# MARKING KEY

## Part 1: Multiple Choice Section [60 marks]

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

## Part 2: Short Answer Section [100 marks]

### 31. Scientific Method

| Question | Answers | Marks |
|---|---|---|
| (a) | Graph<br>• Horizontal axis: Temperature,<br>• correct scale, units<br>• Vertical axis: Time taken for sucrose breakdow<br>• correct scale, units<br>• Accurate plotting, line graph<br>• Title | <br>1<br>1<br>1<br>1<br>1<br>1 |
| | Total | 6 |

| Question | Answers | Marks |
|---|---|---|
| (b) | • An increase in temperature | 1 |
| | • decreases the time taken for sucrase to break down sucrose | 1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (c) | • Temperature | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (d) | • Time taken for sucrose breakdown | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (e) | • To ensure only one factor influences the results/outcome.<br>• Eliminate as many factors/ variables that may influence results | 1<br>1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (f) | • pH/conc of sucrose/conc of sucrase/measurement techniques | 2 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (g) | • pH - buffer/ conc. of sucrose - accurate measuring/ | 2 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (h) | • More reliable to have three measurements than one/Averaging allows grouping of data | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (i) | • Active site on enzyme, is specific for sucrose – not lactose<br>• to form enzyme–substrate complex (lock and key), to catalyse breakdown | 1<br>1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (j) | • Produced in pancreas, released into duodenum<br>• Breakdown of fats into fatty acids and glycerol | 1<br>1 |
| | Total | 2 |

## 32. Artificial Cell

| Question | Answers | Marks |
|---|---|---|
| (a) | • Fructose | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (b) | • Glucose | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (c) | • Water will move into the cell<br>• increasing its size | 1<br>1 |
| | Total | 2 |

## 33. DNA

| Question | Answers | Marks |
|---|---|---|
| (a) | • X = Thymine<br>• Y = Cytosine | 1<br>1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (b) | • Replication | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (c) | • Unzipping of DNA, exposes bases on two single strands of DNA,<br>• Complementary nucleotides attach to exposed bases<br>• Nucleotide = S + P + B, A-T, C-G<br>• To form two complementary molecules | 1<br>1<br>1 |
| | Total | 3 |

| Question | Answers | Marks |
|---|---|---|
| (d) | • Enables DNA strand to be exactly copied<br>• So that the coded information can be passed on to new cells<br>• Sequence of bases codes for gene/s<br>• So each daughter cell will have an identical copy of genetic code | 1<br><br>1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (e) | • Genes determine the kinds of proteins a cell can make<br>• Enzymes are proteins which control chemical reactions in cells<br>• Or are important parts of cell structures e.g., membranes | 1<br><br>1<br>1 |
| | Total | 3 |

## 34. Respiratory System

| Question | Answers | Marks |
|---|---|---|
| (a) | • Structure 1 alveoli<br>• very thin walls to enable rapid diffusion /large surface area /network of blood capillaries<br>• Structure 2 trachea<br>• ciliated mucous epithelium to trap and remove dust/bacteria /rings of cartilage to prevent collapse of tube during inspiration<br>• | 1<br>1<br>1<br>1 |
| | Total | 4 |

| Question | Answers | Marks |
|---|---|---|
| (b) | • External intercostals contract and ribcage moves up and out<br>• Diaphragm contracts downwards<br>• Increased volume of thoracic cavity<br>• Reduced pressure in thoracic cavity so air forced in from higher pressure region outside body | 1<br>1<br>1<br>1 |
| | Total | 4 |

| Question | Answers | Marks |
|---|---|---|
| (c) | Any 2 structures from list below<br>Trachea<br>Larynx<br>Bronchi<br>Bronchioles<br>Alveoli<br><br>Any explanation of impact on ventilatory process:<br><br>• Damage/irritation to trachea and larynx makes inspiration uncomfortable - causes coughing and wheezing.<br>• Damage to bronchi and bronchioles causes swelling and mucus build up which will result in reduced amount of surface areas for gas exchange with every breathe<br>• Damage to alveolus (cellular destruction) is permanent and results in ventilatory process becoming laboured and rapid in the long term. | 2<br><br>2 |
| | Total | 4 |

## 35. Digestion

| Question | Answers | Marks |
|---|---|---|
| (a) | • Lacteal<br>• lymph-carrying vessels that carry absorbed fats from the intestine.<br>• Capillary<br>• absorbs simple nutrients like monosaccharides, amino acids<br>• Microvilli<br>• increases surface area for absorption | 1<br>1<br>1<br>1<br>1<br>1 |
| | Total | 6 |

| Question | Answers | Marks |
|---|---|---|
| (b) | • Bile salts emulsify fats into droplets which<br>• Increases surface area for chemical digestion | 1<br>1 |
| | Total | 2 |

## 36. Kidney

| Question | Answers | Marks |
|---|---|---|
| (a) | Structure A - Kidney<br>Structure B - Nephron | 1<br>1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (b) | • filters the blood of wastes/excess water/salts/ regulates water/waste balance | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (c) | •water<br>•urea<br>•ions<br>•other | 1<br>1<br>1 |
| | Total | 3 |

## 37. Ovarian Cycle

| Question | Answers | Marks |
|---|---|---|
| (a) | •Hormone Y is Luteinising Hormone<br>•which causes ovulation to occur | 1<br>1 |
| | Total | 2 |

| Question | Answers | Marks |
|---|---|---|
| (b) | ovulation | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (c) | •hormone W is follicle stimulating hormone<br>• which stimulates the growth of follicles in the ovaries. The follicle then secretes oestrogen due to FSH. | 1<br>1 |
| | Total | 2 |

## 38. Placenta

| Question | Answers | Marks |
|---|---|---|
| (a) | Any three of the following:<br>•Chorionic villi<br>• provide a large surface area for diffusion and active transport<br>•Network of blood capillaries<br>• providing nutrient rich blood and removing waste from the foetus<br>•Umbilical artery and vein transport materials<br>•blood sinuses enable close contact of maternal and foetal blood. | <br>1<br>1<br>1<br>1<br>1<br>1 |
| | Total | 6 |

| Question | Answers | Marks |
|---|---|---|
| (b) | Any two<br>• Foramen ovale closes at birth preventing blood flow direct to the left atrium<br>• Ductus arteriosus closes up<br>• All blood from hepatic portal vein passes through liver<br>• Babies have higher heart rate and red blood cell numbers are increased | <br><br>1<br>1<br>1<br><br>1 |
| | Total | 4 |

| Question | Answers | Marks |
|---|---|---|
| (c) | • Chemicals that cause physical defects in developing embryos | 1 |
| | Total | 1 |

| Question | Answers | Marks |
|---|---|---|
| (d) | • Drugs e.g. LSD, marihuana, hormones, antibiotics, thalidomide<br>• Effects of chosen teratogen | <br>1 |
| | Total | 1 |

**39. Stem Cells**

| Question | Answers | Marks |
|---|---|---|
| (a) | • Cells from embryos, bone marrow and umbilical chords that are able to replicate themselves<br>• into cells with similar properties<br>OR<br>• Cells that with proper growth conditions can be made to differentiate into a number of different cell types with specific biological functions<br>• | 1<br>1 |
| | Total | 2 |
| (b) | • Foetal stem cells are able to develop into cells of all tissues types<br>• while adult stem cells are restricted to the specific cell types | 1<br>1 |
| | Total | 2 |
| (c) | • Spinal injuries<br>• production of new nerve cells for the spinal cord<br>others … Diabetes, Leukaemia, Alzheimer's, Parkinson's, Stroke, Burns, Heart Disease, Osteoarthritis | 1<br>1<br>2 |
| | Total | 4 |
| (d) | Any issue with some explanation<br>▪ Embryo cells or considered human<br>▪ Who owns the cells<br>▪ Disposal of cells<br>▪ Problems that arise due to new cells<br>▪ Unknown long term consequences | 2<br>2 |
| | Total | 4 |

## 40. Pedigree

| Question | Answers | Marks |
|---|---|---|
| (a) | • Recessive<br>• Individual 15 and 16 are normal while their sons all have the condition | 1<br>1 |
| | Total | 2 |
| (b) | • Individual 1 Hh<br>• Individual 8 HH, Hh<br>• Individual 13 hh | 1<br>1<br>1 |
| | Total | 3 |
| (c) | • Individual 6 is a normal father<br>• and individual 5 is a normal mother (1) therefore they cannot have a daughter<br>• who has the condition<br>• if it is sex linked. | 1<br>1<br>1<br>1 |
| | Total | 4 |

## Part 3: Extended Answer Section [40 marks]

### 41. Pathogens

| Question | Answers<br>Any three of the following with description for two marks each | Marks |
|---|---|---|
| (a) | • Lysozyme in sweat, tears, saliva<br>• Mucous traps: nasal passages, respiratory passages<br>• Hairs and cilia<br>• Chemical traps: HCl of stomach, low pH of vagina<br>• Flushing actions: sneezing, coughing, vomiting, urine | 3x2 |
| | Total | 6 |

| Question | Answers | Marks |
|---|---|---|
| (b) | Damaged cells release histamine | 1 |
| | Causes local dilation of blood vessels, increased blood flow | 1 |
| | Increases capillary permeability | |
| | Loss of blood proteins | 1 |
| | Accumulation of fluid at site- swelling | 1 |
| | Neutrophils attracted to site | 1 |
| | Phagocytosis | 1 |
| | Accumulation of dead cells – pus | 1 |
| | Total | 8 |
| (c) | • Lymphatic capillaries lead to ducts | 1 |
| | • Lymphatic vessels have valves so lymph movement one-way | 1 |
| | • Ducts lead to nodes | |
| | • Mesh-like interior of node traps cell debris and bacteria | 1<br>1 |
| | • Fixed phagocytes engulf cell debris and bacteria | 1 |
| | • ‘cleaned’ lymph returns to blood | 1 |
| | Total | 6 |

## 42. Circulation

| Question | Answers | | Marks |
|---|---|---|---|
| (a) | Arteries | Thick muscular walls | 1 |
| | | Elastic layer | 1 |
| | | No valves | 1 |
| | Veins | Valves | 1 |
| | | Thin walls little muscle | 1 |
| | | Thin elastic layer | 1 |
| | Capillaries | One cell thick | 1 |
| | | Network | 1 |
| | | Narrow/ short | 1 |
| | | Total | 9 |

| Question | Answers Any 6 of the following worth 1 mark each. | | Marks |
|---|---|---|---|
| (b) | Arteries | Relax or contract to enable greater or less blood flow to organs | 6 x1 |
| | | Enables stretching to hold varying amounts of blood | |
| | | Carry blood away from heart at high blood pressure | |
| | Veins | Prevent backflow of blood | |
| | | Carry blood to heart at low blood pressure | |
| | | Blood at constant low pressure | |
| | Capillaries | Enables easy diffusion of substances | |
| | | To enable contact with all cells | |
| | | Reach all areas of body | |
| | | Total | 6 |

| Question | Answers | Marks |
|---|---|---|
| (c) | Carbon Dioxide | |
| | ▪ As carb-oxy-haemoglobin in the RBCs (22%) | 1 |
| | ▪ As bicarbonate ions in the blood plasma (70%) | 1 |
| | ▪ Dissolved in blood plasma (8%) | 1 |
| | Oxygen | |
| | ▪ Dissolved in blood plasma (3%) | 1 |
| | ▪ As oxyhaemoglobin (97%) | 1 |
| | Total | 5 |

## 43. Pregnancy

| Question | Answers Any 3 examples with explanation | Marks |
|---|---|---|
| (a) | Rhythm Method<br>Coitus Interruptus<br>Mechanical barriers: Condoms, Diaphragm, Cervical Cap, Female Condom<br>Chemical methods: Spermicide<br>The Pill<br>Sterilisation | 3 x 2 |
| | Total | 6 |

| Question | Answers | Any two of the following – each one worth 4 marks total | Marks |
|---|---|---|---|
| (b) | Endometriosis | Endometrial tissue grows outside the uterus.<br>***Technology*** :<br>Surgery to remove abnormal tissue or unblock tubes and assisted conception treatments | |
| | Ovulation problems | Any condition (usually hormonal) that prevents the release of a mature egg from an ovary.<br>***Technology :***<br>Ovulation-stimulating drugs and in vitro fertilisation (IVF) using these drugs. | |
| | Poor egg quality | Eggs that become damaged or develop chromosomal abnormalities cannot sustain a pregnancy.<br>***Technology:***<br>Egg donation or surrogacy | |
| | Female tube blockages | Blocked or damaged fallopian tubes prevent eggs from getting to the uterus and sperm from getting to the egg.<br>***Technology:***<br>Surgery to open tubes, if possible. If surgery fails, in vitro fertilisation | |
| | Male tube blockages | Any obstructions in the vas deferens or epididymis<br>***Technology :***<br>Surgery to repair the obstruction | |
| | Sperm problems | Low or no sperm counts, poor sperm motility and abnormally-shaped sperm<br>***Technology :***<br>Fertility drugs may boost sperm production. Other options include artificial insemination with donor sperm and injecting sperm directly into the egg | |
| | | Total | 8 |

## 43. Pregnancy

| Question | Answers Any 3 of the following and explanation | Marks |
|---|---|---|
| (c) | Ethical issues<br>• Number of embryos via IVF implanted in a female/ multiple births<br>• Excess embryos to destroy or donate to other couples or to research.<br>• Sale of embryos<br>• Birth defects as a result of donor egg or sperm<br>• Surrogacy issues: surrogate mother wants keep baby | 3 x 2 |
| | Total | 6 |

## 44. Mutations

| Question | Answers | Marks |
|---|---|---|
| (a) | • Mutations: offspring show new variations unlike either parent. Occur suddenly and purely by chance. Changes to base pair sequence.<br>• Gene mutations<br>• changes in a single gene, occur during replication of DNA before cell division<br>• e.g. achondroplasia, Duchene muscular dystrophy<br>• Somatic Mutations cannot be passed to offspring<br>• e.g. cancer<br>• Germ line Mutations can be passed on to offspring<br>• e.g. PKU<br><br>Chromosomal mutations: all or part of a chromosome is affected. Too few, too many chromosomes or parts of chromosomes. e.g. Down syndrome | 1<br><br>1<br>1<br>1<br>1<br>1<br>1<br>1 |
| | Total | 8 |

| Question | Answers | Marks |
|---|---|---|
| (b) | Variation from meiosis<br>• Chiasmata: Chromatids that have exchanged genetic material through crossing over during meiosis.<br>• Random assortment: Individuals contain two sets of each chromosome but gametes contain only one set. For each homologous pair of chromosomes, one chromosome will be randomly selected for each gamete formed when they line up at the equator.<br>• Non-disjunction occurs when paired chromosomes do not separate during meiosis. This causes gametes to develop that have too few or too many chromosomes. | 2<br><br>2<br><br>2 |
| | Total | 6 |

| Question | Answers | Marks |
|---|---|---|
| (c) | Any three examples (1) with explanation (1)<br>• Amniocentesis various including Down syndrome<br>• DNA Test Muscular Dystrophy<br>• Blood Test for newborns for PKU | 2<br>2<br>2 |
| | Total | 6 |

**END OF PAPER**

# EXAM QUESTION MAPPING TO COURSE CONTENT

## Human Biological Science
## Sample Examination Stage 2
## Mapping questions to content

| | Human Form and Function | | Human Diversity and Change | | The Practice of Human Biology | |
|---|---|---|---|---|---|---|
| **Quest. No.** | **Cells, metabolism and regulation** | **Body Systems** | **Inheritance** | **Variation and Evolution** | **Approaches to investigating** | **The relevance of human biology to everyday life** |
| **Section A - Multiple Choice** | | | | | | |
| **1** | ✓A | | | | | |
| **2** | ✓A | | | | | |
| **3** | ✓A | | | | | |
| **4** | | ✓A | | | | |
| **5** | ✓A | | | | | |
| **6** | ✓A | ✓A | | | | |
| **7** | | ✓A | | | | |
| **8** | | ✓A | | | | |
| **9** | | | ✓B | | | |
| **10** | | ✓B | | | | |
| **11** | | | | | | ✓A |
| **12** | | ✓A | | | | |
| **13** | | | | ✓B | | |
| **14** | | ✓A | | | | |
| **15*** | | | | | | |
| **16** | | ✓B | | | | |
| **17** | | | ✓A | | | |
| **18** | | | ✓A | | | |
| **19** | | | ✓B | | | |
| **20** | | ✓B | | | | |
| **21** | | ✓B | | | | |
| **22** | ✓A | | | | | |
| **23** | | | | | ✓AB | |
| **24** | ✓A | | | | | |
| **25** | ✓B | | | | | |

| | Human Form and Function | | Human Diversity and Change | | The Practice of Human Biology | |
|---|---|---|---|---|---|---|
| Quest. No. | Cells, metabolism and regulation | Body Systems | Inheritance | Variation and Evolution | Approaches to investigating | The relevance of human biology to everyday life |
| 26 | | ✓B | | | | |
| 27 | | ✓B | | | | |
| 28 | | | ✓A | | | |
| 29 | | | | ✓B | | |
| 30 | ✓A | | | | | |

| | Human Form and Function | | Human Diversity and Change | | The Practice of Human Biology | |
|---|---|---|---|---|---|---|
| Quest. No. | Cells, metabolism and regulation | Body Systems | Inheritance | Variation and Evolution | Approaches to investigating and communicatig human biology | The relevance of human biology to everyday life |
| **Section B - Short Answer** | | | | | | |
| 31 | ✓A | | | | ✓AB | |
| 32 | ✓A | | | | | |
| 33 | ✓B | | | | | |
| 34 | | ✓A | | | | ✓A |
| 35 | | ✓A | | | | |
| 36 | | ✓A | | | | |
| 37 | | ✓B | | | | |
| 38 | ✓A | ✓B | | ✓B | | |
| 39 | ✓B | | | | | ✓B |
| 40 | | | ✓B | | | |

| | Human Form and Function | | Human Diversity and Change | | The Practice of Human Biology | |
|---|---|---|---|---|---|---|
| **Quest.No.** | **Cells, metabolism & regulation** | **Body Systems** | **Inheritance** | **Variation and Evolution** | **Approaches to investigating and communicating human biology** | **The relevance of human biology to everyday life** |
| **Section C Extended Answer** | | | | | | |
| **41** | | **✓A** | | | | |
| **42** | | **✓A** | | | | |
| **43** | | **✓B** | | | | **✓B** |
| **44** | | | **✓B** | **✓B** | | **✓B** |