GCSE

Science: Double Award (Non-Modular)

Summer2010

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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Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 1
Foundation Tier

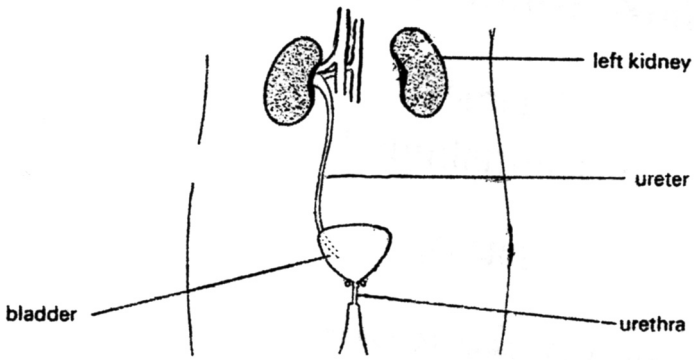
[G8401]

FRIDAY 21 MAY, MORNING

MARK SCHEME

			AVAILABLE MARKS
1	**(a)**	Diaphragm raised/diaphragm relaxed/dome shaped (**not** moves up and out/ up and in) ribs move down and in/ribs move down/in; reference to intercostal muscles (**not** muscles) volume decreases/chest/thorax smaller (**not** lungs decrease) pressure increases; [4] QWC Any 4 [2]	
	(b)	Large surface area/**<u>many</u>** alveoli/moist/short diffusion distance/ permeable/good blood supply/thin walls/thin cell membranes (**not** thin cell walls) [1]	7
2	**(a)**	More cigarettes smoked → more lung cancer [1]	
	(b)	Still get lung cancer – even if don't smoke [1]	
	(c)	mouth/throat cancer/bronchitis/emphysema/CHD/COPD (**not** gum disease/lung disease/fingers stained) [1]	3
3	**(a)**	White/any type of white blood cell [1]	
	(b)	Bacterium drawn with non-matching antigens/any shape that doesn't have triangles [1]	
	(c)	Bacterium engulfed surround; and/digested/broken down; [2]	4
4	**(a)**	**(i)** Retina; [1] (**not** back of eye) **(ii)** iris; [1] (**not** pupil)	
	(b)	Eyebrows/eyelashes/tears/conjunctiva; [1] (**not** eyelids)	3
5	**(a)**	Temperature; time in solution; volume of **solution**; size of potato; type of potato; (not same volume of water/'amount') [2]	
	(b)	They would have got lighter/shorter/floppier/shrink/thinner [1]	
	(c)	Beaker 3 [1]	4

		AVAILABLE MARKS
6	**(a)** Biceps – relax Triceps – contract/shorten/tighten [2]	
	(b) Work together in opposite ways/one contracts the other relaxes [1]	3
7	**(a)** Phototropism/tropism [1]	
	(b) More light/more photosynthesis/growth in direction of sunlight [1]	2
8	**(a)** **(i)** Ureter	
	(ii) Bladder All correctly labelled [2]	

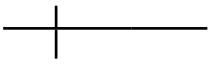


	(b) Correct position, size and shape of the left kidney [1]	3
9	**(a)**	

Type of Drug	**Effect on the body**
Depressant	Drowsiness
Hallucinogen	Makes you more alert
Stimulant	Can cause flash backs or bad trips

[3]

	(b) increased medical costs/work-related problems/vandalism/time off work etc/violence/increase in crime [1]	4

		AVAILABLE MARKS
10	**(a)** Nucleus [1]	
	(b) Genes/alleles [1]	
	(c) DNA [1]	3
11	**(a)** Punnett;  Correct cross; both parents Rr; [3]	
	(b) wrinkled and smooth [1] 3 : 1 [1] must have correct phenotype to get this mark	5
12	Mother XX; Gametes (X) (Y) ; XX and XY corresponding [3]	3
13	**(a)** 18 to 6 3 times [2]	
	(b) Cells from baby/chromosomes/DNA [1]	3
14	**(a)** **(i)** Chlorophyll/chloroplast; [1]	
	(ii) Water; CO_2 (either order); → oxygen (accept symbols) [3]	
	(b) **(i)** Place in 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/no colour change) Leaf 2 – blue-black/black (**not** blue on its own) (**not** brown-black) [2]	

	R	r
R	RR	Rr
r	Rr	rr

				AVAILABLE MARKS
(c)	**(i)**	2 marks for all correct points; (–1 per error) 1 mark – straight lines joining points (allow curve if it join all the points)	[3]	
	(ii)	60/60 **or over**	[1]	
	(iii)	enzyme denatured/described/still a lot of starch left/enzyme doesn't work	[1]	
(d)	**(i)**	Cheese; oily fish;	[2]	
	(ii)	Bones/teeth + – bones and blood growth	[1]	
(e)	**(i)**	Iron/Fe (**not** haemoglobin)	[1]	
	(ii)	Carry Oxygen	[1]	
	(iii)	Double	[1]	
(f)	**(i)**	Pulmonary artery	[1]	
	(ii)	Aorta; pulmonary vein	[2]	24
15	**(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/photosynthesise/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]	

				AVAILABLE MARKS
	(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 another/if one dies out more to eat;	[1]	
(b)	**(i)**	Decomposers use up oxygen/microbes use up oxygen	[1]	
	(ii)	Slurry/sewage/silage/detergent/manure/farm waste/urine	[1]	
	(iii)	Less O_2 in hot water	[1]	19
16 **(a)**	**(i)**	Sperm – head with nucleus; tail; 2 for diagram 1 mark for 2 labels (correct) (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 formed/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 indent	[1]	

			AVAILABLE MARKS
(iii)	• Diffusion/gas exchange/O_2 from mother/CO_2 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 (**not** measles/mumps/HIB/MMR)	[1]	
(d) (i)	Bacteria	[1]	
(ii)	Spread to someone else **before know you have it**	[1]	
(iii)	Antibiotics/or named	[1]	
(iv)	Gonorrhoea/AIDS/chlamydia/syphilis/HIV	[1]	20
	Total		**110**

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 2
Foundation Tier

[G8402]

WEDNESDAY 26 MAY, MORNING

MARK SCHEME

			AVAILABLE MARKS
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] 6

2 **(a)** **(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]

(b) diffusion [1] [1]

(c) it would take less time [1] [1] 4

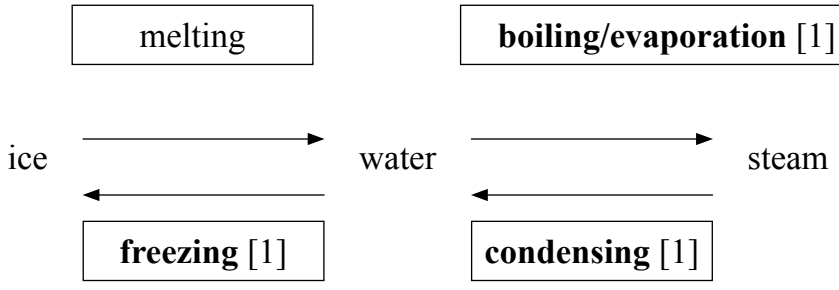
3 **(a)** S [1] [1]

(b) calcium hydroxide [1] [1]

(c) $MgCO_3$ [1] [1]

(d) lithium sulphate [1] [1] 4

4



[3] 3

AVAILABLE MARKS

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

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

6 **(a)** solute [1] [1]

(b) hardness is removed [1] [1]

(c) it contributes to global warming [1] [1]

(d) the Periodic Table [1] [1] 4

7 **(a)** any **two** of:
idea of being unreactive
idea of being malleable/easily moulded
idea of being rigid/strong
idea of not dissolving in water
idea of not melting
not idea of being cheap
not good conductor
not cheap
(2 × [1]) [2]

(b) idea that copper conducts **heat**/heat would escape [1] [1] 3
not insulator

8

reaction	reaction forms			
	a salt	**hydrogen gas**	**water**	**carbon dioxide**
magnesium hydroxide with hydrochloric acid	✓	✗	✓	✗
magnesium with hydrochloric acid	✓	✓	✗	✗
magnesium oxide with hydrochloric acid	✓	✗	✓	✗
magnesium carbonate with hydrochloric acid	✓	✗	✓	✓

For each reaction 4 boxes correct = [2]; 3 boxes correct = [1];
2 or 1 correct = [0] (3 × [2]) [6] 6

AVAILABLE MARKS

9 **(a)** carbon dioxide **or** sulphur dioxide [1] accept correct formula [1]

(b) magnesium oxide or iron (II) oxide [1] [1]

(c) water **or** carbon monoxide [1] [1] 3

10

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] 6

11 Any **three** of:
hard **not** coloured
brittle
soluble in water
high melting point
solid
crystalline
or other correct
(3 × [1]) [3] 3

12 **(a)** idea of needing a lot of power/keeping costs down [1] [1]

(b) idea that it cannot be obtained by any other method/aluminium is very reactive/idea of cheaper electricity [1] [1]

(c) clear idea that they **react** [1]
with oxygen/to produce carbon dioxide [1] [2]

(d) idea of being tapped off/run off [1]
i.e. that it is liquid **not** just hole in bottom of tank [1] 5

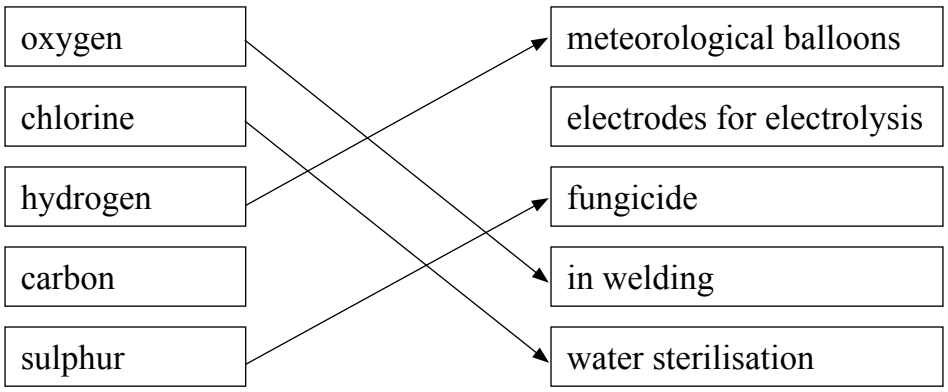
AVAILABLE MARKS

13 (a) (i) lead [1]

(ii) ductile [1]

(iii) 1 idea that it will melt/fall off [1]
metal conducts [1] **heat** [1] allow travelling along the rod for conducting [1] QWC [1] [6]

(b)



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]
allow idea of "saving" other fuels

(iii) any **two** of:
noise pollution destroys habitats unsightly
idea of flooding dust pollution
uses up natural resources/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/use stronger acid (3 × [1]) [3] 20
not add more (dilute) acid

AVAILABLE MARKS

14 **(a)** Lighted splint [1] **not** glowing splint
Turns milky/cloudy [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}Cl	17	20	17
^{35}Cl	**17** [1]	**18** [1]	**17** [1]

[3]

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

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

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

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

(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 × [1]) [2]
do not accept exothermic
allow idea of pungent smell
allow idea that yellow colour disappears

20

		AVAILABLE MARKS
15 (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 × [1]) allow idea that magnesium ribbon disappears [2]	
(iii)	magnesium oxide [1] [1]	
(b) (i)	any **three** of: Calcium sinks **or** sinks and rises idea of reaction getting faster **not** reaction is fast Bubbles/gas evolved/fizzing Idea of solution going cloudy Calcium gets smaller/dissolves/disappears allow moves in the water and **not** just moves Idea that solution formed is alkaline (3 × [1]) Idea of reaction vessel getting warm/exothermic [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 → calcium hydroxide [1] + hydrogen [1] apply CM for formula equations 15a(iii) [2]	
(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/CO_2 given off Exothermic reaction idea of vigorous/fast reaction (2 × [1]) [2]	
(ii)	Idea that it does **not** react Idea that copper does **not** react. i.e. that copper is **not** reactive [1] [1]	
(e) (i)	blue [1] to colourless [1] **not** clear [2]	
(ii)	$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ [1] [1] [2]	
(iii)	displacement/redox [1] [1]	20
	Total	**110**

Rewarding Learning

General Certificate of Secondary Education
2010

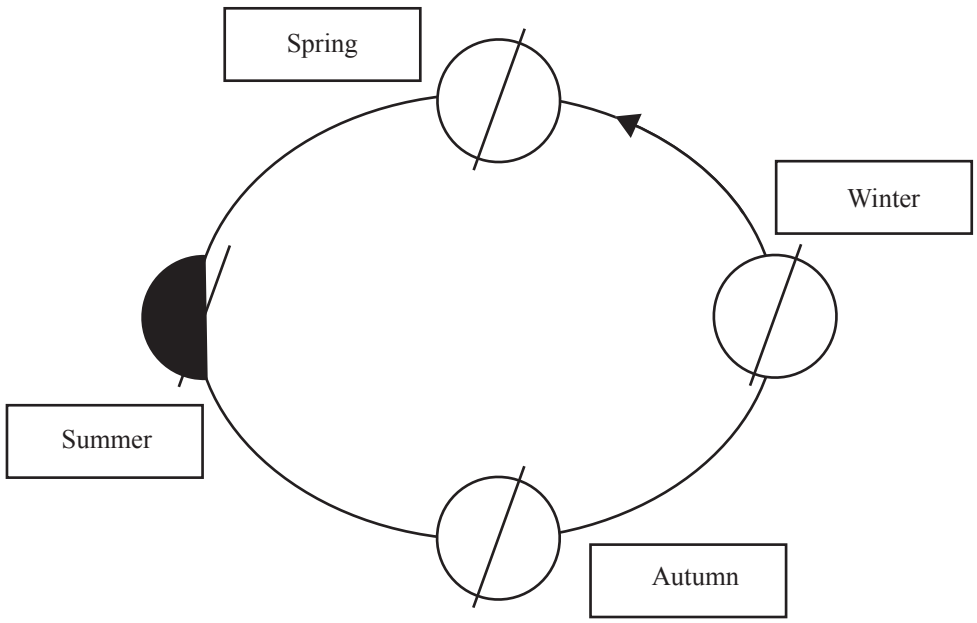
Science: Double Award (Non-Modular)

Paper 3
Foundation Tier

[G8403]

FRIDAY 28 MAY, MORNING

MARK SCHEME

			AVAILABLE MARKS
1	**(i)** Heat or Thermal	[1]	
	(ii) Kinetic/Movement/Moving	[1]	
	(iii) Sound	[1]	3
2	**(a)** Correct clockwise arrows [1] each	[2]	
	(b) even distribution of heat (or equivalent)	[1]	3
3	Speed = grad. or $\frac{\text{dist}}{\text{time}}$	[1]	
	$= \frac{200}{25}$	[1]	
	= 8 (m/s)	[1]	3
4			
	(a) $\frac{1}{2}$ mark per correct answer [round up]	[2]	
	(b) 6 months	[1]	
	(c) 24 hours	[1]	
	(d) As above	[1]	5

				AVAILABLE MARKS
5	**(a)**	Gravity	[1]	
	(b)	The temperature increased/It got hotter/It spins/Density increases	[1]	
	(c)	(Nuclear) fusion	[1]	
	(d)	Any em radiation/heat	[1]	
	(e)	Venus	[1]	5
6	**(a)**	Less friction/gets faster	[1]	
	(b)	Higher/rises	[1]	
	(c)	Less stable	[1]	
	(d)	Make heavier/wider	[1]	4
7	**(a)**	Shiny surfaces reflect the heat [1] better [1] or Black absorbs [1] better [1]	[2]	
	(b)	Matt black would **emit** [1] the heat **better** [1] than a shiny surface/ **Less** [1] heat is **emitted** [1] (by the shiny surface)	[2]	
	(c)	It has trapped air [1] which makes it a (good) insulator. [1]	[2]	6

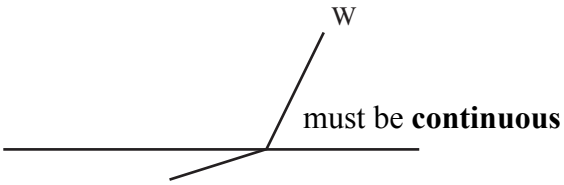
					AVAILABLE MARKS
8	**(i)**	6 (m^2)		[1]	
	(ii)	$P = \frac{\text{Weight}}{\text{Area}} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$ or equivalent f'la		[1]	
		$= \frac{9000}{6}$ **e.c.f. from (i)**		[1]	
		$= 1500$		[1]	
		N/m^2 / Pa Unit mark is free-standing Reject: N/cm^2, N/mm^2		[1]	5
9	**(i)**	Moment = F × d	[1]		
		= 25 × 40	[1]		
		= 1000 (Ncm)	[1]	[3]	
	(ii)	Anticlockwise		[1]	4
10	**(i)**	A – air resistance/friction/drag	[1]		
		B – weight/(force due to) gravity	[1]	[2]	
	(ii)	A and C or engine thrust and air resistance		[1]	
	(iii)	Accelerates/speeds up/gets faster		[1]	4
11	**(a)**	**(i)** They never run out/no pollution/less pollution		[1]	
		(ii) Two from: Wind, wave, tidal, HEP, biomass, geothermal, solar, wood, biofuel, sun		[2]	
	(b)	Not enough sun		[1]	4
12	$\text{Power} = \frac{\text{Energy}}{\text{Time}}$ or $\frac{\text{Work}}{\text{Time}}$ or $\frac{E}{T}$ or $\frac{W}{T}$			[1]	
	$= \frac{15\,000}{30}$			[1]	
	= 500 [1] W [1]			[2]	4

					AVAILABLE MARKS
13	**(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, ± ½ 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 $R = \frac{1}{0.002}$ e.c.f. from **(iii)** and **(iv)** $= 500 (\Omega)$	[1] [1] [1]	[7]
	(c)		A : 12 (V) B : 12 (V)		[2]
	(d)		0·3 A 0·7 A		[2]
	(e)		20 10 0 0		[4]

20

AVAILABLE MARKS

14 (a) (i)



[1]

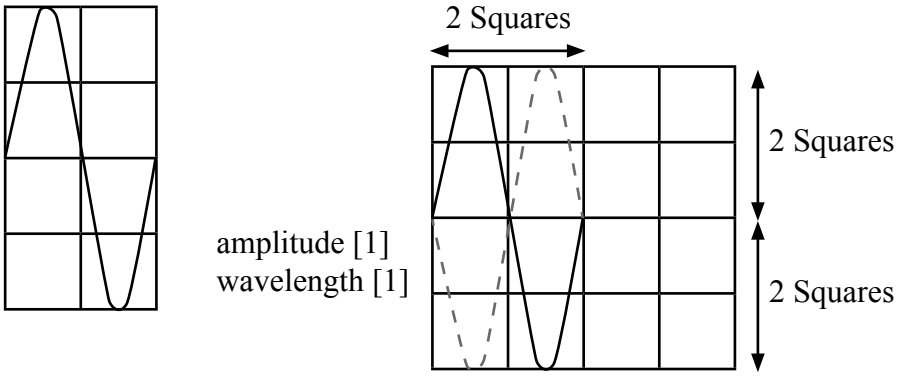
(ii) Wavelength = 1.5 (cm) [1]

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

(iv) Speed = Frequency × wavelength (or use symbols) [1]
= 6 {ecf from **(iii)**} × 1.5 {ecf 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 S [1]

(iii) Energy [1] [3]

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

(ii) lower/decreases/less [1]

(iii) Speed = $\frac{\text{distance}}{\text{time}}$ or distance = speed × time [1]
or 1500 × 0.4 [2]
(Total) distance = 1500 × 0.8 [1]
= 600 [1]
= 1200 m [1]
Distance = 600 (m) [1] [6]

20

							AVAILABLE MARKS
15	**(a)**	**(i)**	Four correct rays		[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]	20
						Total	**110**

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 1
Higher Tier

[G8404]

FRIDAY 21 MAY, MORNING

MARK SCHEME

				AVAILABLE MARKS
1	**(a)**	Diaphragm raised/relaxed/becomes dome-shaped/moves up; (**not** up & out/up & in); Ribs move down and in/down/in; reference to **intercostal** muscles (**not** muscles); Volume decrease/smaller chest/thorax dec.; (**not** lungs decrease) Pressure increases; Any four	[4]	
		QWC	[2]	
	(b)	Large surface area/**many** alveoli/moist/short diffusion distance/ permeable/good blood supply/thin walls/thin membranes; (**not** thin cell walls)	[1]	7
2	**(a)**	To kill any bacteria present in the broth/make sure no microbes present/ remove microbes	[1]	
	(b)	Cloudy – A; Clear – B; Clear – C;	[3]	
	(c)	Microbes can't enter both/caught in bend (**not** describing shape of swan-neck flask/ref to dust alone)	[1]	
	(d)	Pasteur	[1]	
	(e)	**Spontaneous** generation or described	[1]	7
3	**(a)**	X on right atrium or blood vessel	[1]	
	(b)	Aorta	[1]	
	(c)	One branch to each lung (**not** one to head, one to lungs) (**not** one to lungs) (**not** one back to heart)	[1]	
	(d)	Left ventricle	[1]	4
4	**(a)**	Lens between suspensory ligaments	[1]	
	(b)	Bend/refract light/focus the image/focus the light/focus rays (**not** concentrate light)	[1]	
	(c)	Retina/fovea (**not** at the back (on its own))	[1]	
	(d)	Arrow at or beside optic nerve	[1]	4

			AVAILABLE MARKS
5	• Hair flat/down/bends; less air as insulation/less air trapped/less insulation/ allows more heat loss; [2] • Capillaries dilates/widens/vasodilation/shunt vessel constricts; **more** blood to skin/(**more**) heat to surface; (not capillaries move) [2] • Heat used; to evaporate sweat; [2]		6
6	**(a)** Fungi (**not** earthworms) [1]		
	(b) Denitrifying – A; Nitrogen fixing – B; Nitrifying bacteria – C; [3]		
	(c) Denitrifying/A [1]		
	(d) **More** nitrates (**not** nitrogen/protein/fertilises) [1]		6
7	**(a)** 4 cells; (**not** ball of cells); Each cell 1 large + 1 small chromosome; At least 2 different combinations; If 2 cells – haploid with diff. combinations = 1 mark [3]		
	(b) Meiosis; [1]		
	(c) Haploid (**not** n) [1]		5
8	**(a)** weigh **$CaCl_2$** at start; leave for certain time; (**not** weigh plant) Reweigh $CaCl_2$ at end/record the change in mass; reset up with plant with less leaves/reset with 2nd plant; Some mass of $CaCl_2$/keep light/wind speed/temp/named variable constant; calculate water loss per given time; (Any five) [5]		
	(b) Slower/lower/less transpiration [1]		6

					AVAILABLE MARKS
9	**(a)**	**(i)**	Place in dark cupboard **for 1 day or more**	[1]	
		(ii)	Yellow/brown; orange-yellow; (**not** red/no colour change) Blue/black; black (**not** blue on own/brown-black)	[2]	
	(b)	**(i)**	Down – arrow	[1]	
		(ii)	Phloem	[1]	
		(iii)	Respiration/energy/active transport/germination; (**not** food/glycogen) fruit formation/seed formation/stored as fat; growth/new leaves/new flowers/proteins/reproduction - gametes; (**not** repair/nutrient storage) cellulose; (**not** cell walls on own) stored as starch/starch on own/tubers; (**not** storage/stores glycogen) chlorophyll; nectar; (**not** attracts insects) (Any three)	[3]	8
10	**(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; for growth/repair;	[2]	
	(c)	**(i)**	Component — Present or Absent in dialysis fluid at start of dialysis Water ✓ Urea ✗ (**not** left blank) Glucose ✓ Red blood cells ✗ (**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/fills up with urea	[1]	

				AVAILABLE MARKS
(d)	**(i)**	Stored as glycogen/stores glycogen; (**not** stores on own) insulin produced in the pancreas; stored as fat; (insulin causes) more uptake; (liver) more respiration; insulin reduces the blood glucose level; (**not** returns blood sugar level to normal) (Any three) [3]		
	(ii)	Diabetes [1]		16
11	**(a)**	**(i)** Sun/light/sunlight/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/photosynthesise/starch; (**not** produce energy) Using sunlight; [2]		
		(v) Less phytoplankton/less food; 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]		

AVAILABLE MARKS

(b) **(i)** $\frac{500}{4000}$; × 100 = 12.5%; or 2 marks for 12.5% [2]

(ii) Not all the animal is eaten;
Movement/hunting;
excretion/defaecation/urine/faeces/waste;
reproduction;
resipration/heat
(Any two) [2]

(c) **(i)** $\frac{112 \times 140}{16}$; = 980; [2]

(ii) Disease;
pollution/acid rain/eutrophication/thermal pollution;
overfishing; (**not** fishing)
predators;
lack of food/decrease number of prey;
(Any two) [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

12 **(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]

				AVAILABLE MARKS
(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_2; O_2; humidity (water/moisture); (Any two)	[2]	
(e)	**(i)**	T	[1]	
	(ii)	Mutation	[1]	
	(iii)	Protein (**not** amino acids or protein **and** 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 (**not** x-rays/using microscopes)	[1]	
	(vi)	Double; Helix;	[2]	25
			Total	**120**

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 2
Higher Tier

[G8405]

WEDNESDAY 26 MAY, MORNING

MARK SCHEME

				AVAILABLE MARKS
1	**(a)**	halogens **not** halides	[1]	
	(b)	chlorine	[1]	
	(c)	hydrogen, lithium, sodium, potassium Rb, Cs, Fr, Ag, Cu or other correct	[1]	
	(d)	carbon	[1]	4
2	**(a)**	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 i.e. award [1] not [2]	[2]	
	(b)	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]	6
3	**(a)**	More vigorously [1] Idea that reactivity increases down the Group or other correct [1] e.g. higher in reactivity series e.g. idea of (outer) electrons further away from nucleus	[2]	
	(b)	**(i)** strontium hydroxide [1]		
		(ii) hydrogen [1]	[2]	
	(c)	SrO [1]	[1]	5
4	**(a)**	none [1] produces lather	[1]	
	(b)	any **two** of: good for teeth/bones **not** just health **not** contains calcium ions tanning leather helps prevent heart disease brewing beer idea of nice taste (2 × [1])	[2]	
	(c)	ion exchange/distillation/addition of washing soda or other correct [1]	[1]	4

			AVAILABLE MARKS
5	**(a)** 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]	
	(b) Idea of atoms/metal ions in **layers** [1] Which can **slide** over one another [1] mark each point separately	[2]	6
6	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]	4
7	**(a)** 40 [1]	[1]	
	(b) 148 [1]	[1]	
	(c) 0.125 (moles) apply CM [1]	[1]	
	(d) 18.5 g [2] one method mark available for incorrect answer but with one correct step e.g. no of moles $Mg(NO_3)_2$ = no of moles MgO or work which shows ans (c) X ans (b) apply CM	[2]	5
8	**(a)** Idea that ions are not free to move [1]	[1]	
	(b) Idea of poisonous nature of bromine [1] Toxic, not dangerous, not harmful	[1]	
	(c) Metal/silvery beads forming **not** bubbles of gas [1] allow lead/grey solid/grey metal	[1]	
	(d) $2Br^- \rightarrow Br_2 + 2e^-$ [1] [1] balancing mark if other [2] gained [1] $2Br^- - 2e^- \rightarrow Br_2$	[3]	6

AVAILABLE MARKS

9 **(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}Cl	17	20	17
^{35}Cl	**17** [1]	**18** [1]	**17** [1]

[3]

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

(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 × [1]) [2]

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

(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 × [1]) [2]
allow idea of pungent smell
allow idea that yellow colour disappears
not exothermic, yellow colour disappears

20

AVAILABLE MARKS

10 (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 × [1]) magnesium ribbon disappears [2]

(iii) magnesium oxide [1] [1]

(b) (i) any **three** of:
Calcium sinks **or** sinks and rises
Bubbles/gas evolved/fizzing
idea of reaction getting faster **not** reaction is fast
Idea of solution going cloudy
Calcium gets smaller/dissolves/disappears
Idea that solution formed is alkaline [3]
Idea of reaction vessel getting warm/exothermic (3 × [1])
ignore reference to hissing or noise
mark idea of moving across the surface of the water as wrong
accept moves **in** the water and **not** just moves

(ii) Wear goggles/use a screen/use a fume cupboard/only small amount of Ca [1] [1]

(iii) calcium + water → calcium hydroxide [1] + hydrogen [1] [2]
apply CM for formula equation from 4a(iii)

(c) (i) Hydrogen [1] [1]

(ii) Magnesium oxide [1] [1]
allow hydrogen through CM if magnesium oxide given in (i)

(d) (i) Any **two** of:
Copper carbonate dissolving/disappearing/getting smaller
Blue solution formed
Bubbles/gas evolved/fizzing/CO_2 given off
Exothermic reaction
idea of vigorous/fast reaction
(2 × [1]) [2]

(ii) Idea that it does **not** react [1]
i.e. that copper is not reactive [1]

(e) (i) blue [1] to colourless [1] **not** clear [2]

(ii) $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$
[1] [1] [2]

(iii) displacement [1] allow redox [1]

20

AVAILABLE MARKS

11 (a) (i) time (min) [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) $5\frac{1}{2}$ – 6 minutes [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 CO_2 [1]

(b) (i)

substance	common name	chemical name
A	**Coke** [1]	carbon
B	**Limestone** [1]	calcium carbonate

[2]

(ii) air [1] **not** oxygen [1]

(iii) $CO_2 + C \rightarrow 2CO$
[1] [1] balancing mark if other 2 gained [1] [3]

(iv) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
[1] [1] balancing mark if other 2 gained [1] [3]

(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

AVAILABLE MARKS

12 (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 [2]
If answer just "carbon and hydrogen only" award [1]

(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)

	molecular formula	**structural formula**	**state at room temperature**
ethane	C_2H_6	Structural formula	Gas
ethene	C_2H_4	Structural formula	Gas

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

(c)

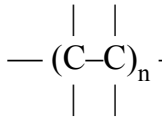
Test	Bromine **Water** [1] or bromine solution not **bromine**
Ethane	solution remains yellow/orange/brown/ red-brown or any combination or no change/no reaction [1]
Ethene	yellow/orange/brown/red-brown or any combination [1] turns colourless [1]

allow the "colour" mark for either ethane or ethene do not allow red [4]

(d) (i) steam [1] **not** water **not** H_2O, accept $H_2O_{(g)}$ [1]

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

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

(ii)

[2] one mark for showing single C–C bond second mark for rest of diagram correct [2] 20

Total **120**

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 3
Higher Tier

[G8406]

FRIDAY 28 MAY, MORNING

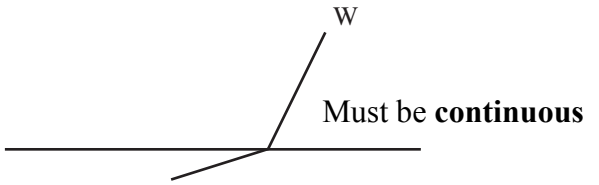
MARK SCHEME

				AVAILABLE MARKS
1	**(i)** Acceleration is constant during AB (✓)		[1]	
	(ii) Momentum = mass × velocity **or** p = mv	[1]		
	= 3000 × 20	[1]		
	= 60 000	[1]		
	= kg m/s **or** Ns	[1]	[4]	5
2	**(a)** **(i)** W.D. = Force × distance	[1]		
	= 60 × 150	[1]		
	= 9000 (J)	[1]	[3]	
	(ii) 9000 J (**e.c.f**. **(a)(i)**)	[1]	[1]	
	(b) Mass = 1425 (kg)		[1]	5
3	**(a)** **(i)** Sun		[1]	
	(ii) Mercury		[1]	
	(iii) Neptune		[1]	
	(b) Earth **or** Planet Earth		[1]	4
4	**(a)** (Collection of) **stars**		[1]	
	(b) Milky Way		[1]	
	(c) Problem with time **or** fuel **or** logistics **or** distance		[1]	
	QWC		[1]	4

						AVAILABLE MARKS
5	**(a)**	**(i)**	Hydrogen Reject: Nebula	[1]		
		(ii)	Gravity/gravitational	[1]		
		(iii)	Temperature rises/gets hotter/density increases/begin to spin	[1]		
		(iv)	(Nuclear) fusion	[1]		
		(v)	Any named em radiations/heat	[1]	[5]	
	(b)		Steady State Theory and Big Bang Theory		[2]	7
6	**(i)**		CWM = ACWM F × 3 [1] = 900 × 2 [1] F = 600 (N)	$F_1 \times d_1 = F_2 \times d_2$ [1] CM = ACM [2] [1]		
	(ii)		Clockwise	[1]	[5]	5
7	**(a)**	**(i)**	Anticlockwise current with arrows ↓↑	[2]		
		(ii)	Shiny surface is a bad [1] radiator [1]/bad [1] emitter [1]	[2]	[4]	
	(b)	**(i)**	Greater k.e./velocity/amplitude/vibrate more/faster		[1]	
		(ii)	Molecules jostle/molecules collide **or** Conduction		[1]	6
8	**(i)**		Kinetic (energy) **or** Movement energy		[1]	
	(ii)		Any combination of PE = mgh = 3 × 10 × 0.2 = 0.6	[1]		
			Any combination of KE = ½ mv^2 = ½ × 3 × v^2	[1]		
			Applying Principle of Conservation of energy KE = PE **or** 6 = ½ × 3 v^2 v = 2	[1] [1]	[4]	5

AVAILABLE MARKS

9 **(a)** **(i)**



[1]

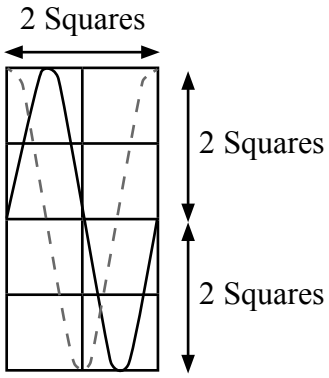
(ii) Wavelength = 1.5 (cm) [1]

(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 [1]

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

(Total) distance = 1500 × 0.8 [1]

= 1200 m or = 1500 × 0.4 [2] [1]

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

20

							AVAILABLE MARKS
10	**(a)**	**(i)**	Four correct rays	Dotted lines OK See handout Straight by eye	[4]		
		(ii)	Correct label		[1]	[5]	
	(b)	**(i)**	**1st mark – 2** rays, one 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 RHS of mirror.				
		(ii)	Less		[1]	[5]	
	(c)	**(i)**	Splitting of light into different colours/wavelengths		[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) definition of Transverse wave travel in vacuum transverse can be polarised		[2]		
		(iii)	Two from: infra-red microwaves visible/light Reject: Radio, Gamma, X-rays, UV		[2]	[5]	20

						AVAILABLE MARKS
11	**(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)		Charge = Current × time or Q = It Charge = 0.2 × 5 × 60 Charge = 60 [1] C [1]	[1] [1] [2]	[4]	
	(c)	**(i)**	5 correct points, ± ½	[1]		
		(ii)	A smooth curve through the points Reject: Not starting at (0, 0) Thick curve or tramlines 'Joining the dots' with ruler	[1]		
		(iii)	Current = 50 mA [±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 Ω 20 Ω 20 Ω 10 Ω	[1] [1] [1] [1]	[4]	20

						AVAILABLE MARKS
12	**(a)**	**(i)**	If switch is closed, other will not turn lamp off.		[1]	
		(ii)	Switch completed Bulb added	[1] [1]	[2]	
	(b)	**(i)**	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/bare wires at Earth Earth must be one of the choices	[2]		
		(ii)	Live and neutral/(brown and blue)	[1]		
	(c)	**(i)**	Circuit breaker/Trip switch/RCB/RCD/RCCB	[1]		
		(ii)	Faster response/safer No need to replace } Dependent marking from (c) (i)	[1] [1]	[6]	
	(d)	**(i)**	(Electromagnetic) induction/EMI	[1]		
		(ii)	Alternating current	[1]		
		(iii)	Equal or same	[1]	[3]	
	(e)		$\frac{Np}{Ns} = \frac{Vp}{Vs}$ or equivalent	[1]		
			$\frac{Np}{200}$ [1] = $\frac{240}{6}$ [1] Must include "="	[2]		
			Np = 8000 (turns)	[1]	[4]	
	(f)	**(i)**	D	[1]		
		(ii)	D	[1]		
		(iii)	B	[1]	[3]	19
					Total	**120**