STAGE 2

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: • Horizontal axis: Temperature, • Correct scale, units • Vertical axis: Time taken for sucrose breakdown • Correct scale, units • Accurate plotting, line graph • Title.	 1 1 1 1 1 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 • Eliminate as many factors/ variables that may influence results.	1 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 • To form enzyme-substrate complex (lock and key), to catalyse breakdown.	1 1
	Total	2

Question	Answers	Marks
(j)	• Produced in pancreas, released into duodenum • Breakdown of fats into fatty acids and glycerol.	1 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 • Increasing its size.	1 1
	Total	2

33. DNA

Question	Answers	Marks
(a)	• X = Thymine • Y = Cytosine.	1 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 • Complementary nucleotides attach to exposed bases • Nucleotide = S + P + B, A-T, C-G • To form two complementary molecules.	1 1 1
	Total	3

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

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

34. Respiratory System

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

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

Question	Answers	Marks
(c)	Any 2 structures from list below: Trachea Larynx Bronchi Bronchioles Alveoli. Any explanation of impact on ventilatory process: • Damage/irritation to trachea and larynx makes inspiration uncomfortable— causes coughing and wheezing. • 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. • Damage to alveolus (cellular destruction) is permanent and results in ventilatory process becoming laboured and rapid in the long-term.	2 2
	Total	4

35. Digestion

Question	Answers	Marks
(a)	• Lacteal • Lymph-carrying vessels that carry absorbed fats from the intestine • Capillary • Absorbs simple nutrients like monosaccharides, amino acids • Microvilli • Increases surface area for absorption.	1 1 1 1 1 1
	Total	6

Question	Answers	Marks
(b)	• Bile salts emulsify fats into droplets • Increases surface area for chemical digestion.	1 1
	Total	2

36. Kidney

Question	Answers	Marks
(a)	Structure A —Kidney Structure B — Nephron.	1 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 •urea •ions •other.	1 1 1
	Total	3

37. Ovarian Cycle

Question	Answers	Marks
(a)	•Hormone Y is Luteinising Hormone •Which causes ovulation to occur.	1 1
	Total	2

Question	Answers	Marks
(b)	Ovulation.	1
	Total	1

Question	Answers	Marks
(c)	• Hormone W is follicle stimulating hormone • Stimulates the growth of follicles in the ovaries. The follicle then secretes oestrogen due to FSH.	1 1
	Total	2

38. Placenta

Question	Answers	Marks
(a)	Any three of the following: •Chorionic villi • Provide a large surface area for diffusion and active transport •Network of blood capillaries • Providing nutrient rich blood and removes waste from the foetus •Umbilical artery and vein transport materials •Blood sinuses enable close contact of maternal and foetal blood.	 1 1 1 1 1 1
	Total	6

Question	Answers	Marks
(b)	Any two: • Foramen ovale closes at birth preventing blood flow direct to the left atrium. • Ductus arteriosus closes up • All blood from hepatic portal vein passes through liver • Babies have higher heart rate and red blood cell numbers are increased.	 1 1 1 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 • Effects of chosen teratogen.	 1
	Total	1

39. Stem Cells

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

40. Pedigree

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

Part 3: Extended Answer Section [40 marks]

41. Pathogens

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

Question	Answers	Marks
(b)	Damaged cells release histamine Causes local dilation of blood vessels, increased blood flow Increases capillary permeability Loss of blood proteins Accumulation of fluid at site—swelling Neutrophils attracted to site Phagocytosis Accumulation of dead cells – pus.	1 1 1 1 1 1 1
	Total	8
(c)	• Lymphatic capillaries lead to ducts • Lymphatic vessels have valves so lymph movement one-way • Ducts lead to nodes • Mesh-like interior of node traps cell debris and bacteria • Fixed phagocytes engulf cell debris and bacteria • 'Cleaned' lymph returns to blood.	1 1 1 1 1 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 • Coitus Interruptus • Mechanical barriers: Condoms, Diaphragm, Cervical Cap, Female Condom • Chemical methods: Spermicide • The Pill • 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. ***Technology*** : 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. ***Technology :*** 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. ***Technology:*** 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. ***Technology:*** Surgery to open tubes, if possible. If surgery fails, in-vitro fertilisation	
	Male tube blockages	Any obstructions in the vas deferens or epididymis. ***Technology :*** Surgery to repair the obstruction.	
	Sperm problems	Low or no sperm counts, poor sperm motility and abnormally-shaped sperm. ***Technology :*** 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: • Number of embryos via IVF implanted in a female/ multiple births • Excess embryos to destroy or donate to other couples or to research. • Sale of embryos • Birth defects as a result of donor egg or sperm • 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. • Gene mutations • changes in a single gene, occur during replication of DNA before cell division • e.g. achondroplasia, Duchene muscular dystrophy • Somatic mutations cannot be passed to offspring • e.g. cancer • Germ line mutations can be passed on to offspring • e.g. PKU Chromosomal mutations: all or part of a chromosome is affected. Too few, too many chromosomes or parts of chromosomes. e.g. Down syndrome	1 1 1 1 1 1 1 1
	Total	8

Question	Answers	Marks
(b)	Variation from meiosis: • Chiasmata: Chromatids that have exchanged genetic material through crossing over during meiosis. • 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. • 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 2 2
	Total	6

Question	Answers	Marks
(c)	Any three examples (1) with explanation (1) • Amniocentesis various including Down syndrome • DNA Test Muscular Dystrophy • Blood Test for newborns for PKU.	2 2 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 communicating 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**

HUMAN BIOLOGICAL SCIENCE
SAMPLE EXAMINATION STAGE 2
MAPPING OF CONTENT

Unit 2A	*Questions*	Unit 2B	Questions
Metabolism		**DNA**	
• anabolic and catabolic reactions and organelles involved (word equations only) e.g. *mitochondria and ribosomes*	MC 2, 6	• structure of DNA including base pair model • locations in the cell including nucleus and mitochondria • role of DNA in the cell • DNA replication–base pair model.	SA33
• respiration (aerobic and anaerobic); inputs, outputs and organelles involved	MC1, MC22 MC14,24		
• nutrients required and their uses including carbohydrates/simple sugars, proteins/amino acids, lipids/fatty acids and glycerols, vitamins and minerals		**Differentiation**	
• enzymes function including reduction in activation energy, lock and key principle		• differentiation forming embryonic germ layers • tissues formed from the primary germ layers • types of stem cells and their potency • importance of stem cells e.g. *cord blood* • teratogenic effects on stem cells.	SA39
• factors that affect enzyme activity including pH temperature, cofactors, co-enzymes.			
Transport			
• structure of the cell membranes as it relates transport of materials greater detail covered in Unit 3A	MC30	**Reproductive systems:**	
• methods of transporting materials including diffusion, facilitated diffusion, osmosis, active transport, endocytosis and exocytosis	SA32	• structure and function of male and female reproductive systems	MC21
• factors affecting exchange of materials including SA/Vol ratio, concentration gradients.		• spermatogenesis and oogenesis • hormone control of menstrual and ovarian cycles and spermatogenesis.	MC20 SA37
Mitosis		**Development**	
Function and significance of chromosome number.		• implantation and development of the placenta	MC25
		• significant developments in embryonic and foetal stages	SA38
Respiratory system	MC3,5	• changes to a female during pregnancy	
Structure and function related to:		• birth process	MC10
• gas exchange including characteristics of respiratory surfaces • maintenance of concentration gradients in lungs including breathing and blood flow.	SA34	• comparison of foetal and neonate circulation • patterns and milestones of development in infants.	MC26,27
Circulatory system		**Enviromental factors:**	
Structure and function related to:		• care of the unborn child e.g. *risks associated with smoking, alcohol and other drug use*	
• role of the heart, arteries, veins and capillaries in the circulation of the blood	MC7,8	• the effect of various types of teratogens.	SA38 (c) (d)

• roles of plasma and erythrocytes in the transport of materials including oxygen, nutrients and waste. • clotting of blood at wound including fibrinogen and platelets • inflammatory response • lymphatics and white blood cells (overview only). **Digestive system** Structure and function related to: • mechanical digestion including teeth, bile, process of peristalsis • chemical digestion of carbohydrates, lipids and proteins including enzymes and associated glands • absorption of nutrients • elimination. **Excretory system** Structure and function related to: • formation of urine in the kidney (details of the processes of filtration, re-absorption and secretion not required) • deamination of amino acids in liver. **Assisted protection of the body:** • external e.g. *hygiene, topical preparations and barriers.* **Inheritance** • dominant, recessive, co-dominant, autosomal and sex linked. inheritance • sex determination • monohybrid crosses using punnet squares and simple probabilities. **Meiosis** • function and significance of chromosome changes meiosis • compare mitosis and meiosis. **Variation from fertilisation** • random fertilisation.	ER42 MC4 SA35 SA 31 (i) (j) MC12 SA36 ER41 MC17,18 MC28 MC15 ER44 (b)	**Reproductive technology** related to: • STI's • contraception • infertility e.g. *IVF, GIFT donors* • maintenance of pregnancy including ultrasound, foetal monitoring and hormonal intervention. **Mutations** • causes of mutations • changes in the DNA sequence • conditions caused by mutations including somatic e.g. *cancer and germ line e.g. PKU* • chromosomal mutations including analysis of karyotypes. **Pedigrees** • construction and interpretation of pedigrees for autosomal and sex-linked conditions • probabilities of producing affected offspring for autosomal and sex linked inheritance • inheritance of mitochondrial DNA. **Genetic testing** of parents and offspring for: • gene and chromosomal abnormalities. **Human Genome Project**: • information provided by the Human Genome Project • range of possible uses for this information. **Variations and the environment:** • new variations due to mutations may be advantageous or disadvantageous to survival • differential survival of genotypes/phenotypes e.g. *lethal recessives* • teratogens the range of actions and their effects.	ER43 MC16 ER44 (a) SA40 MC29 MC9 MC13 MC19

Approaches to investigating and communicating human biology • plan and conduct a safe Investigation on a question of choice, developed from a given contextual problem • use a prescribed format and trial a range of techniques to collect data • collect valid and reliable data • analyse data using rates, percentages and frequencies • refer to possible bias and experimental error • use scientific terminology and appropriate abstract concepts in discussions. • **Lifestyle choices that compromise health** • active or sedentary lifestyle • personal hygiene • use of drugs including alcohol, smoking and diet **Individual differences:** • diagnosis depends upon individual's differences in body form, stature and disease progression • genetic disorders linked to particular populations e.g. *Tay-Sachs, sickle cell anaemia and thalassemia.*	MC23 MC11	**Approaches to investigating and communicating human biology** • plan and conduct a safe investigation on a question of choice, developed from a given contextual problem • trial a range of techniques to collect data • analyse data using rates, percentages and frequencies • present information using appropriate symbols, terminology and conventions. • consider experimental errors and the ramifications of results that support or disprove hypotheses • discuss different perspectives of a problem. **Medical technologies**: • sex selection of embryo to avoid genetic disease • birth control methods • stem cell collection for future use e.g.*cord blood banks* • treatment for various genetic diseases. **Health choices** • pregnant women e.g. *warnings on food labels, drugs, alcohol and smoking* • performance enhancing e.g. *steroid use* • parent's choice for infants e.g. *diet and immunisation choices.*	SA31 ER 44 (c)