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Mark Scheme Summer 2009

GCE

GCE O Level Human Biology (7042)

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Summer 2009

Contents

7042/01 O LEVEL HUMAN BIOLOGY MARK SCHEME - JUNE 2009

Question Number	Answer	Mark
1(a)	1 mark for each correct answer. • **C** – cerebrum / cerebral hemispheres / cerebral cortex; • **E** – medulla (oblongata) / brain stem; • **F –** spinal cord; R – spine	**(3)**

Question Number	Answer	Mark
1(b)	1 mark for each correct answer. function / region *balance and muscle coordination* – D; *stimulating the action of involuntary muscles* – E; *production of sex hormones* – A; *intelligence and reasoning* – C;	**(4)**

Question Number	Answer	Mark
1(c)	1 mark for each correct answer from any of the following – maximum 2 marks . • controls involuntary muscles / heart beat / breathing; • regulates many homeostatic mechanisms; • loss of control / processes of above leads to death;	**(2)**

(Total 9 marks)

Question Number	Answer	Mark
2(a)	1 mark for each correct answer. • heat is generated within body; • skin loses heat to environment;	**(2)**

Question Number	Answer	Mark
2(b)(i)	1 mark for each correct answer. • at least 6 points correctly plotted; • remaining 3 points correctly plotted; • points joined; • both curves identified;	**(4)**

Question Number	Answer	Mark
2(b)(ii)	1 mark for correct answer. • 32 to 44 minutes (accept values from candidate's graph) • accept +/- 0.5	**(1)**

Question Number	Answer	Mark
2(b)(iii)	1 mark for correct answer. • cold water chills throat / stomach; • temperature of blood leaving these organs falls; • affects rest of circulatory system;	**(2)**

Question Number	Answer	Mark
2(b)(iv)	1 mark for each correct answer. • hypothalamus / brain;	**(1)**

Question Number	Answer	Mark
2(c)	1 mark for each correct answer. • allows constant rate of metabolism /respiration/A/W; • ref. to enzyme optimum / A/W; • animal can remain active in many climates;	**(2)**

(Total 12 marks)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>3</td><td>1 mark for each correct answer.

<table>
<tr><th>disease</th><th>causative agent</th><th>method of transmission</th></tr>
<tr><td>diphtheria</td><td>bacterium;</td><td>droplet infection</td></tr>
<tr><td>typhus</td><td>rickettsia</td><td>vector / louse borne;</td></tr>
<tr><td>malaria</td><td>protozoan / Plasmodium;</td><td>vector / mosquito;</td></tr>
<tr><td>athlete's foot</td><td>fungus / Tinea;</td><td>contact with infected clothing, towels or floor</td></tr>
<tr><td>poliomyelitis</td><td>virus</td><td>droplet infection;</td></tr>
<tr><td>gonorrhoea</td><td>bacterium</td><td>sexual transmission / intercourse;</td></tr>
</table>
</td><td>(7)</td></tr>
</table>

(Total 7 Marks)

Question Number	Answer	Mark
4(a)(i)	1 mark for each correct answer from any of the following – maximum 6 marks. • reasonable size diagram, at least 6 cm depth; • main bones drawn; • biceps and triceps muscles drawn, connected correctly at both ends; • forearm raised/bent at elbow; • biceps shown contracted (fatter); • triceps relaxed (long and thin); • tendons at same length as original;	**(6)**

Question Number	Answer	Mark
4(a)(ii)	1 mark for correct answer from any of the following – maximum 2 marks. • when biceps contracts; • transmits pull; • to the radius;	**(2)**

Question Number	Answer	Mark
4(b)(i)	1 mark for each correct answer. • **Y** – ball and socket / universal A/W; • **Z** – hinge;	**(2)**

Question Number	Answer	Mark
4(b)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks. • **Y** – all round movement / eq: • **Z** – movement in one plane only / up to 180^{o} /A/W;	**(2)**

Question Number	Answer	Mark
4(c)(i)	1 mark for each correct answer. • presence of synovial fluid / bones shaped to articulate with one another;	**(1)**

Question Number	Answer	Mark
4(c)(ii)	1 mark for each correct answer from any of the following – maximum 2 marks. • bones "scrape" against one another / increased friction; • movement painful; • movement may become almost impossible;	**(2)**

(Total 15 Marks)

Question Number	Answer	Mark
5(a)(i)	1 mark for each correct answer. • **A** – Bowman's capsule; • **B** – glomerulus;	**(2)**

Question Number	Answer	Mark
5(a)(ii)	1 mark for correct answer from any of the following – maximum 3 marks. • high blood pressure; • generated by heart; • narrowing of blood vessels increases pressure; • walls of glomerulus and capsule porous; • ultrafiltration / blood plasma forced out under pressure;	**(3)**

Question Number	Answer	Mark
5(a)(iii)	1 mark for each correct answer from any of the following – maximum 2 marks • red blood cells; • white blood cells; • platelets; • <u>blood</u> proteins / <u>named</u> blood protein; (ref to blood cells unspecified 1 mark)	**(2)**

Question Number	Answer	Mark
5(a)(iv)	1 mark for correct answer. • label **G** to first convoluted tubule;	**(1)**

Question Number	Answer	Mark
5(b)(i)	1 mark for each correct answer from any of the following – maximum 3 marks. • amount remaining in blood must be constant / osmoregulation / homeostasis / A/W; • input varies with diet; • input varies with amount drunk; • output varies due to sweating / activity; • depends on external temperature;	**(3)**

Question Number	Answer	Mark
5(b)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks. • blood to the brain / hypothalamus monitored; • (pituitary) secretes ADH; • amount of ADH released depends on the water content of plasma; • ADH carried in blood; • to collecting duct (of nephron); • ADH stimulates water reabsorption; • the more ADH secreted – more water reabsorbed / ORA;	**(4)**

(Total 15 Marks)

Question Number	Answer	Mark
6(a)(i)	1 mark for correct answer. • B;	**(1)**

Question Number	Answer	Mark
6(a)(ii)	1 mark for correct answer. Both needed for mark. • F and G;	**(1)**

Question Number	Answer	Mark
6(a)(iii)	1 mark for each correct answer. • B to C/ from 1.9 -3.3 minutes;	**(1)**

Question Number	Answer	Mark
6(b)	1 mark for each correct answer from any of the following – maximum 4 marks. • ciliary muscles relax; • pressure from vitreous / aqueous humour pushes on sclera; • (suspensory) ligaments are pulled taut; • pull on lens; • lens flexible (jelly like) / elastic; • lens becomes less convex / thinner / flatter;	**(4)**

(Total 7 Marks)

Question Number	Answer	Mark
7(a)(i)	1 mark for correct answer. • **R** – tissue fluid;	**(1)**

Question Number	Answer	Mark
7(a)(ii)	1 mark for each correct answer from any of the following – maximum 2 marks. • has no red blood cells in it; • has no plasma proteins in it; • not enclosed in vessels;	**(2)**

Question Number	Answer	Mark
7(b)(i)	1 mark for correct answer. • 1 kPa; (unit required)	**(1)**

Question Number	Answer	Mark
7(b)(ii)	1 mark for correct answer. • from the capillary to the tissue fluid / out from capillary / towards R / from S to R;	**(1)**

Question Number	Answer	Mark
7(b)(iii)	1 mark for each correct answer from any of the following – maximum 3 marks. • substances diffuse; • into / out of muscle cells; • e.g. glucose (into); • oxygen (into); • waste substances / named example out of cells / into fluid;	**(3)**

Question Number	Answer	Mark
7(c)(i)	1 mark for correct answer. • volume of liquid (in capillary) reduced / friction with capillary wall / A/W;	**(1)**

Question Number	Answer	Mark
7(c)(ii)	1 mark for each correct answer from any of the following – maximum 2 marks. • fluid is forced back into capillaries from R to T; R diffusion • fluid carries waste substances from the cells; • e.g. carbon dioxide;	**(2)**

Question Number	Answer	Mark
7(d)(i)	1 mark for each correct answer. • **P** - lymph;	**(1)**

Question Number	Answer	Mark
7(d)(ii)	1 mark for each correct answer from any of the following – maximum 2 marks. • (lymph) drains into lymph vessels; • lymph vessels / lymphatics join to form larger vessel; • passes through lymph nodes; • rejoins blood system (near heart) • ;	**(2)**

(Total14 Marks)

Question Number	Answer	Mark
8(a)(i)	1 mark for each correct answer. If candidate has used old nomenclature, penalise in 8(a)(i) and 8(a)(ii) only. • $I^A I^A$; • $I^A I^o$;	**(2)**

Question Number	Answer	Mark
8(a)(ii)	1 mark for correct answer. • $I^A I^B$;	**(1)**

Question Number	Answer	Mark
8(b)(i)	1 mark for each correct answer. Accept any form of genetic diagram but labels / annotation necessary for each marking point. • parental genotypes I^BI^o I^AI^B; • gametes I^B I^o I^A I^B; • possible offspring I^AI^B I^AI^o I^BI^B I^BI^o; genotypes • possible offspring AB A B B; phenotypes	**(4)**

Question Number	Answer	Mark
8(b)(ii)	1 mark for correct answer. • 25%; accept ecf ¼ / 1in4	**(1)**

Question Number	Answer	Mark
8(c)	1 mark for each correct answer from any of the following – maximum 4 marks. • males XY; • females XX; • heterozygous female / carrier does not show condition; • must be present on both X chromosomes to cause condition in females A/W; • if present (on single X chromosome) in male it causes condition;	**(4)**

(Total 12 Marks)

Question Number	Answer	Mark
9(a)(i)	1 mark for each correct answer from any of the following – maximum 3 marks. • bacteria (in plaque) act on / respire sugars; • release acid; • acid attacks / erodes / dissolves enamel; • allows entry / access by bacteria to dentine / living tissues;	**(3)**

Question Number	Answer	Mark
9(a)(ii)	1 mark for each correct answer – maximum 2 marks • brush teeth after eating / ref. to regular daily brushing; • using (fluoride) toothpaste / mouth wash dental floss; • regular visits to the dentist; • eat fibrous fruit / veg;	**(2)**

Question Number	Answer	Mark
9(b)(i)	1 mark for each correct answer from any of the following – maximum 2 marks. • cannot form new cytoplasm / cells; • poor growth / slow healing of wounds; • reduced immunity /A/W; • ref. to kwashiorkor;	**(2)**

Question Number	Answer	Mark
9(b)(ii)	1 mark for correct answer from any of the following – maximum 2 marks. • excess carbohydrates changed to fats; • excess fat stored around organs / under skin; • obesity; • extra mass to move around; • strain on muscles / heart / skeleton / increased risk of diabetes; • Increased risk of coronary heart disease;	**(2)**

(Total 9 Marks)

(Total for paper: 100 marks)

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Question Number	Answer	Mark
1(a)	1 mark for each correct answer from any of the following – maximum 4 marks. • chopping / grind food • put sample in a dry test tube; • add ethanol and shake; • decant the liquid; • add a drop of cold water; • cloudy / milky liquid confirms fat;	**(4)**

Question Number	Answer	Mark
1(b)(i)	1 mark for each correct answer from any of the following – maximum 5 marks. • alkaline conditions; • provided by pancreatic juice; • by bile; • fats emulsified; • lipase; • from pancreas; • digests / breaks fats into fatty acid and glycerol;	**(5)**

Question Number	Answer	Mark
1(b)(ii)	2 marks for each correct answer from any of the following pairs – maximum 3 marks. • in ileum; • via villi; • by diffusion; • into lacteal / lymph vessel; • joins blood near heart;	**(3)**

Question Number	Answer	Mark
1(c)	1 mark for each correct answer from any of the following – maximum 4 marks • fat layer (under skin); • provides insulation; • fat layer lost / used up if diet lacks fat; • more heat lost/AW; • loses source of energy from diet;	**(4)**

Question Number	Answer	Mark
1(d)	2 marks for each correct answer from any of the following pairs – maximum 4 marks. • electrical insulation; • around axons / dendrons of neurones; • energy store; • for use when body requires extra energy; • solvent for uptake of vitamins A and D; • allows them to pass across cell membranes; • component of cell membrane; • needed for formation of new cells; • protection of internal organs; • named organ / example;	**(4)**

(Total 20 marks)

Question Number	Answer	Mark
2(a)(i)	1 mark for each correct answer from any of the following – maximum 7 marks • two pumps (side by side) ; • each pump has two chambers /4 chambers altogether; • upper chamber / atrium receives blood; • lower chamber / ventricle pumps blood (by contraction); • deoxygenated blood into right side / in via vena cava; • pumped out to lungs; • (rbc) oxygenated in lungs; • via pulmonary artery; • oxygenated blood returns to left side/ atrium; • via pulmonary vein;	**(7)**

Question Number	Answer	Mark
2(a)(ii)	1 mark for each correct answer from any of the following – maximum 3 marks • valves between atria and ventricles/cuspid valves; • valves between ventricles and pulmonary artery / aorta semilunar valves; • fill up as pressure rises in ventricles / arteries; • close passageway to blood / prevent backflow;	**(3)**

Question Number	Answer	Mark
2(a)(iii)	1 mark for each correct answer from any of the following – maximum 4 marks • oxygenated and deoxygenated blood may mix in heart; • blood leaving left side/to body may not be fully oxygenated; • muscles receive limited oxygen supply; • less respiration occurs; • less energy released; • exercise difficult tire easily; • lips / skin may develop a blue tinge;	**(4)**

Question Number	Answer	Mark
2(b)	1 mark for each correct answer from any of the following – maximum 3 marks. • cardiac muscle involuntary but skeletal muscle voluntary; • cardiac muscle does not fatigue but skeletal muscle does; • skeletal muscle attached to bones but cardiac muscle not; • cardiac muscle has one nucleus per cell but skeletal muscle has many nuclei scattered within fibre; • any other valid difference;	**(3)**

Question Number	Answer	Mark
2(c)	1 mark for each correct answer from any of the following – maximum 3 marks • not too much saturated fat - increases risk of heart attack; • adequate protein – needed to maintain heart muscle; • not too much salt – salt raises blood pressure; • no or low alcohol intake – too much can damage heart; • avoid too much caffeine – raises heart rate / blood pressure;	**(3)**

(Total 20 marks)

Question Number	Answer	Mark
3(a)(i)	1 mark for each correct answer from any of the following – maximum 8 marks • DNA (in nucleus) decides which protein is formed; • forms corresponding RNA; • passes out of nucleus; • to ribosomes; • in cytoplasm; • RNA "decoded" by ribosomes A/W; • Sequence of bases on RNA determines order of amino acids; • attract / collect correct amino acids; • arranged in a chain; • linked by peptide bonds; • to form protein / polypeptide; • amino acids arrive via endoplasmic reticulum/ eq;	**/** **(8)**

Question Number	Answer	Mark
3(a)(ii)	1 mark for each correct answer. • some of the proteins formed used to make enzymes; • enzymes control chemical reactions in cell / speed up metabolism;	**(2)**

Question Number	Answer	Mark
3(b)(i)	1 mark for each correct answer from any of the following – maximum 3 marks • mitochondria contain enzymes; • bring about respiration; • releases energy; • ref. to ATP formation; • (energy) needed for protein formation; • and for mitosis;	**(3)**

Question Number	Answer	Mark
3(b)(ii)	1 mark for each correct answer from any of the following – maximum 7 marks. Accept annotations on diagrams • cell nucleus appears to become granular; • chromosomes appear; • become shorter and fatter; • nuclear membrane disappears; • each chromosome of two chromatids; • spindle appears; • chromosomes on equator of spindle; • chromatids pulled apart; • one of each pair move to each pole of cell; • two nuclear membranes appear; • cytoplasm divides;	**(7)**

(Total 20 marks)

Question Number	Answer	Mark
4(a)(i)	1 mark for each correct answer from any of the following – maximum 6 marks • diagram at least 8 cm long; • section to show wall thickness; <u>correctly drawn and labelled-</u> • ovary; • oviduct / fallopian tube; • uterus; • cervix; • vagina;	**(6)**

Question Number	Answer	Mark
4(b)(i)	1 mark for each correct answer from any of the following – maximum 7 marks • FSH begins maturation of ovum in follicle; • stimulates production of oestrogen; • oestrogen concentration rises / released at ovulation; • pituitary releases LH; • causes old follicle cells to release progesterone; • causes blood vessels to grow into uterus lining; • progesterone level falls / less produced; • leads to menstruation; • drop stimulates more FSH release / production;	**(7)**

Question Number	Answer	Mark
4(b)(ii)	1 mark for each correct answer from any of the following – maximum 3 marks • progesterone causes / maintains thickening of uterus lining; • increases vascularisation; • prevents further FSH production / ovulation; • at end of pregnancy oxytocin / other hormones; • initiate contractions/ birth;	**(3)**

Question Number	Answer	Mark
4(c)	1 mark for each correct answer from any of the following – maximum 4 marks • (breast milk) contains all the materials needed for the baby; • in correct proportions for the baby; • milk transfers antibodies from mother to child; • ref. to colostrum; • breast milk normally uncontaminated by external pathogens; • forms mother - child bond;	**(4)**

(Total 20 marks)

Question Number	Answer	Mark
5(a)	1 mark for each correct answer from any of the following – maximum 8 marks. (mark points could be on labelled diagram) • airtight cavity; • bordered by ribs; • sternum; • backbone / thoracic vertebrae; • diaphragm; • contains heart and lungs; • intercostal muscles; • contract; • pull ribs up and outwards; • diaphragm flattens; • volume of cavity increases; • air enters via trachea and bronchi; • *Points 2-7 need description, not just name	**(8)**

Question Number	Answer	Mark
5(b)(i)	1 mark for each correct answer from any of the following – maximum 4 marks • carbon dioxide levels in blood monitored / increases; • nerve impulses from medulla; • causes intercostal muscles / diaphragm muscles; • to contract more rapidly; • more strongly; • volume of thorax increases and decreases more rapidly; • greater gaseous exchange/ A/W;	**(4)**

Question Number	Answer	Mark
5(b)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks • exercise requires increased energy; • oxygen releases energy from glucose; • by respiration; • carbon dioxide released; • extra oxygen got from air in lungs; • extra carbon dioxide got rid of via air in lungs;	**(4)**

Question Number	Answer	Mark
5(c)	1 mark for each correct answer from any of the following – maximum 4 marks • lactic acid formed; • limited energy released/A/W • ref. to build up of oxygen debt; • lactic acid build up; • causes muscle pain / cramp; • must be broken down using oxygen;	**(4)**

(Total 20 marks)

Question Number	Answer	Mark
6(a)(i)	1 mark for each correct answer. • clear outline at least 6cm long - NO nucleus; (1 mark) 1 mark for each correct answer from any of the following – maximum 4 marks Correctly shown and labelled: • nuclear / DNA thread; • cytoplasm; • membrane; • cell wall; • slime capsule; • plasmids / flagellum;	**(5)**

Question Number	Answer	Mark
6(a)(ii)	1 mark for each correct answer from any of the following – maximum 3 marks • parasitic / A/W; • saprophytic / A/W; • secrete enzymes to digest food; • absorb soluble products; • some bacteria are photosynthetic / autotrophic; • Correct ref to bacteria in nitrogen cycle;	**(3)**

Question Number	Answer	Mark
6(b)(i)	1 mark for each correct answer from any of the following – maximum 2 marks • via droplet infection; • patient coughs / breathes out droplets; • inhaled by uninfected person; • drinking infected milk;	**(2)**

Question Number	Answer	Mark
6(b)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks • (early detection) to prevent major damage to lungs; • prevent spread of infection to other parts of the body; • rest / no stress; • good diet; • use of antibiotics; • e.g. streptomycin; • use of other drugs (chemical); • isolation of patient;	**(4)**

Question Number	Answer	Mark
6(c)	1 mark for each correct answer from any of the following – maximum 4 marks • improved living conditions / less overcrowding; • improved diet; • introduction of antibiotics; • mass testing / X rays / screening techniques; • pasteurisation of milk / TT cows; • vaccination;	**(4)**

Question Number	Answer	Mark
6(d)	1 mark for each correct answer from any of the following – maximum 2 marks • breakdown of social conditions / wars etc; • rapid travel, spread of infection / infecting people is easier; • antibiotic resistant strains of bacterium developed / A/W;	**(2)**

(Total 20 marks)

Question Number	Answer	Mark
7(a)(i)	1 mark for each correct answer from any of the following – maximum 8 marks Many of these points could be as annotations on a diagram or as a paragraph • diagram to show three layers; • living structures in middle layer; • fat layer provides insulation; • dead/ cornified layer waterproof; • Malpighian layer produces new cells; • (Malpighian layer produces) melanin gives protection against UV light; • hair follicles produce hairs; • sebaceous gland alongside shaft of hair; • waterproof hair / secrete sebum; • sweat glands to reduce temperature; • capillaries; • nerve endings – sensitive to touch / temperature;	**(8)**

Question Number	Answer	Mark
7(a)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks • no gaps in outer layer: • difficult for pathogens to gain entry; • outer layer waterproof; • barrier against many chemicals; • sebum from gland is antiseptic;	**(4)**

Question Number	Answer	Mark
7(b)(i)	1 mark for each correct answer from any of the following – maximum 5 marks • ciliated epithelium; • with cells that secrete mucus; • mucus traps pathogens / dust; • cilia beat in sequence; • push mucus away from lungs / towards throat; • mucus is swallowed;	**(5)**

Question Number	Answer	Mark
7(b)(ii)	1 mark for each correct answer from any of the following – maximum 3 marks • smoke is irritant; • nicotine; • paralyses cilia; • may destroy them; • particles and tar not removed; • accumulation of mucus; • bronchitis; • tar linked to increase in cancers of the airways;	**(3)**

(Total 20 marks)

Question Number	Answer	Mark
8(a)(i)	1 mark for each correct answer – maximum 4 marks • bacteria; • fungi; • saprophytic nutrition; • release / secrete enzymes; • cellulase; • breakdown / digest cell walls / cellulose; • release cell contents;	**(4)**

Question Number	Answer	Mark
8(a)(ii)	1 mark for each correct answer – maximum 4 marks • reasonable temperature; • enzymes / microorganisms only active at suitable temperature /pH; • presence of water / damp conditions; • as reactant / as medium for chemical reactions; • oxygen; • respiration of bacteria / fungi; • suitable pH;	**(4)**

Question Number	Answer	Mark
8(a)(iii)	1 mark for each correct answer – maximum 3 marks • recycling A/W; • materials removed from environment; • by plants etc; • e.g. nitrate; • released by decay; • returned to soil /air;	**(3)**

Question Number	Answer	Mark
8(b)	Any three examples – 3 marks each (1 for method and 2 for explanation)– maximum 9 marks • dehydration / drying; • water removed; • microorganisms inactivated; • salting / syrup; • osmotic method • water made unavailable to microorganisms; • refrigeration / freezing; • low temperature / removes heat; • enzymes inactivated; • microorganisms cannot reproduce / metabolise; • canning; • food heated – microorganisms killed; • can sealed – no more microorganisms can enter / no entry of oxygen; • vacuum packing; • contents lack oxygen / air; • microorganisms killed or inactivated; • radiation; • food in sealed container; • irradiated; • microorganisms killed;	**(9)**

(Total 20 marks)

Question Number	Answer	Mark
9(a)(i)	1 mark for each correct answer from any of the following – maximum 8 marks. Accept points if explained on diagram. * Can be awarded on equation • photosynthesis / autotrophic nutrition; • * carbon dioxide + water; • chlorophyll; • light energy absorbed; • * glucose formed; • * oxygen released; • glucose basis for other food materials; • e.g. starch / fats / proteins; • oxygen removed from atmosphere for respiration; • replaced as result of photosynthesis; • animals depend on plants for nutrition;	**(8)**

Question Number	Answer	Mark
9(a)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks • carbon dioxide removed by photosynthesis; • replaced by respiration; • by combustion use of fossil fuels; • oxygen removed by respiration / combustion; • these processes roughly balance out;	**(4)**

Question Number	Answer	Mark
9(b)(i)	1 mark for each correct answer from any of the following – maximum 4 marks • increased combustion of fossil fuels; • increased energy demand in homes / industry; • increased use of vehicles; • original carbon dioxide removal over millions of years; • replaced over a very short time; • effects of deforestation; • increased population, more respiration;	**(4)**

Question Number	Answer	Mark
9(b)(ii)	1 mark for each correct answer from any of the following – maximum 4 marks • combines with haemoglobin/ forms carboxyhamoglobin; • irreversible; • reduces oxygen transport in body; • less oxygen for respiration / energy release; • death; • ref. effect on fetus;	**(4)**

(Total 20 marks)

(Total for paper: 100 marks)

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