



*Rewarding Learning*

**General Certificate of Secondary Education  
2012**

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**Science: Biology**

Paper 2  
Higher Tier

**[G0904]**

**WEDNESDAY 20 JUNE, MORNING**

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**MARK  
SCHEME**

- 1 (a) (i) Coal/oil; [1]
- (ii) Any **two** from:  
CO/CO<sub>2</sub>;  
SO<sub>2</sub>/SO<sub>x</sub>;  
NO<sub>2</sub>/NO<sub>x</sub>; [2]
- (iii) Soot covers leaves/blocks stomata;  
(Must affect **outside** of leaf) [1]
- (iv) Less light enters leaf/trapped by chlorophyll/  
Less gas exchange; [1]  
Less photosynthesis; [1]
- (v) Any **two** from:  
Renewable sources of energy;  
Scrubbers in factory chimneys;  
Catalytic converters;  
Increased use of public transport/example described;  
Increased insulation;  
Burn less fossil fuels;  
Use unleaded petrol; [2]
- (b) (i) Landfill; [1]
- (ii) Any **two** from:  
Smell;  
Unsanitary;  
Disease;  
Attracts unwanted birds/gulls/animals/rodents/foxes;  
Leaching of toxins to ground/water;  
Needs **large area** of land/damages habitats/needs long time; [2]
- (iii) Incineration/burning/composting/recycling; [1]
- (c) (i) Knock; [1]
- (ii) Red squirrels decreasing;  
Grey squirrels increasing; [2]  
(**Reject** a description of numerical values)
- (iii) Any **three** from: Grey squirrels –  
Eat wider range of food;  
Outcompete them for habitats;  
Higher reproduction rate;  
Resistant to/carryer of virus (parapox); [3]

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- 2 (a) (i) A – **Spongy mesophyll**;  
 B – **Lower** epidermis;  
 C – Stoma(ta); [3]
- (ii) Allows (maximum amount of) light into leaf/cells/mesophyll/chloroplasts;  
 Thin (leaf);  
 Large **surface area** (for light absorption); [3]
- (iii) 8 (arbitrary units); [1]
- (iv) Any **two** from:  
 Thickened **inner** walls;  
 Chloroplasts present;  
 Smaller vacuole;  
 No cuticle; [2]
- (v) Any **three** from:  
 Carbon dioxide ; }  
 By diffusion; } **or** { Water  
 Through stomata; } { From xylem;  
 Into mesophyll cell/chloroplast/air space/vacuole/any appropriate }  
 named structure; { By osmosis; [3]
- Quality of written communication [2]
- (b) (i) Kill the leaf/break down cuticle/cells to allow chemicals to enter;  
 Remove chlorophyll/green colour/decolorise leaf; [2]
- (ii) Any **one** from:  
 Turn off Bunsen/no naked flames;  
 Wear goggles; [1]
- (iii) Dip(ped) in water; [1]
- (iv) Starch;  
 Yellow-brown to blue-black; [2]
- (v) Starch all used (up)/not present;  
 By respiration; [2]

- 3 (a) (i) nn;  
Normal wing; [2]
- (ii) Wings can't be used/can't fly;  
to get food/find mate/escape (predators); [2]
- (iii) Length of DNA/chromosome;  
In nucleus; [2]
- (b) (i) NN, Nn;  
Nn, nn; [2]
- (ii) 3:1; [1]
- (iii) 16, 4; [1]
- (iv) 4:1; [1]
- (v) Any **one** from:  
Random process;  
Large numbers required/small numbers produced in this case; [1]
- (c) (i) Males: Testosterone;  
Female: Oestrogen; [2]

(ii)

Secondary sexual characteristic	Males	Females	
Voice deepens	✓	✗	[1]
Growth of body and pubic hair	✓	✓	[1]
Menstruation begins	✗	✓	[1]
Sexual awareness	✓	✓	[1]

[4]

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- 4 (a) (i) Bacterium; [1]
- (ii) Prevents bacteria/microorganisms reproducing; [1]
- (iii) Temperature does not get high enough;  
Microorganisms not killed/can grow/can reproduce; [2]
- (iv) Microorganisms can only reproduce **slowly** at 4° C; [1]
- (v) Any **two** from:  
Wash hands/utensils before handling food;  
Keep raw and cooked food apart;  
Allow cooked food to cool before refrigerating;  
Ensure reheated food reaches a high temperature;  
Cover food;  
Obey use by dates;  
Avoid hand to mouth actions/described; [2]
- (b) (i) So person does not catch the disease/microorganism/bacterium; [1]
- (ii) Antigen; [1]
- (iii) White blood cell (lymphocyte) recognises antigen/structure X; [1]
- (iv) Phagocyte; [1]
- (v) Nucleus; [1]
- (vi) Any **three** from:  
Antibodies; [1]  
  
Attach to/clump microorganisms;  
Prevent microorganisms reproducing/spreading;  
Makes easier target for phagocyte; [2]
- (vii) Stage 5 – White blood cell (phagocyte) **engulfs** the microorganisms;  
Stage 6 – White blood cell (phagocyte) **digests** microorganisms; [2]
- (viii) Antibiotic; [1]

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5	<p>(a) (i) A, G, C; ([-1] for each wrong up to maximum [-2])</p> <p>(ii) X-ray crystallography/diffraction;</p> <p>(iii) Crick and Watson;</p> <p>(iv) Double helix;</p> <p>(v) Genes/bases; Codes for; amino acids;</p> <p>(b) (i) A – Stirrer;</p> <p>(ii) Nutrients;</p> <p>(iii) To maintain (optimum) temperature/prevent high temperatures; Could cause death/denaturing of genetically engineered bacterium;</p> <p>(iv) Any <b>two</b> from: pH; O<sub>2</sub> (concentration); CO<sub>2</sub> (concentration); Amount/concentration of nutrient/sugar/glucose;</p> <p>(c) (i) Enzyme used;</p> <p>(ii) Step 3 – Human <b>insulin gene</b> inserted into bacterial <b>chromosome/plasmid</b>; Step 4 – Bacterial <b>chromosome/plasmid</b> placed into <b>bacterium</b>;</p> <p>(iii) Divides/reproduces/clones; Produces (genetically) <b>identical</b> copy;</p> <p>(iv) Any <b>two</b> from: Extracted/separated from bacterial culture; Purified/concentrated; Packaged/sterilized;</p> <p>(v) Any <b>one</b> from: Animal insulin not the same/does not work as well; Concentration not known; Allergic response/side effects; No ethical issue with use of animal material/described; Get larger quantities produced;</p>	<p>[2]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[3]</p> <p>[1]</p> <p>[1]</p> <p>[2]</p> <p>[2]</p> <p>[1]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[1]</p>
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			AVAILABLE MARKS	
6	(a)	(i) (Biological) catalyst; Digests protein;	[2]	18
		(ii) Amino acids;	[1]	
	(b)	(i) Accurate plots ( $\times 2$ ); Line drawn; Line labelled;	[4]	
		(ii) Any <b>two</b> from: Size/surface area/of film; Temperature; Type of film/thickness of coating; <b>Volume/concentration</b> of protease;	[2]	
		(iii) 6; minutes;	[2]	
		(iv) Correct reference to <b>rate of reaction/digestion</b> ; Optimum at pH2;	[2]	
		(v) Enzyme A; Optimum at acid pH (as in stomach);	[2]	
		(vi) Film coating not clear/not digested; Enzymes are specific; Lipase would not react with protein substrate/only reacts with lipids/fats;	[3]	

- 7 (a) (i) A – Blood;  
B – Amniotic fluid; [2]
- (ii) Any **two** from:  
Carried in the umbilical vein;  
Diffuses;  
Across placenta/villi; [2]
- (iii) Carbon dioxide;  
Urea; [2]
- (iv) Large surface area;  
Thin (membrane)/short diffusion distance/capillaries **close** to surface;  
Good blood supply/maintains concentration (diffusion) gradient; [3]
- (b) (i) To **increase the chance** of a sperm reaching/fertilizing the egg; [1]
- (ii) Sperm carry X **or** Y chromosome;  
Eggs carry **only** X chromosome; [2]
- (iii) Dairy farmers prefer female calves/beef farmers prefer male calves; [1]
- (iv) Glucose – provides energy (food) for sperm;  
Antibiotics – kill pathogens which could damage sperm/embryo/  
infect cow; [2]
- (v) Can be used after bull is dead/appropriate time reference;  
Easily transported; [2]
- (vi) Embryo transfer – Placing embryos into host/another female (cow);  
IVF – Fertilization in (glass) dish/outside female’s body; [2]
- (vii) Pedigree embryo has qualities of pedigree mother and father;  
Qualities of non-pedigree mother are not transferred to embryo; [2]
- (viii) More expensive/more skilled; [1]

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			AVAILABLE MARKS	
8	(a)	(i) <b>Chemical messenger;</b> Transported <b>in the blood;</b>	[2]	
		(ii) Insulin; [1] Liver; [1] Fight/fright/stress; [1] Adrenal gland; [1]	[4]	
		(iii) <b>Heart –</b> <b>Increased</b> heart rate; Increased blood flow (to muscles); <b>Muscles –</b> More oxygen/glucose; <b>More</b> respiration; <b>Bronchioles –</b> Dilate; More O <sub>2</sub> <b>absorbed</b> /CO <sub>2</sub> <b>released</b> / <b>gas exchange;</b>	[6]	
		(iv) Blood is diverted away from skin/to other organs;	[1]	
		(v) Blood glucose level <b>monitored by pancreas;</b> <b>Correct reference to</b> insulin production; Brings blood glucose level back/return to <b>normal;</b>	[3]	
	(b)	(i) Similarity – Both increase/rise; Difference – Gradients differ/A steeper than B/A always above B/ higher than B;	[2]	
		(ii) Any <b>two</b> from: Different masses/blood volume; Gender; B more alcohol tolerance/more used to heavy drinking/good liver function; Amount of food in stomach; Duration of drinking;	[2]	
		(iii) Any <b>two</b> from: Impaired judgement/described/Increased risk of accidents; Increased risk of cancer/liver disease (cirrhosis)/other appropriate health issues; Social effects;	[2]	
			<b>Total</b>	<b>22</b>
				<b>160</b>