

**GCSE**

**Science: Double Award  
(Modular)**

**Summer 2010**

**Mark Schemes**

Issued: October 2010



**NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCATION (GCSE)  
AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION (GCE)**

**MARK SCHEMES (2010)**

**Foreword**

***Introduction***

Mark Schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

***The Purpose of Mark Schemes***

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16 and 18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.



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**General Certificate of Secondary Education  
2010**

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**Science: Double Award (Modular)**

Paper 1  
Foundation Tier

**[G8201]**

**FRIDAY 21 MAY, MORNING**

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**MARK  
SCHEME**


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- 1 (a) (i) Chlorophyll/chloroplast; [1]  
(ii) Water; CO<sub>2</sub> (either order); oxygen (accept symbols) [3]
- (b) (i) Place in a dark cupboard for **1 day or more** [1]  
(ii) Step 2 – remove chlorophyll/green colour/decolourise  
**Not** kill chlorophyll  
Step 3 – remove alcohol/soften leaf  
**Not** kill leaf [2]  
(iii) Alcohol is flammable/inflammable  
**Not** dangerous/explosive/using Bunsen burners [1]  
(iv) Leaf 1 – yellow/brown/yellow-orange;  
(**not** red) (**not** no colour change)  
Leaf 2 – blue-black/black (**not** blue on its own) (**not** brown-black) [2]
- (c) (i) 2 marks for all correct points (–1 per error);  
1 mark for points joined with straight lines  
(allow curve if it join all the points) [3]  
(ii) 60 °C/60 **or over** [1]  
Enzyme denatured/described/still a lot of starch left/  
enzyme doesn't work [1]
- (d) (i) Cheese; oily fish; [2]  
(ii) Bones/teeth [1]
- (e) (i) Iron/Fe  
**Not** haemoglobin [1]  
(ii) Carry oxygen [1]  
(iii) Double [1]
- (f) (i) Pulmonary artery [1]  
(ii) Aorta; pulmonary vein (either order) [2]



- 2 (a) (i) Sun/sunlight/light/light energy; [1]
- (ii) Zooplankton; [1]  
sand eel; [1]
- (iii) Phytoplankton → zooplankton → sand eels → fish → polar bears
- [1] mark phytoplankton at start & polar bears at end  
[1] mark missing arrow →  
[1] mark organisms in between in correct order  
(zooplankton – sand eels – fish) [3]
- (iv) Produce sugars/food/photosynthesis/starch (**not** produce energy);  
Using sunlight; [2]
- (v) Less phytoplankton;  
due to less light/temp;  
**Not** harsh conditions/**Not** more sand eels eat them [2]
- (vi) Pyramid  
Numbers 1 – polar bear  
4 – fish  
6 – sand eels  
8 – zooplankton  
12 – phytoplankton
- [1] symmetrical and pyramid shape  
[1] mark numbers correct  
[1] mark phytoplankton at base  
[1] mark polar bear top/or seals if CM from (iii)  
[1] mark all other labels correct [5]
- (vii) If problem with one food source – still have other/If one dies out/  
more to eat [1]
- (b) (i) Decomposers use up oxygen/microbes use up oxygen [1]
- (ii) Slurry/sewage/silage/manure/detergent/farm waste/urine [1]
- (iii) Less O<sub>2</sub> present; [1]

- 3 (a) (i) Sperm – head with nucleus;  
tail;  
2 for diagram  
1 mark for 2 correct labels  
(Must have nucleus for 3 marks) [3]
- (ii) 23 chromosomes/tail/swimming/streamlined/pointed head [1]
- (iii) Testes (**Not** scrotum) [1]
- (b) (i) Divided into two/mitosis/divided/duplicated/replicated [1]
- (ii) Divided into four and each with a nucleus;  
attached; [2]
- (iii) Different/tissues/organs form/implantation/embeds/  
development of placenta/umbilical cord/amnion/  
named tissue or organ forms/moved to uterus [1]
- (c) (i) In oviduct [1]
- (ii) In lining of uterus & must be above the indent [1]
- (iii) • Diffusion/gas exchange/O<sub>2</sub> from mother/CO<sub>2</sub> from foetus;  
antibodies from mother;  
nutrients from mother;  
urea from foetus; (Any two) [2]  
• large surface area/or described/good blood supply [1]
- (iv) Amnion/amniotic fluid [1]
- (d) Dilation of cervix; waters break; mucus plug comes away;  
muscle contractions/umbilical cord cut/afterbirth/baby born usually  
head first; [3]
- QWC [2]
- (e) (i) Bacteria [1]
- (ii) Spread to someone else **before you know you have it** [1]
- (iii) Antibiotics/or named [1]
- (iv) Abstinence/use condoms [1]

			AVAILABLE MARKS										
4	(a) (i) Punnett; both parents Rr; Correct cross;		<table border="1" style="border-collapse: collapse; margin: auto;"> <tr> <td style="padding: 2px 5px;"></td> <td style="padding: 2px 5px;">R</td> <td style="padding: 2px 5px;">r</td> </tr> <tr> <td style="padding: 2px 5px;">R</td> <td style="padding: 2px 5px;">RR</td> <td style="padding: 2px 5px;">Rr</td> </tr> <tr> <td style="padding: 2px 5px;">r</td> <td style="padding: 2px 5px;">Rr</td> <td style="padding: 2px 5px;">rr</td> </tr> </table>		R	r	R	RR	Rr	r	Rr	rr	[3]
		R	r										
	R	RR	Rr										
	r	Rr	rr										
	(ii) wrinkled and smooth 3 : 1 must have correct phenotype to get this mark			[1]									
	(b) (i) Nucleus			[1]									
	(ii) Genes/alleles			[1]									
	(iii) DNA			[1]									
	(c) Mother XX; Gametes $\textcircled{X}$ $\textcircled{Y}$ ; XX and XY corresponding;			[3]									
	(d) (i) 18 : 6; 3 times			[2]									
<b>Total</b>			<b>13</b>										
			<b>80</b>										





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**Science: Double Award (Modular)**

Paper 2  
Foundation Tier

**[G8202]**

**WEDNESDAY 26 MAY, MORNING**

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**MARK  
SCHEME**

1 (a)

man-made materials	natural materials
nylon	wood
plastic	silk
glass	cotton
aluminium	

6 correct [3]; 4 or 5 correct [2]; 2 or 3 correct [1] [3]

(b) (i) strength [1]

(ii) transparent [1]

(iii) high melting point [1] [3]

(c) (i) idea of seeing brown colour move to upper gas jar/  
idea of mixing [1]

(ii) idea of becoming **evenly** spread/brown throughout/  
even colour throughout [1] [2]

(iii) diffusion [1] [1]

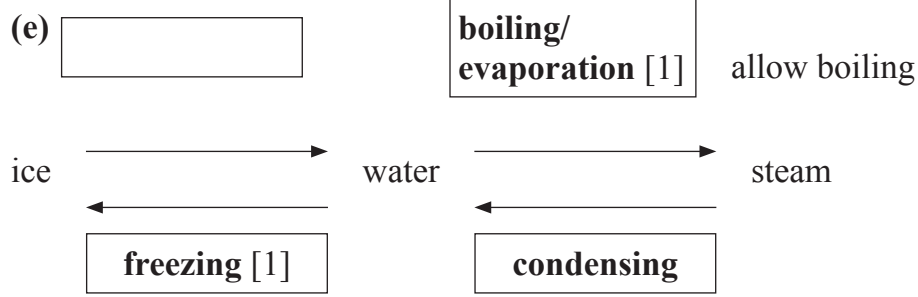
(iv) it would take less time [1] [1]

(d) (i) S [1] [1]

(ii) calcium hydroxide [1] [1]

(iii)  $MgCO_3$  [1] [1]

(iv) lithium sulphate [1] [1]



[3]

(f) (i) an element is a pure substance containing one type of atom [1]

(ii) liquid gas solid 3 correct = [2]; 1 correct = [1] [2]

AVAILABLE  
MARKS

20

2 (a) (i) lead [1]

(ii) ductile [1]

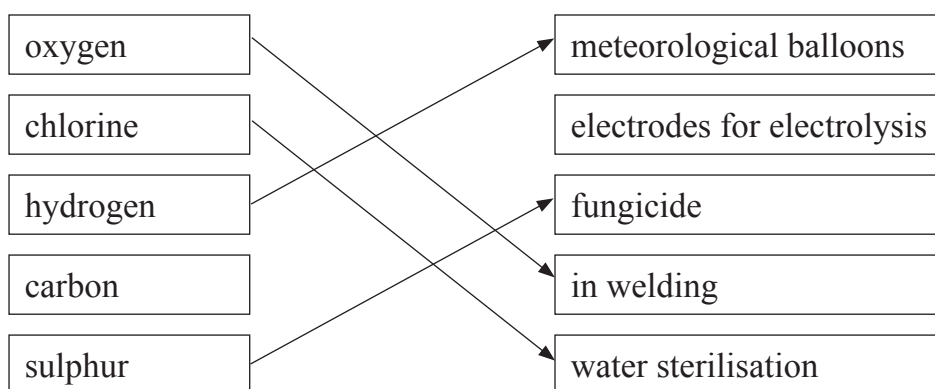
(iii) (1) idea that it will melt/fall-off [1]

(2) idea that **metal conducts** [1] **heat** [1]/allow travels along the rod as equivalent to conduct [1]

QWC [1] [6]

(b) **Element**

**Use**



4 correct [3]; 2 or 3 correct [2]; 1 correct [1] [3]

(c) (i) Use as fuel **or** in gardening [1]

(ii) provides jobs/helps economy/easily extracted/ idea of using an available resource/**cheap** fuel [1] idea of 'saving' use of other fuels

(iii) any **two** of:

noise pollution destroys habitats unsightly

idea of flooding dust pollution

uses up natural resources/idea of limited supply

**not** just pollution – must be qualified (2 × [1]) [4]

(d) (i) idea of taking in heat/energy [1]

**not** just idea of using heat/energy

(ii) exothermic A and C (both needed) [1]

endothermic B [1]

(iii) exothermic [1] [4]

- (e) any **three** of:  
 stir/shake use smaller pieces of iron/use iron powder  
 add a catalyst warm the mixture  
 use more **concentrated** acid ( $3 \times [1]$ ) [3]  
**not** add more (dilute) acid

- 3 (a) Lighted splint [1] **not** glowing splint  
 Turns milky [1]  
 Oxygen [1]  
 Turns blue [1] [4]

- (b) (i) idea of containing 2 **atoms** [1] [1]

- (ii) idea of **two** (or more) atoms [1] idea of chemically combined/  
 joined/bonded [1] [2]

(iii)

isotope	number of electrons	number of neutrons	number of protons
$^{37}\text{Cl}$	17	20	17
$^{35}\text{Cl}$	<b>17</b> [1]	<b>18</b> [1]	<b>17</b> [1]

[3]

- (iv) Colour at start–colourless [1] **not** “clear”  
 Colour at end yellow/orange/brown/red-brown  
 or combinations but **not** red [1] [2]

- (c) (i) sulphur dioxide [1] [1]

- (ii) any **two** of:  
 Kills fish/(allow damages) corrodes stonework or buildings  
 (**not** erodes)/destroys or damages or kills vegetation/leaches  
 nutrients from the soil, **not** destroys habitats, **not** pollutes,  
**not** makes lakes acidic  
 Or other correct ( $2 \times [1]$ ) [2]

- (iii) idea of scrubbers/desulphonation filters or low sulphur fuels  
**not** use alternative fuels [1]  
**not** catalytic converters, **not** burn less fossil fuel [1]



- (d) (i) yellow [1] solid/powder or similar [1]  
i.e. colour [1] physical state [1] [2]
- (ii) any **two** of:  
Idea of mixture glowing/continuing to glow when removed from heat/grey or black solid formed or other correct ( $2 \times [1]$ ) [2]  
allow idea of pungent smell **not** exothermic  
allow idea that yellow colour disappears
- 4 (a) (i) Group 2 [1] [1]
- (ii) any **two** of:  
Bright (white) light/white or grey ash or powder or solid formed/  
(very) vigorous reaction/allow smoke unless wrongly qualified  
exothermic reaction ( $2 \times [1]$ ) [2]  
allow idea that magnesium ribbon disappears
- (iii) magnesium oxide [1] [1]
- (b) (i) any **three** of:  
Calcium sinks **or** sinks and rises  
idea of reaction getting faster **not** reaction is faster  
Bubbles/gas evolved/fizzing  
Idea of solution going cloudy  
Calcium gets smaller/dissolves/disappears  
allow moves in water **not** just moves  
Idea that solution formed is alkaline  
Idea of reaction vessel getting warm/exothermic ( $3 \times [1]$ ) [3]  
**Ignore** reference to hissing or noise  
mark idea of moving across the surface of the water as wrong
- (ii) Wear goggles/use a screen/use a fume cupboard/only small amount of Ca [1] [1]
- (iii) calcium + water  $\rightarrow$  calcium hydroxide [1] + hydrogen [1] [2]  
apply CM for formula equation from 4(a)(iii)
- (c) (i) Hydrogen [1] [1]
- (ii) Magnesium oxide [1] [1]  
allow hydrogen through CM if magnesium oxide given in (i)





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**Science: Double Award (Modular)**

Paper 3  
Foundation Tier

**[G8203]**

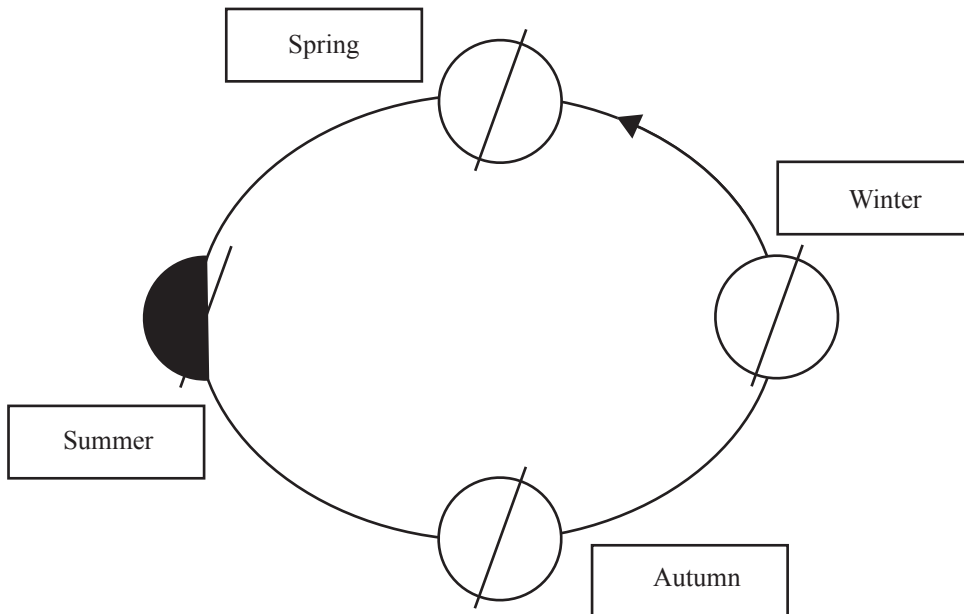
**FRIDAY 28 MAY, MORNING**

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**MARK  
SCHEME**

- 1 (a) (i) Heat/Thermal [1]  
 (ii) Kinetic/Movement/Moving [1]  
 (iii) Sound [1]  
 (b) (i) Correct clockwise arrows [1] each [2]  
 (ii) even distribution of heat (or equivalent) [1]  
 (c) (i) Less friction/gets faster [1]  
 (ii) Higher/rises [1]  
 (iii) Less stable [1]  
 (iv) make heavier/wider [1]

(d)



- (i)  $\frac{1}{2}$  mark per correct answer (round up) [2]  
 (ii) 6 months [1]  
 (iii) 24 hours [1]  
 (iv) As above [1]

AVAILABLE  
MARKS

- (e) (i) Gravity/Gravitation [1]
- (ii) The temperature increased/It got hotter/It spins/Density increases [1]
- (iii) (Nuclear) fusion [1]
- (iv) Any named em radiation/heat [1]
- (v) Venus [1]

AVAILABLE  
MARKS

20

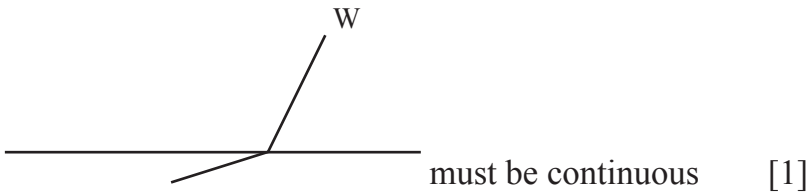
- 2 (a) (i) **Electrons** moved [1] from cloth [1]/to the rod [1]  
 Rod gains electrons [2]  
 QWC [1] [3]
- (ii) Like charges repel [1]
- (iii) Attract (the paint) [1] [5]
- (b) (i) Four correct points  $\pm 0.5$  square [1]
- (ii) Best fit line [1]
- (iii) Voltage = 1.0(V) **ecf** from (ii) [1]
- (iv) 0.002(A) [1]
- (v)  $R = \frac{V}{I}$  or  $V = IR$  or equivalent [1]  
 $R = \frac{1}{0.002}$  e.c.f. from (iii) and (iv) [1]  
 $= 500(\Omega)$  [1] [7]
- (c) A : 12(V)  
 B : 12(V) [2]
- (d) 0.3A  
 0.7A [2]
- (e) 

20
10
0
0

 [4]

20

3 (a) (i)



(ii) Wavelength = 1.5 (cm) [1]

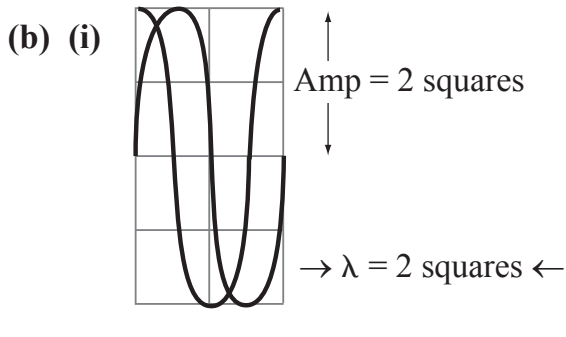
(iii) Frequency = 6 [1] (Hz) [1]

(iv) Speed = Frequency × wavelength (or use symbols) [1]

$$= 6 \text{ \{e.c.f. from (iii)\}} \times 1.5 \text{ \{e.c.f. from (ii)\}} [1]$$

$$= 9.0 \text{ (cm/s)} [1]$$

(v) Smaller/Shorter/decreases/less [1] [7]



(ii) Light, any other named em radiation [2] [4]

(c) (i)



In the box [1]

(ii) Sound, ultrasound, s-waves [1]

(iii) Energy [1] [3]

(d) (i) 20 (Hz) [1]

(ii) lower/decreases/less [1]

(iii)  $\text{Speed} = \frac{\text{distance}}{\text{time}}$  or  $\text{distance} = \text{speed} \times \text{time}$  [1]

$$\text{(Total) distance} = 1500 \times 0.8 \text{ or distance} = 15 \times 0.4 [2] [1]$$

$$= 1200 \text{ m} [1]$$

$$\text{Distance} = 600 \text{ m} = 600 [1] [6]$$

			AVAILABLE MARKS	
4	(a) (i)	Four correct arrows (rays) within 1mm	[4]	
	(ii)	Correct label	[1]	[5]
	(b) (i)	Normal	[1]	
		Incident ray (correct direction)	[1]	
		Reflected ray (into eye)	[1]	
		$i = r$	[1]	
	(ii)	Less	[1]	[5]
	(c) (i)	Splitting of light into different colours/wavelengths	} Independent Marking	[1]
				[1]
	(ii)	At point of incidence labelled P	[1]	
	(iii)	Label Q inside prism	[1]	
	(iv)	Away from normal	[1]	[5]
	(d) (i)	X-rays	[1]	
	(ii)	Two from: same velocity/(speed) travel in vacuum transverse can be polarised	[2]	
	(iii)	Two from: infra-red microwaves visible/light	[2]	[5]
			<b>Total</b>	<b>20</b>
				<b>80</b>





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**General Certificate of Secondary Education**

**2010**

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**Science: Double Award (Modular)**

Paper 1

Higher Tier

[G8204]

**FRIDAY 21 MAY, MORNING**

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**MARK  
SCHEME**

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- 1 (a) (i) Place in dark cupboard for **1 day or more** [1]
- (ii) Alcohol/ethanol/meths [1]
- (iii) Yellow/brown/yellow-orange; (**not** red/no colour change)  
Blue/black/black; (**not** blue (on own)/brown-black) [2]
- (b) (i) Down – arrow [1]
- (ii) Phloem [1]
- (iii) Energy/active transport/respiration/germination (**not** food glycogen);  
fruit formation/seed formation/stored on fats;  
growth/new leaves/new flowers/protein/reproduction – gametes;  
(**not** repair on own/nutrient storage)  
cellulose; (**not** cell walls on own)  
chlorophyll;  
nectar; (**not** attract insects)  
stored as starch/starch on own/tubers; (**not** storage/stores glycogen)  
(Any three) [3]
- 2 (a) (i) Emulsify fats/  
Neutralise acids; (**not** breakdown fat droplets/food) [1]
- (ii) Lipase [1]
- (b) (i) Diffusion/absorption [1]
- (ii) Hepatic portal vein (**not** hpv/hepatic portal) [1]
- (iii) To make protein/enzymes;  
growth/repair; [2]
- (c) (i) Water ✓  
Urea X (**not** left blank)  
Glucose ✓  
Red blood cells X (**not** left blank) [4]
- (ii) Urea/**more** salt/**more** water/more urea/  
equal amount of salt as in blood  
(**not** red blood cells/glucose/water/salt) [1]
- (iii) Maintain concentration gradient/described/  
prevent urea going back into blood [1]

9

- (d) (i) Insulin produced in the pancreas;  
 Stored as **glycogen**/stores **glycogen**;  
 stored as **fat**; (**not** stores on own)  
 (insulin causes) more uptake;  
 (liver) more respiration;  
 insulin reduces the blood glucose level;  
 (**not** returns blood sugar level to normal)  
 (Any **three**) [3]
- QWC [2]
- (ii) Diabetes [1]
- 3 (a) (i) Sun/sunlight/light/light energy; [1]
- (ii) Zooplankton; [1]  
 sand eel; [1]
- (iii) Phytoplankton → zooplankton → sand eels → fish → polar bears
- [1] mark phytoplankton at start & polar bears at end  
 [1] mark arrow  
 [1] mark organisms in between in correct order  
 (zooplankton – sand eels – fish) [3]
- (iv) Produce sugars/food/photosynthesis/starch; (**not** produce energy)  
 Using sunlight; [2]
- (v) Less phytoplankton; due to less light/temp;  
 (**not** harsh conditions – **not** more sand eels eat them) [2]
- (vi) Pyramid  
 Numbers 1 – polar bear  
 4 – fish  
 6 – sand eels  
 8 – zooplankton  
 12 – phytoplankton
- [1] symmetrical **and** pyramid shape  
 [1] mark numbers correct  
 [1] mark phytoplankton at base  
 [1] mark polar bear top/or seals if CM from (iii)  
 [1] mark all other labels correct [5]
- (vii) If problem with one food source – still have other/more to eat  
 1 may die out [1]

18

			AVAILABLE MARKS	
	(b) (i)	$\frac{500}{4000} \times 100 = 12.5\%$ ; or 2 marks for 12.5%	[2]	
	(ii)	Not all the animal is eaten; Movement/hunting; excretion/defaecation/urine/faeces/waste; (Any <b>two</b> ) reproduction; respiration/heat	[2]	
	(c) (i)	$\frac{112 \times 140}{16} = 980$ ;	[2]	
	(ii)	Disease; pollution/acid rain/eutrophication/thermal pollution; overfishing; ( <b>not</b> fishing) predators; lack of food/decrease number of prey; (Any <b>two</b> )	[2]	
	(iii)	Larger area/not enclosed/fish can move	[1]	
	(iv)	adjust or apply quotas/legislation/to prevent extinction/ to determine pollution levels/to prevent overfishing;	[1]	26
4	(a) (i)	Plants die; Microbes decay plants; Use up oxygen; Less oxygen for the fish; Fish die; Must be in the correct sequence but can have more than 1 in 1 box.	[4]	
	(ii)	silage/slurry/sewage/detergent/farm waste/urine/manure ( <b>not</b> waste)	[1]	
	(iii)	Less O <sub>2</sub> present	[1]	
	(b) (i)	Fungi ( <b>not</b> earthworms)	[1]	
	(ii)	Denitrifying – A; Nitrogen fixing – B; Nitrifying bacteria – C;	[3]	
	(iii)	Denitrifying/A	[1]	
	(iv)	<b>More</b> nitrates ( <b>not</b> nitrogen/protein/fertiliser)	[1]	12

- 5 (a) (i) 4 cells; (**not** ball of cells)  
Each cell 1 large + 1 small chromosome;  
At least two different combinations;  
If 2 cells – haploid with diff. combinations = 1 mark [3]
- (ii) Meiosis [1]
- (iii) Haploid (**not** n) [1]
- (b) (i) Divided into two/mitosis/divided/duplicated/replicated [1]
- (ii) Divided into four cells and each with a nucleus;  
attached; [2]
- (iii) Different tissues/organs formed/implantation/embeds/  
development of placenta/umbilical cord/amnion/  
named tissue or organ forms/moved to uterus [1]
- (c) (i) In oviducts [1]
- (ii) In lining of uterus and must be above the indent [1]
- (iii) • Diffusion/gas exchange/O<sub>2</sub> from mother/CO<sub>2</sub> from foetus;  
antibodies from mother;  
nutrients from mother;  
urea from foetus; (**Any two**) [2]  
• large surface area/or described/good blood supply [1]
- (iv) Amnion/amniotic fluid [1]
- (v) Rubella/German measles [1]
- (d) (i) Bacteria [1]
- (ii) Spread to someone else **before know you have it** [1]
- (iii) Antibiotics/named [1]
- (iv) AIDS/Syphilis/Chlamydia/Herpes/Genital warts/HIV  
(**not** Gonorrhoea) [1]

6 (a) (i) 

	R	r
R	RR	Rr
r	Rr	rr

 Punnett; 


 both parents correct; correct cross; [3]

(ii) wrinkled and smooth  
3 : 1  
(Must have phenotype to get 2 marks) [2]

(b) (i) 

	R	R
r	Rr	Rr
r	Rr	Rr

	R	r
r	Rr	rr
r	Rr	rr

 [3]

Only two Punnetts;  
each with rr;  
one RR and one Rr;

(ii) Parents must have been heterozygous/carry the recessive gene/Rr [1]

(c) (i) drought resistant/frost resistant/wind/resistant;  
Disease free/disease resistant;  
long shelf life/long lasting flowers or fruit;  
colour/scent/attractiveness/taste/variegated/good shape;  
quick growing/large yield/lots of flowers/lots of fruit/big leaves/  
tall plants/dwarf plant;  
(not size/height/strength) [2]

(ii) Characteristics selected by man  
(not produced by man) [1]

(iii) Large numbers/faster/all same/get plants out of season  
(not cheaper/easily done/economically viable unqualified) [1]

(iv) Mg – Chlorophyll/chloroplasts;  
Ca – Cell walls/cellulose cell walls (not cellulose on own); [2]

(v) Sterilise/to kill bacteria/remove bacteria  
(not remove germs/impurities/clean them) [1]

(vi) Light (sun); temp (heat); pH; nutrient concentrates/nutrient cocktail;  
fertiliser; CO<sub>2</sub>; O<sub>2</sub>; humidity (water/moisture); (Any two) [2]

		AVAILABLE MARKS
(e) (i) T	[1]	
(ii) Mutation	[1]	
(iii) Protein ( <b>not</b> amino acids or protein <b>and</b> amino acids)	[1]	
(iv) Different protein made/A different amino acid in sequence/ causes a genetic disorder/different molecule/changes shape;	[1]	
(v) Model/3D Model ( <b>not</b> x-rays/using microscopes)	[1]	
(vi) Double; Helix;	[2]	25
<b>Total</b>		<b>110</b>







*Rewarding Learning*

**General Certificate of Secondary Education**

**2010**

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**Science: Double Award (Modular)**

Paper 2  
Higher Tier

**[G8205]**

**WEDNESDAY 26 MAY, MORNING**

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**MARK  
SCHEME**

- 1 (a) (i) halogens **not** halides [1]
- (ii) chlorine [1]
- (iii) hydrogen, lithium, sodium, potassium, Rb, Cs, Fr, Ag, Cu  
or other correct [1]
- (iv) carbon [1]
- (b) (i) correct 2,8,8,2 representation for calcium [1]  
correct 2,8,7 representation for chlorine [1]  
Apply CM if not drawn, but correct 2,8,8,2 and 2,8,7 GIVEN [2]  
i.e. AWARD [1] NOT [2]
- (ii) loss of 2 electrons by calcium [1]  
gain of 1 electron by chlorine [1]  
idea that 2 chlorine atoms are needed (for each calcium) [1]  
reference to loss or gain of atoms/sharing electrons negates first  
2 marks [3]
- QWC [1]
- (c) (i) More vigorously [1]  
Idea that reactivity increases down the Group or other correct [1]  
e.g. Higher reactivity series OR idea of (outer) electrons further  
away from nucleus [2]
- (ii) (1) strontium hydroxide [1]
- (2) hydrogen [1] [2]
- (iii) SrO [1] [1]
- 2 (a) (i) Diagram should show:–  
Positive ions but no negative ions [1] (PI)  
Regular arrangement of positive ions only [1] (RA)  
Sea/cloud of delocalised electrons [1] (DE)  
Further mark for labelled diagram–i.e. 2 or 3 of the points above  
labelled [1] (L) [4]
- (ii) Idea of atoms/metal ions in **layers** [1]  
Which can **slide** over one another [1] [2]  
Mark each point separately

- (b) Idea that bonds in hydrogen and oxygen are broken (i.e. named reactants) [1]  
 Idea that bond breaking requires energy/is endothermic [1]  
 Idea that bonds in water are made (i.e. named product) [1]  
 Idea that bond making gives out energy/is exothermic [1]  
 Maximum [3]  
 Clear idea that reaction is exothermic because **more energy is given out than is taken in** not just that it is exothermic because energy is given out [1]  
 e.g. The energy given out on making bonds in water is more than the energy needed to break the bonds in hydrogen and oxygen [4] [4]
- (c) (i) 40 [1] [1]  
 (ii) 148 [1] [1]  
 (iii) 0.125 (moles) apply CM [1] [1]  
 (iv) 18.5 g [2] one method mark available for incorrect answer but with one correct step e.g. no of moles  $\text{Mg}(\text{NO}_3)_2 = \text{no of moles MgO}$  or work which shows ans (iii) X ans (ii) apply CM [2]

15

3 (a)

Atom	Number of protons	Number of electrons	Number of neutrons	Atomic number	Mass number
magnesium	12	12 [1]	12	12	24 [1]
potassium	19 [1]	19	20 [1]	19	39
boron	5	5 [1]	6	5 [1]	11

[6]

- (b) (i) idea of containing 2 atoms [1] [1]

(ii)

Isotope	Number of electrons	Number of neutrons	Number of protons
$^{37}\text{Cl}$	17	20	17
$^{35}\text{Cl}$	17 [1]	18 [1]	17 [1]

[3]

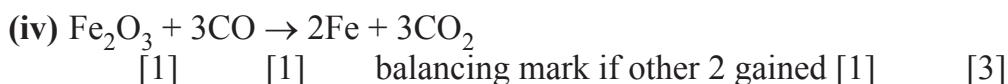
- (iii) Colour at start – colourless [1] **not** “clear”  
 Colour at end yellow/yellow-orange/orange [1]  
 Allow yellow/orange/brown/red-brown or combinations but **not** red [2]

- (c) (i) sulphur dioxide [1]
- (ii) any **two** of:  
Kills fish/allow damages, corrodes stonework or buildings (**not** erodes)/destroys or damages or kills vegetation/leaches nutrients from the soil **not** destroys habitats, **not** pollutes, **not** makes lakes acidic.  
Or other correct ( $2 \times [1]$ ) [2]
- (iii) idea of scrubbers/desulphonation filters or low sulphur fuels **not** use alternative fuels [1] **not** catalytic converters, **not** burn less fossil fuel [1]
- (d) (i) yellow [1] solid/powder or similar [1] i.e. colour [1]  
physical state [1] [2]
- (ii) any **two** of:  
Idea of mixture glowing/continuing to glow when removed from heat/grey or black solid formed or other correct ( $2 \times [1]$ )  
allow idea of pungent smell  
allow idea that yellow colour disappears  
**not** exothermic [2]
- 4 (a) (i) Group 2 [1] [1]
- (ii) any **two** of:  
Bright (white) light/white or grey ash or powder or solid formed/  
(very) vigorous reaction/allow smoke unless wrongly qualified  
exothermic reaction ( $2 \times [1]$ ) allow idea that magnesium ribbon disappears [2]
- (iii) magnesium oxide [1] [1]
- (b) (i) any **three** of:  
Idea of reaction getting faster **not** reaction is fast  
Allow moves **in** water **not** just moves  
Calcium sinks **or** sinks and rises  
Bubbles/gas evolved/fizzing  
Idea of solution going cloudy  
Calcium gets smaller/dissolves/disappears  
Idea that solution formed is alkaline  
Idea of reaction vessel getting warm/exothermic ( $3 \times [1]$ ) [3]  
**ignore** reference to hissing or noise  
mark idea of moving across the surface of the water as wrong
- (ii) Wear goggles/use a screen/use a fume cupboard/only small amount of Ca [1] [1]
- (iii) calcium + water  $\rightarrow$  calcium hydroxide [1] + hydrogen [1]  
apply CM for equation from 4(a)(iii) formula [2]

20

- (c) (i) Hydrogen [1] [1]
- (ii) Magnesium oxide [1] allow hydrogen through CM if magnesium oxide given in (i) [1]
- (d) (i) Any **two** of:  
Copper carbonate dissolving/disappearing/getting smaller  
Blue solution formed  
Bubbles/gas evolved/fizzing  
Exothermic reaction  
Idea of vigorous/fast reaction  
(2 × [1]) [2]
- (ii) Idea that it does **not** react i.e. that copper is **not** reactive [1] [1]
- (e) (i) blue [1] to colourless [1] **not** clear [2]
- (ii)  $\text{Mg} + \text{CuSO}_4 \rightarrow \text{MgSO}_4 + \text{Cu}$   
[1] [1] [2]
- (iii) displacement [1] allow redox [1]
- 5 (a) (i) Time (mins) [1] units needed [1]
- (ii) 7–8 points correct [2], 5–6 points correct [1] appropriate hand-drawn curve [1]  
Do not award curve mark for points joined by a ruler [3]
- (iii) 5 mins 30 sec – 6 mins [1] [1]
- (iv) 1.25–1.4 minutes i.e. 1 min 15 sec–1 min 24 sec [1]
- (v) Clear idea that increasing size of marble chips decreases the surface area [1]  
there are fewer collisions [1]  
the reaction slows down/takes longer [1] [3]
- (vi) no effect on mass of  $\text{CO}_2$  [1] [1]
- (b) (i)
- | Substance | Common name          | Chemical name     |
|-----------|----------------------|-------------------|
| A         | <b>Coke</b> [1]      | carbon            |
| B         | <b>Limestone</b> [1] | calcium carbonate |
- [2]
- (ii) (hot) air [1] **not** oxygen [1]

20



- (v) Idea of slag heaps or other correct [1] [1]  
 e.g. idea of effect on landscape  
 noise pollution  
 dust pollution  
 air pollution e.g. waste gases pollute/greenhouse effect/acid  
 rain

20

- 6 (a) (i) A compound made up of carbon and hydrogen atoms [1] only [1]  
 the “only” should be implied i.e. made up of carbon and hydrogen  
 atoms can gain both marks unless wrongly qualified  
 If answer just ‘carbon and hydrogen only’ award [1] [2]

- (ii) idea that each carbon has four single bonds only/no C=C double  
 bond [1] accept idea of no addition reactions [1]

- (iii) breaking down of long chain (less useful) hydrocarbons into short  
 chain (more useful) hydrocarbons [1] using heat/with the formation  
 of an alkene [1] [2]

- (iv) alkenes [1] [1]

(b)

	<b>Molecular formula</b>	<b>Structural formula</b>	<b>State at room temperature</b>
ethane	$\text{C}_2\text{H}_6$	Structural formula	Gas
ethene	$\text{C}_2\text{H}_4$	Structural formula	Gas

6 correct = [4]; 5 correct = [3]; 3–4 correct = [2]; 2 correct = 1 [4]

(c)

Test	Bromine <b>Water</b> [1] or bromine solution <b>not</b> bromine
Ethane	Solution remains yellow/orange/brown/red- brown or combinations OR no change/no reaction [1]
Ethene	Yellow/orange/brown/red-brown or combinations [1] turns colourless [1]

allow the ‘colour’ mark for either the ethane or ethene  
 do **not** allow red [4]

(d) (i) steam [1] **not** water, **not** H<sub>2</sub>O, accept H<sub>2</sub>O(g) [1]

(ii) carbon dioxide [1]; water [1] [2]

(e) (i) polypropene [1] [1]

(ii)  $\begin{array}{c} | \quad | \\ \text{---}(\text{C}-\text{C})_n\text{---} \\ | \quad | \end{array}$  single C–C [1] rest of diagram [1]  
one mark for showing single C–C bond second  
mark for rest of diagram correct [2]

**Total**

AVAILABLE  
MARKS

20

**110**







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**2010**

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**Science: Double Award (Modular)**

Paper 3  
Higher Tier

**[G8206]**

**FRIDAY 28 MAY, MORNING**

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**MARK  
SCHEME**

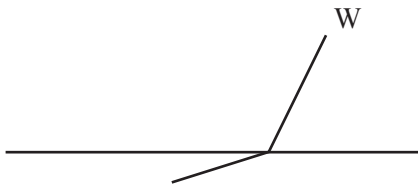
			AVAILABLE MARKS	
<b>1</b>	<b>(a) (i)</b>	Sun	[1]	15
	<b>(ii)</b>	Mercury	[1]	
	<b>(iii)</b>	Neptune	[1]	
	<b>(b)</b>	Earth or Planet Earth	[1]	
	<b>(c)</b>	(Collection of) stars	[1]	
	<b>(d)</b>	Milky Way	[1]	
	<b>(e)</b>	Problem with time <b>or</b> fuel <b>or</b> logistics <b>or</b> distance	[1]	
		QWC	[1]	
	<b>(f) (i)</b>	Hydrogen    Reject: Nebula	[1]	
	<b>(ii)</b>	Gravity/gravitational	[1]	
	<b>(iii)</b>	Temperature rises/gets hotter/density increases/ begin to spin/rotate	[1]	
	<b>(iv)</b>	(Nuclear) fusion	[1]	
	<b>(v)</b>	Any named em radiations/heat	[1]    [5]	
	<b>(g)</b>	Steady State Theory and Big Bang Theory	[2]	

- 2 (a) (i) CWM = ACWM  $F_1 \times d_1 = F_2 \times d_2$  } [1]  
or CM = ACM } [2]
- $F \times 3$  [1] (=)  $900 \times 2$  [1] [2]
- $F = 600$  (N) [1]
- (ii) Clockwise [1] [5]
- (b) (i) Anticlockwise current with arrow  $\downarrow \uparrow$  [2]
- (ii) Shiny surface is a bad radiator [1]/bad [1] emitter [1] [2] [4]
- (c) (i) Greater k.e./velocity/amplitude/vibrate more/faster [1]
- (ii) Molecules jostle/molecules collide/or conduction [1]
- (d) (i) Kinetic (energy) or movement or moving [1]
- (ii) Any combination of  
 $PE = m g h = 3 \times 10 \times 0.2 = 6$  [1]
- Any combination of  
 $KE = \frac{1}{2} m v^2 = \frac{1}{2} \times 3 \times v^2$  [1]
- Applying Principle of Conservation of Energy  
 $KE = PE$  or  $6 = \frac{1}{2} \times 3 \times v^2$  [1]
- $v = 2$  [1]

AVAILABLE  
MARKS

16

3 (a) (i)



must be **continuous** [1]

(ii) Wavelength = 1.5 (cm) [1]

(iii) Frequency = 6 [1] (Hz) [1]

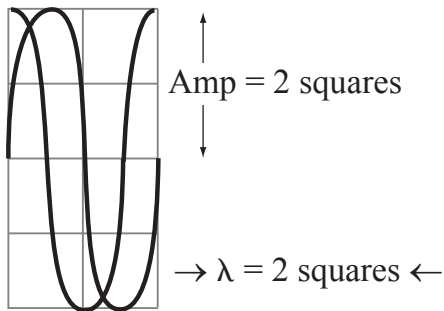
(iv) Speed = Frequency × wavelength (or use symbols) [1]

= 6 {e.c.f. from (iii)} × 1.5 {e.c.f. from (ii)} [1]

= 9 cm/s [1]

(v) Smaller [1] [7]

(b) (i)



Amplitude [1]

Wavelength [1]

[2]

(ii) Light, any other named em radiation, radar [2] [4]

(c) (i)



In the box [1]

(ii) Sound or ultrasound **or** P-waves [1]

(iii) Energy [1] [3]

(d) (i) 20 (Hz) [1]

(ii) lower/decreases/less Reject: weakens [1]

(iii) Speed =  $\frac{\text{distance}}{\text{time}}$  or distance = speed × time [1]

(Total) distance = 1500 × 0.8 or = 1500 × 0.4 [2] [1]

= 1200 m [1]

Distance = 600 (m) = 600 (m) [1] [1] [6]

20

- 4 (a) (i) Four correct arrows (rays) [4]
- (ii) Correct label [1] [5]
- (b) (i) **1st mark** – 2 rays, one straight from shoe to mirror and the other from mirror to eye  
**2nd mark** – only 1 correct arrowhead needed  
**3rd mark** – Point of incidence must be between 4th and 6th hatch mark from ground  
**4th mark** – normal must be mostly on R.H.S. of mirror
- (ii) Less [1] [5]
- (c) (i) Splitting of light [1]  
into different colours/wavelengths [1]
- (ii) At point of incidence labelled P [1]
- (iii) Label Q inside prism [1]
- (iv) Away from normal [1] [5]
- (d) (i) X-rays [1]
- (ii) Two from: same velocity/definition of transverse wave (speed)  
travel in vacuum  
transverse  
can be polarised [2]
- (iii) Two from: infra-red      Reject: Radio, gamma X-rays, UV  
microwaves  
visible/light [2] [5]

AVAILABLE  
MARKS

20

- 5 (a) (i) Electrons moved [1] from cloth [1]  
 cloth loses electrons [2] to the rod [1]  
 Rod gains electrons [2]  
 QWC [1] [3]
- (ii) Like charges repel [1]
- (iii) Attract (the paint) [1] [5]
- (b) Charge = Current  $\times$  time or  $Q = It$  [1]  
 Charge =  $0.2 \times 5 \times 60$  [1]  
 Charge = 60 [1] C [1] [2] [4]
- (c) (i) All 5 correct points,  $\pm \frac{1}{2}$  square [1]
- (ii) A smooth curve through the points – Reject: Not starting  
 at origin/Tramlines/Thick curve/Joining the dots with  
 ruler [1]
- (iii) Current = 50 mA [ $\pm 2$  mA] [1]
- (iv) 0.05 (A) e.c.f. from (iii) [1]
- (v)  $R = \frac{V}{I}$  [1] or  $V = IR$  or equivalent  
 $R = \frac{1.3}{0.05}$  [1] e.c.f. from (iv)  
 = 26 ( $\Omega$ ) [1] [3] [7]
- (d) 30  $\Omega$   
 20  $\Omega$   
 20  $\Omega$   
 10  $\Omega$  [4]

20

<b>6</b>	<b>(a) (i)</b> If switch is closed, other will not turn lamp off.	[1]	
	<b>(ii)</b> Switch completed	[1]	
	Bulb added	[1]	[2]
<b>(b)</b>	<b>(i)</b> Live wire not connected to fuse or Live connected to neutral or Neutral in wrong place or live is in wrong place or Earth wire not connected or fuse is on neutral must be <b>one</b> of 2 choices	[2]	
	<b>(ii)</b> Live and neutral/(brown and blue)	[1]	
<b>(c)</b>	<b>(i)</b> Circuit breaker/ <b>Trip switch</b> /RCB/RCD/RCCB	[1]	
	<b>(ii)</b> Faster response/Safer } dependent marking No need to replace } from <b>(c)(i)</b>	[1] [1]	[6]
<b>(d)</b>	<b>(i)</b> (Electromagnetic) induction/EMI	[1]	
	<b>(ii)</b> Alternating current	[1]	
	<b>(iii)</b> Equal or same	[1]	[3]
<b>(e)</b>	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$ or equivalent	[1]	
	[1] $\frac{N_p}{200} = \frac{240}{6}$ [1] must include “=”	[2]	
	$N_p = 8000$ (turns)	[1]	[4]
<b>(f)</b>	<b>(i)</b> D	[1]	
	<b>(ii)</b> D	[1]	
	<b>(iii)</b> B	[1]	[3]

AVAILABLE  
MARKS

**Total**

19

**110**

