



Rewarding Learning

**General Certificate of Secondary Education
2012**

Science: Biology

Paper 2
Higher Tier

[G0904]

WEDNESDAY 20 JUNE, MORNING

**MARK
SCHEME**

- 1 (a) (i) Coal/oil; [1]
- (ii) Any **two** from:
CO/CO₂;
SO₂/SO_x;
NO₂/NO_x; [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]

AVAILABLE
MARKS

18

- 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]

18

AVAILABLE
MARKS

- 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]

AVAILABLE
MARKS

18

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 two from: pH; O₂ (concentration); CO₂ (concentration); Amount/concentration of nutrient/sugar/glucose;</p> <p>(c) (i) Enzyme used;</p> <p>(ii) Step 3 – Human insulin gene inserted into bacterial chromosome/plasmid; Step 4 – Bacterial chromosome/plasmid placed into bacterium;</p> <p>(iii) Divides/reproduces/clones; Produces (genetically) identical copy;</p> <p>(iv) Any two from: Extracted/separated from bacterial culture; Purified/concentrated; Packaged/sterilized;</p> <p>(v) Any one 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>
---	---	--

			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 two from: Size/surface area/of film; Temperature; Type of film/thickness of coating; Volume/concentration of protease;	[2]	
	(iii)	6; minutes;	[2]	
	(iv)	Correct reference to rate of reaction/digestion ; 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]

AVAILABLE
MARKS

22

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