 3 structure1 function |
| Capillaries | only one cell thick | where exchange of substances occurs | 1 structure1 function |

**Question 39**

(a) List the substances absorbed in the intestine and describe how and where this occurs.

(12 marks)

|  |  |  |
| --- | --- | --- |
| Name | Where | How |
| Small intestine* glucose
* amino acids
* fatty acids/ glycerol
* water
* vitamins

Any 3 substances 9 marks | * capillaries of villi
* capillaries of villi
* lacteal
* capillaries of villi
* capillaries of villi
 | * diffusion/active transport/ facilitated diffusion
* diffusion/active transport/ facilitated diffusion
* diffusion
* osmosis
* diffusion
 |
| Large intestine* water
* vitamins

1 substance for 3 marks | * large intestine capillaries
* large intestine capillaries
 | * osmosis
* diffusion
 |

(b) Describe the factors that influence the activity of enzymes.

(8 marks)

|  |  |
| --- | --- |
| **Description (5 factors required for 10 marks)** | **Marks** |
| * Concentration of enzyme – the higher the concentration the faster the reaction
* as more enzymes present to collide with the substrate
 | 2 |
| * Substrate concentration – the higher the substrate concentration the faster the reaction
* as more particles present to collide with enzyme
 | 2 |
| * Temperature – all enzymes function at an optimal temperature
* If higher than optimum the enzyme denatures
* Lower than the optimum it (lacks kinetic energy and) moves more slowly decreasing the reaction rate
 | 3 |
| * pH – all enzymes have an optimum pH
* either side of this the enzyme denatures
* example (named eg pepsin) works best at a pH of 3 whilst (named eg pancreatic amylase) works in a pH of 8
 | 2 |
| * Many enzymes require co-factors
* these change the shape of the active site allowing the Enzyme – substrate complex to form
* Without cofactors present the reaction won’t proceed
 | 2 |
| * Enzyme inhibitors slow down or stop the enzyme activity
 | 1 |

**End of questions**