

Mark Schemes Summer 2008

IGCSE

IGCSE Double Award Science (4437)

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Summer 2008

Publications Code UG020273

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4437-1F MARK SCHEME

Key

; indicates separate mark points

/ indicates alternatives

eq allow for correct equivalent

— word underlined means no alternatives allowed

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)	C;			1
(b)	B;			1
(c)	A;			1
(d)	B;			1
(e)	D;			1
(f)	B;			1
(g)	C;			1
				(7)

(Total 7 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)	A cornea; B lens; C iris; D retina;			1 1 1 1
				(4)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(i)	C / iris;			1
				(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(ii)	D / retina;			1
				(1)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)	three boxes, one on top of the other, getting smaller nearer the top;			1
	boxes labelled in correct order;			1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(i)	Decrease / die;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)(ii)	less food (for the big fish);			1 (1)

(Total 4 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)	line to trachea (below larynx); Accept T			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)	cartilage; ribs; alveoli / air sacs / lungs;			1 1 1 (3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)	muscle; contract; flattens / moves down / eq; volume (of thorax) increases; pressure (inside the thorax) decreases;			Max 3

(Total 7 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)	beaker B;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)	C; less gas / less photosynthesis / slower enzyme activity / eq;			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (c)	Animal	Sex chromosomes		(2)
	Snuppys father	(XY)		
	The surrogate mother	XX;		
	snuppy	XY;		

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)	access / transport / travel / communication / trees for a purpose / construction / manufacture / logging / eq / trees for fuel farming / mining;			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)	<p>loss of habitat / food; loss of numbers / death / extinction / loss of genes / migration / loss of species / eq;</p> <p>less photosynthesis; global warming / greenhouse effect / ref to CO₂ in air;</p> <p>soil erosion idea / <u>leaching</u>; flooding / eutrophication / desertification / lack of minerals / eq;</p> <p>less transpiration; less rainfall;</p>			<p>Max 4</p> <p>(4)</p>

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)(i)	anther / stamen / pollen sac;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)(ii)	drawn to anther only (not to filament);			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)(iii)	pollen; from <u>anther/P</u> to <u>stigma</u> ;			2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)	light / gravity;	sun / sunlight;	phototropism / geotropism	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (c)(i)	carbon dioxide + water; (or opposite) glucose + oxygen; (or opposite) Ignore light / chlorophyll	chemical symbols;;		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (c)(ii)	thin; large surface area; stomata; air spaces / spongy (mesophyll);		pores / guard cells	Max 2 (2)

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9	mouth / saliva; mechanical digestion / chewing / mastication / eq; amylase; ONCE Ignore carbohydrase (starch to) maltose; pancreas / pancreatic juice / eq; small intestine / duodenum / ileum; starch/maltose to glucose; maltase;			Max 6 (6)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
12 (b)	all / extra / increase / more mineral ions / more named mineral / correct amount / eq; use or purpose;	nutrients		2 (2)

(Total 4 marks)

PAPER TOTAL 75 MARKS

4437-2F MARK SCHEME

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)	second box			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(i)	top box			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(ii)	middle box			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(i)	made up of/contains only one type of atom or something that can not be broken down by chemical means			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(ii)	three/3			(1)

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	magnesium			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	gold			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(i)	magnesium/zinc is more reactive than iron OR magnesium displaces iron			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(ii)	word equation using metal in (i). Give mark for ANY equation of type: Metal + iron(II) sulphate → iron + metal sulphate do not penalise omission of (II) on left or inclusion of (II) on right			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(i)	A has air/oxygen and water OR air/oxygen and water needed for rust B no air/oxygen C no water			(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	zinc			(1)

(Total 8 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(i)	lighted spill pop (dependent on correct test)			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(ii)	sodium hydroxide			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(iii)	green blue/purple			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)	loses gains (give one mark if the first two are the wrong way round) high strong (dependent on having high correct)			1 1 1 1 (4)

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(i)	bitumen			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	refinery gases			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(iii)	gasoline			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)	kerosene diesel/gasoline/refinery gases bitumen			1 1 1 (3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(i)	oxygen on left water on right carbon dioxide on right			1 1 1 (3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(ii)	carbon monoxide			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)(iii)	carbon			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(i)	giant molecules			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(ii)	middle box			(1)

(Total 14 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(i)	fifth/last box			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(ii)	A E C D - fully correct gets three marks. If not fully correct then (to a maximum of two): both A and E before C - 1 mark D directly after C - 1 mark E directly before C - 1 mark			(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(iii)	heat / warm			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(i)	yellow			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(ii)	red			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(iii)	neutralisation			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(iv)	water			(1)

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(i)	electrolysis			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(ii)	graphite / carbon			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(iii)	- on left and + on right			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(iv)	aluminium oxide / alumina cryolite	accept correct formulae ignore bauxite		1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(v)	electricity (ignore qualifications) / electrical energy (not energy alone)	Anode/positive electrode replacement	Cathode /electrode replacement	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)(i)	oxygen			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)(ii)	<ul style="list-style-type: none"> •carbon dioxide / carbon monoxide •graphite/carbon/electrode oxidised/burned/reacts with oxygen 	accept correct formulae (ignore lower case)	lists equation	1 1 (2)
				9

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(i)	Any two from: <ul style="list-style-type: none"> •same or similar chemical properties / same functional group • gradation in physical properties •neighbouring/successive members differ by CH₂ 	gradation of specified physical property (eg: boiling point/bp(t), melting point/mp(t), viscosity)	NOT a specified chemical property different/same physical properties	(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(ii)	alkene			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)(i)	<ul style="list-style-type: none"> •(H) one electron shown •(C) two electrons in first shell and four in second shell 	Accept any symbol for electrons.	Electrons on nucleus	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)(ii)	<ul style="list-style-type: none"> •all five atoms and four shared pairs of electrons •no extra outer electrons. 	IGNORE inner electrons		1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (c)(i)	<ul style="list-style-type: none"> •(compounds with) same molecular formula •(but) different structural formulae /displayed formula/structure / atoms arranged differently (same) elements = 0 marks 	Mark independently	same chemical formula. Reject substances	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (c)(ii)	Correct structures of butane and methylpropane. ALL bonds shown Penalise sticks with missing H once only			(2)

(Total 11 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)(i)	any two from <ul style="list-style-type: none"> •effervescence / fizzing / bubbles • cloudiness / white precipitate /milky / white suspension •Ca get smaller / disappears (ignore dissolves). •Ca moves up and down 	Ignore gas made ignore floats/moves	List	(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)(ii)	Ca(OH) ₂			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)(iii)	<ul style="list-style-type: none"> •blue •alkali / OH⁻ / hydroxide / pH >7 (ignore base) •stated pH value in range 8-14 		purple	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(i)	<ul style="list-style-type: none"> •grey / silver(y) •white 			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(ii)	any two from <ul style="list-style-type: none"> •over/through water / downward displacement of water • (gas) syringe •upward delivery / downward displacement of air 	a description of this suitable diagrams	gas cylinder	(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(iii)	hydrogen + oxygen → water / steam	ignore heat	formulae	(1)

(Total 10 marks)

PAPER TOTAL 75 MARKS

4437-3F MARK SCHEME

Abbreviations used in mark scheme:

OWTTE - or words to that effect

dop - depending on previous

ecf - error carried forward

ora - or reverse argument

sfs - start from scratch

UP - unit penalty

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(i)	P	p		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(ii)	Q	q		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(iii)	Q and R	q and r either order		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(i)	sloping		sloping and horizontal	1
	straight			1
	independent marks but sloping and horizontal scores (0)			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(ii)	horizontal ignore 'straight'			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)	less distance (travelled in section R than in section P)			(1)

(Total 7 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	long	allow answers to (i) and (ii) in either order		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	frayed			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)	stray wire(s)			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(i)	plastic (casing)			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	small/low current			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (d)	* circuit breaker * double insulation	either one		(1)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)	energy	in either order		1
	information			1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)	D		wrong order	1
	C			1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(i)	cycles/waves second/unit time		wrong order	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(ii)	speed	velocity (time) period time to travel a wavelength		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (d)(i)	longitudinal			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (d)(ii)	20 Hz - 20 000 Hz			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (d)(iii)	less than			(1)

(Total 10 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(i)	microphone			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	kettle/iron/heater/ (electric) fire/ toaster/hairdryer/ soldering iron	there are many other examples credit if the useful energy transfer is from electricity to heat		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)	any falling body		do not credit examples where both falling and rising occur e.g. child's swing or bungee jump unless falling is specified	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)	heat	sound		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)	total energy input total energy output	in either order scores 2 or 0		(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (e)	kinetic kinetic			1 1 (2)

(Total 8 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(i)	100 000			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(ii)	500 000	100 000 × 5 for (1) mark		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(i)	330	400 - 70 for (1) mark		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)(ii)	background (count/radiation) random/variable/not constant			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (c)	cosmic rays/rocks/medical etc	any two (1) each		(2)

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)	yellow green	1 mark if colours reversed		1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)(i)	A infra-red B ultra violet		answers reversed	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)(ii)	B / ultra violet			(1)

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Mark
7(a)(i)	0.8 (seconds)	4/5 second 8/10 second	1 (1)

Question Number	Correct Answer	Acceptable Answers	Mark
7(a)(ii)	3.2 (seconds)	3 1/5 allow ecf from (i) 4.0 - previous answer	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8(b)(i)	same speed (in a vacuum) same velocity (in a vacuum) <i>or</i> (travel at) speed of light (travel at)velocity of light	travel through a vacuum or empty space	transverse	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8(b)(ii)	water (waves)/waves on water/tidal waves/sea waves/ocean waves	waves on (slinky) spring shaken/moved up and down or side to side waves on a rope moved up and down or side to side <i>S waves ignore 'seismic'</i> mexican wave	P waves analogue wave waves on a CRO	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8(b)(iii)	90° energy <i>independent marks</i>	normal/ perpendicular right angles information or data wavefront/front	crest/vibration/direction/pattern	1 1 (2)

(Total 6 marks)

Question Number	Correct Answer	Acceptable answers	Reject	Mark
9(a)(i)	voltage = current × resistance or current = voltage/resistance or resistance = voltage/current	V = IR I=V/R R=V/I	V = C x R	1 (1)
9(a)(ii)	4.5 nwn volts or V or J/C or JC ⁻¹ or AΩ			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Mark
9(b)	decrease increase	Increase decrease scores 1 decrease decrease scores 1 increase increase scores 1	1 1 (2)

(Total 5 marks)

Question Number	Correct Answer	Reject	Mark
10(a)(i)	(semiconductor)diode	LED light emitting diode	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10(a)(ii)	50 50	both required		1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10(a)(iii)	one cell is connected the wrong way	two cells cancel one another/not all facing the same way	battery	1
	some of the voltage is across/used up by diode/component Y/ammeter(s)/(connecting) wire /switch	reference to resistance of these components /cells / whole circuit	voltage used up by/voltage across <i>voltmeter/lamp</i> voltmeter does not have infinite resistance <i>ignore</i> reference to current and energy	1
				(2)

Question Number	Correct Answer	Acceptable Answers	Mark
10 (b)	<i>any <u>three</u> points</i>		
	current increases	voltage increases	1
	increases temperature	increases heat / molecular movement	1
	increases resistance		1
	line or slope becomes less steep	non-ohmic / / not proportional to <i>V</i> / decrease rate of increase /current levels off	(3)

(Total 7 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (a)(i)	not moving (or vibrating) none zero	no <u>kinetic</u> energy no momentum	a response which suggests any kind of movement	1
				(1)

Question Number	Correct Answer	Acceptable Answers	Mark
11 (a)(ii)	-273 (°C)	minus 273 -273.15	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (a)(iii)	373 (K)	373.15(K)	373°C	1 (1)

Question Number	Correct Answer	Reject	Mark
11 (b)	particles knock /jostle /collide	diffusion	1
	smaller/invisible /air/water particles		1
	cause a change of direction dop only as 3 rd mark		1
			(3)

(Total 6 marks)

PAPER TOTAL 75 MARKS

4437-4H MARK SCHEME

Key

; indicates separate mark points

/ indicates alternatives

eq allow for correct equivalent

— word underlined means no alternatives allowed

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)	access / transport / travel / communication/ trees for a purpose / construction / manufacture / logging / eq trees for fuel/ farming / mining;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)	loss of habitat / food; loss of numbers / death / extinction / loss of genes / migration / loss of species / eq; less photosynthesis; global warming / greenhouse effect / ref to CO ₂ in air; soil erosion idea / <u>leaching</u> ; flooding / eutrophication / desertification / lack of minerals / eq; less transpiration; less rainfall;			Max 4 (4)

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	anther / stamen / pollen sac;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	drawn to anther only (not to filament);			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(iii)	pollen; from <u>anther</u> / <u>P</u> to <u>stigma</u> ;			2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)	light / gravity;	sun / sunlight;	phototropism / geotropism	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(i)	carbon dioxide + water; (or opposite) glucose + oxygen; (or opposite) Ignore light / chlorophyll	chemical symbols;;		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	thin; large surface area; stomata; air spaces / spongy (mesophyll);		pores / guard cells	Max 2 (2)

(Total 9 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3	mouth / saliva; mechanical digestion / chewing / mastication / eq; amylase; ONCE Ignore carbohydrase (starch to) maltose; pancreas / pancreatic juice / eq; small intestine / duodenum / ileum; starch/maltose to glucose; maltase;			Max 6 (6)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4	vena cava; atrium / auricle; lung; valves; aorta; hepatic; glucose / sugar; glycogen;			8 (8)

(Total 8 marks)

Question Number	Correct Answer		Acceptable Answers	Reject	Mark
5 (a)	Step	Order of step	all 4 = 3;;; 2 correct = 2;; 1 correct = 1;		Max 3 (3)
	repeat crosses for several generations	4			
	cross parent plants to produce more offspring	2			
	identify parent plants with desired characteristics	1			
	select offspring with desired characteristics	3			

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)	large numbers; quickly produced; identical / all have desired characteristic / cloned / eq;			Max 2 (2)

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)	$3.6 / 5.4 \times 100 = 66.7$;; Accept $66.67 / 66.6666$ etc one for 3.6	66 and two thirds;		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)	all / extra / increase / more mineral ions / more named mineral / correct amount / eq; use or purpose;	nutrients		2 (2)

(Total 4 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(i)	Dd and Dd; DD, Dd, Dd, and dd; (any order)			2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(ii)	3:1 / 75:25 / 75% to 25% / 3 quarters to 1 quarter / eq;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (a)(iii)	zero; both parents must be DD / dd parents are sterile / neither parent has d/recessive allele; ignore term gene			2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)	bigger surface area to volume ratio; lack insulation/fat; lose (more) heat; maintain body temperature; respiration;			Max 2 (2)

(Total 7 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)	glucose / $C_6H_{12}O_6$; carbon dioxide/ CO_2 + ethanol/alcohol/ C_2H_5OH ; Ignore energy	chemical symbols		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(i)	gene / DNA / allele (for enzyme); cut; restriction / endonuclease; plasmid / vector / gene gun / phage ligase; gene / DNA / allele <u>into yeast</u> ;			Max 4 (4)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(ii)	enzyme / amylase; digests starch / less starch / starch to sugar;			2 (2)

(Total 8 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9	bacteria / named bacteria; ammonia/ammonium (cpds) to nitrite/nitrate / nitrite to nitrate; protein / amino acids / growth;			(3)

(Total 3 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10 (a)	energy / insulation / cell membranes / neurones / growth / making new cells / eq;	keep warm / eq		1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10 (b)	respiration / heat / excretion / egestion / movement / uneaten / indigestible;;			Max 2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
10 (c)	nitrates / mineral ion(s) / named mineral ion(s) / eq; growth of plants / algal bloom; <u>eutrophication</u> ; light blocked / less photosynthesis; death of organisms (plant/fish); bacteria / microorganisms / eq; oxygen depletion / eq; respiration;			Max 5 (5)

(Total 8 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark												
11 (a)	<table border="1"> <thead> <tr> <th>Person</th> <th>BMI value</th> <th>Description of weight</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>(24.2)</td> <td>(normal weight)</td> </tr> <tr> <td>B</td> <td>29.6</td> <td>overweight</td> </tr> <tr> <td>C</td> <td>39.6;</td> <td>obese;</td> </tr> </tbody> </table>	Person	BMI value	Description of weight	A	(24.2)	(normal weight)	B	29.6	overweight	C	39.6;	obese;	TE for wrong BMI but correct description = 1		(2)
Person	BMI value	Description of weight														
A	(24.2)	(normal weight)														
B	29.6	overweight														
C	39.6;	obese;														

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (b)	higher / greater / increase / eq;			1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (c)(i)	more risk for men up to 28 / similar risk up to 28 / eq; more risk for women (than men) above 28; more risk for men and women above 28; more risk as BMI increases;	allow higher BMI/overweight as eq to 28		2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (c)(ii)	coronary artery; fat/cholesterol blocks/deposits; (aerobic to) anaerobic; (less) oxygen; (less) glucose; less respiration / less energy / ATP; lactic acid; builds up / toxic / inhibit enzymes / eq;			Max 5 (5)

(Total 10 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
12 (c)(i)	less pressure / flow speed; larger lumen / eq; closer to surface / easier to see / eq; thinner wall / easier to penetrate;	converse		Max 2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
12 (c)(ii)	diffusion; high conc. to low conc. / conc.gradient;			2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
12 (c)(iii)	urea; carbon dioxide; water;		toxins / hormones / glucose / lactic acid	Max 2 (2)

(Total 17 marks)

PAPER TOTAL 90 MARKS

4437-5H MARK SCHEME

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)(i)	electrolysis			(1)
1 (a)(ii)	graphite / carbon			(1)
1 (a)(iii)	- on left and + on right			(1)
1 (a)(iv)	aluminium oxide / alumina cryolite	accept correct formulae ignore bauxite		1 1 (2)
1 (a)(v)	electricity (ignore qualifications) / electrical energy (not energy alone)	Anode/positive electrode replacement	Cathode /electrode replacement	(1)
1 (b)(i)	oxygen			(1)
1 (b)(ii)	•carbon dioxide / carbon monoxide •graphite/carbon/electrode oxidised/burned/reacts with oxygen	accept correct formulae (ignore lower case)	lists equation	1 1 (2)
				9
2 (a)(i)	Any two from: •same or similar chemical properties / same functional group • gradation in physical properties •neighbouring/successive members differ by CH ₂	Gradation of specified physical property (eg: boiling point/bp(t), melting point/mp(t), viscosity)	NOT a specified chemical property different/same physical properties	(2)
2 (a)(ii)	alkene			(1)
2 (b)(i)	•(H) one electron shown •(C) two electrons in first shell and four in second shell	Accept any symbol for electrons.	Electrons on nucleus	1 1 (2)
2 (b)(ii)	•all five atoms and four shared pairs of electrons •no extra outer electrons.	IGNORE inner electrons		1 1 (2)
2 (c)(i)	•(compounds with) same molecular formula •(but) different structural formulae / displayed formula/structure / atoms arranged differently (same) elements = 0 marks	Mark independently	same chemical formula. Reject substances.	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	Correct structures of butane and methylpropane. ALL bonds shown Penalise sticks with missing H once only			1 1 (2)
				11
3 (a)(i)	any two from •effervescence / fizzing / bubbles • cloudiness / white precipitate /milky / white suspension •Ca get smaller / disappears (ignore dissolves). •Ca moves up and down	ignore gas made ignore floats/moves	List	(2)
3 (a)(ii)	Ca(OH) ₂			(1)
3 (a)(iii)	•blue •alkali / OH ⁻ / hydroxide / pH >7 (ignore base) •stated pH value in range 8-14		purple	1 1 (2)
3 (b)(i)	•grey / silver(y) •white			1 1 (2)
3 (b)(ii)	any two from •over/through water / downward displacement of water • (gas) syringe •upward delivery / downward displacement of air	a description of this suitable diagrams	gas cylinder	(2)
3 (b)(iii)	hydrogen + oxygen → water / steam	ignore heat	formulae	(1)
				10
4 (a)(i)	diffusion			(1)
4 (a)(ii)	•mention of particles (if particles named, must be correct) in correct context •moving (randomly)	(accept molecules/ ions) move (from high to low concentration)		1 1 (2)
4 (b)(i)	•(blue) ppt - colour not needed but penalise ppt if colour is wrong •deep/dark/royal blue •solution / dissolves	ignore changes to colour of solution	Dark/royal/de ep blue ppt	1 1 (3)
4 (b)(ii)	[Cu(H ₂ O) ₂ (NH ₃) ₄] ²⁺ / [Cu(NH ₃) ₄ (H ₂ O) ₂] ²⁺	Formulae without []		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
				7
5 (a)(i)	Any three from <ul style="list-style-type: none"> •float/on surface •fizz/bubble (ignore gas) •move/dart about •melt/form sphere/ball •Na gets smaller / disappears (ignore dissolves) 	ignore references to flames / igniting	Apply list rule	(3)
5 (a)(ii)	$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ <ul style="list-style-type: none"> •correct formulae •balancing (dependent on first mark being awarded) 	Na(OH) any multiple		(2)
5 (a)(iii)	Moves/bubbles faster/(more) violent/more vigorous/catches fire/flame/ explodes		Reaction faster/ it is faster	(1)
5 (b)(i)	<ul style="list-style-type: none"> •sodium loses electron(s) • oxygen gains electrons •correct number of electrons for each atom marks could be gained by suitable additions to printed diagram	Indication of 2 Na and 1 O	Any reference to sharing /covalent gives 0	(3)
5 (b)(ii)	<ul style="list-style-type: none"> •strong attractive forces / bonds (regardless of what these are between) •between <u>ions</u> •require a lot of energy to overcome / difficult to break (regardless of what these are between) 		second mark not given if atoms / molecules / intermolecular	1 1 1 (3)
				12

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)	any five from: <ul style="list-style-type: none"> •add magnesium carbonate to acid •stir/mix •excess magnesium carbonate • filter / centrifuge and decant •heat or evaporate filtrate and stop evaporation at a suitable point / heat filtrate and leave to cool / leave filtrate to evaporate or to crystallise or for suitable time / place in oven below 100 °C •dry crystals with (filter) paper / desiccator 	Ignore indicators <ul style="list-style-type: none"> •If use sodium carbonate (or other soluble carbonate)only points 2,5,6 •If use other insoluble carbonate, all bar first point. •Wrong method of prep. Then get 5 and 6 only. 	Heat to dryness, can not get 5 or 6	(5)
6 (b)	<ul style="list-style-type: none"> •colourless •to pink 	if just state "pink" with no start colour, then score 1	purple / red	1 1 (2)
				7
7 (a)(i)	<ul style="list-style-type: none"> •add (named) acid •bubbles/effervescence/fizzing OR gas produced turns limewater milky 	2 nd mark possible only if acid added		1 1 (2)
7 (a)(ii)	2NaOH + CO ₂ → Na ₂ CO ₃ + H ₂ O formulae = 1 balancing = 1 (only if formulae correct)	Accept any multiple		(2)
7 (b)(i)	<ul style="list-style-type: none"> •Mr NaHCO₃ = 84 •moles = 4.2 ÷ 84 •= 0.05(0) ignore any units Correct answer scores 3 If M _r incorrect, max 2 (107 gives 0.039; 168 gives 0.025)			1 1 1 (3)
7 (b)(ii)	(i) ÷ 2 = 0.025 ignore any units	cq		(1)
7 (b)(iii)	(ii) x 24 (dm ³) = 0.6 unit not required but penalise incorrect units.	cq	answer in cm ³	(1)
				9
8 (a)	any in range 40 to 100			(1)
8 (b)(i)	H ₂ + Cl ₂ → 2HCl formulae = 1 balancing = 1 (only if formulae correct) accept any multiples		CL	(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (b)(ii)	water: <ul style="list-style-type: none"> • paper becomes red (NOT orange) • acidic / H⁺ ions produced methylbenzene: <ul style="list-style-type: none"> • no change / orange • no H⁺ ions formed / not acidic / does not ionise (indep. of colour) 	red/orange ignore refs to being neutral	Orange Ionizes alone Green References to acidity of methyl benzene	1 1 1 1 (4)
				7
9 (a)(i)	galvanising / sacrificial protection			(1)
9 (a)(ii)	railings / cars / bridges / buckets / watering cans / lamp posts etc.	accept ships/boats even though zinc blocks and not a continuous layer used	bikes	(1)
9 (a)(iii)	<ul style="list-style-type: none"> • zinc more reactive (than iron) • zinc reacts/corrodes/oxidises in preference to /before /instead of iron 	It is more reactive than iron	It is more reactive zinc rusts protective coating of zinc oxide	1 1 (2)
9 (b)	<ul style="list-style-type: none"> • zinc • loses electron(s) / oxidation number increases 		If not zinc = zero	1 1 (2)
9 (c)	<ul style="list-style-type: none"> • make solution of nickel nitrate • add metal • if reaction occurs then metal is more reactive than nickel OR <ul style="list-style-type: none"> • work down from top of list until no reaction occurs / work up from bottom of list until reaction does occur. 	Displacement reaction without making a solution is max 2	Reaction with anything else (such as HCl(aq)) is zero react with metal (for 2 nd mark)	1 1 1 (3)
				9
10 (a)	<ul style="list-style-type: none"> • Increased • endothermic (left to right) or description of endothermic / ΔH is positive 	ignore references to rate	If decreased or stays the same = zero	1 1 (2)
10 (b)	<ul style="list-style-type: none"> • correct structure with minimum 4 	Ignore "n"	any structure	1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark																												
	<p>carbons</p> <ul style="list-style-type: none"> • continuation bonds shown (not just dots) (brackets not required) 	subscripts	with C=C or based on wrong repeat unit = 0	1 (2)																												
10 (c)	<p>If calculate empirical first:</p> <ul style="list-style-type: none"> • Correct empirical formula with some correct working = 3 <table border="1"> <tr> <td>division by A_r</td> <td>$38.7/12 = 3.23$</td> <td>$9.70/1 = 9.70$</td> <td>$51.6/16 = 3.23$</td> </tr> <tr> <td>division by smallest</td> <td>$3.23 / 3.23 = 1$</td> <td>$9.70 / 3.23 = 3$</td> <td>$3.23 / 3.23 = 1$</td> </tr> <tr> <td>empirical</td> <td colspan="3">CH₃O</td> </tr> </table> <ul style="list-style-type: none"> • Correct molecular formula (with any correct working) = 2 <table border="1"> <tr> <td>mass of empirical</td> <td>31</td> </tr> <tr> <td>molecular</td> <td>C₂H₆O₂</td> </tr> </table> <p>If calculate molecular first</p> <table border="1"> <tr> <td>mass of each element</td> <td>$38.7 \times .62 = 24$</td> <td>$9.70 \times .62 = 6$</td> <td>$51.6 \times .62 = 32$</td> </tr> <tr> <td>division by A_r</td> <td>$24 / 12 = 2$</td> <td>$6 / 1 = 6$</td> <td>$32 / 16 = 2$</td> </tr> <tr> <td></td> <td colspan="3">C₂H₆O₂</td> </tr> </table> <p>correct molecular with some working = 3</p> <p>Correct empirical = 2</p>	division by A_r	$38.7/12 = 3.23$	$9.70/1 = 9.70$	$51.6/16 = 3.23$	division by smallest	$3.23 / 3.23 = 1$	$9.70 / 3.23 = 3$	$3.23 / 3.23 = 1$	empirical	CH ₃ O			mass of empirical	31	molecular	C ₂ H ₆ O ₂	mass of each element	$38.7 \times .62 = 24$	$9.70 \times .62 = 6$	$51.6 \times .62 = 32$	division by A_r	$24 / 12 = 2$	$6 / 1 = 6$	$32 / 16 = 2$		C ₂ H ₆ O ₂			<p>If A_r incorrect/ use Z in place of A_r then lose first mark</p> <p>If NO working shown, then max 1 each for the two answers regardless of order of answers</p>	<p>If first step totally wrong, zero.</p>	<p>1 1 1 2 1 1 1 2 (5)</p>
division by A_r	$38.7/12 = 3.23$	$9.70/1 = 9.70$	$51.6/16 = 3.23$																													
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	C ₂ H ₆ O ₂																															
				9																												

PAPER TOTAL 90 MARKS

Question Number	Correct Answer	Reject	Mark
1 (b)(ii)	intentionally straight vertical arrow pointing downwards from, above, below or through point X	arrow from middle of car	1 (1)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	infra red <i>allow</i> phonetic spelling	i.r. IR	microwaves ultraviolet	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	gamma (rays/radiation)	γ gama	X-rays	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(i)	same speed (in a vacuum) same velocity (in a vacuum) <i>or</i> (travel at) speed of light (travel at)velocity of light	travel through a vacuum or empty space	transverse	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)(ii)	water (waves)/waves on water/tidal waves/sea waves/ocean waves	waves on (slinky) spring shaken/moved up and down or side to side waves on a rope moved up and down or side to side <i>S waves ignore 'seismic'</i> mexican wave	P waves analogue wave waves on a CRO	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(i)	not moving (or vibrating) none zero	no <u>kinetic</u> energy no momentum	a response which suggests any kind of movement	1 (1)

Question Number	Correct Answer	Acceptable Answers	Mark
5 (a)(ii)	-273 (°C)	minus 273 -273.15	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)(iii)	373 (K)	373.15(K)	373 °C	1 (1)

Question Number	Correct Answer	Reject	Mark
5 (b)	particles knock /jostle /collide	diffusion	1
	smaller/invisible /air/water particles		1
	cause a change of direction dop only as 3 rd mark		1
			(3)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(i)	gradient	slope	area	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (a)(ii)	$6.0 \div 0.25$ $= 24$ m/s^2 or $m/s/s$ or ms^{-2} <i>ignore minus signs</i>	Nwn N/kg or Nkg^{-1}		1 1 1 (3)
6 (a)(iii)	$F = m \times a$ $= 70 \times 24$ $= 1680$ (N)	ecf from (a)(ii) nwn	70×10 700×24 score 0/3	1 1 1 (3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b)	<i>any <u>three</u> points</i> same change in velocity (in) more time less acceleration or deceleration ora less force ora	comes to a stop over a longer distance $24 ms^{-2}$ is too high <i>allow 'slower deceleration'</i>	damage to joints effect of area of contact and pressure impact reduced	1 1 1 1 (3)

(Total 10 marks)

Question Number	Correct Answer	Acceptable Answers	Mark
7 (a)	recall $n = \sin i \div \sin r$		1
	$\sin i = 1.5 \times \sin 40^\circ$	$\sin^{-1}(1.5 \sin 40^\circ)$	1
	$i = 74.6^\circ$ or 75°	73.7° or 74° nwn (rounding $\sin 40^\circ$ to 0.64)	1
		$i = 40^\circ$ $r = 25.3^\circ$ scores 1 st mark only	(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (b)(i)	intentional straight line from point of incidence above existing refracted ray		bending away from normal	1 (1)
7 (b)(ii)	n less	less dense/slow down less/less bent	bends away from normal	1
	r is more	turns less to normal refracts less	greater refracted 'ray'	1
		<i>Calculation of $r = 47.9^\circ$ scores both marks</i>		(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
7 (c)	external normal correctly drawn		arrow(s) on normal	1
	i correctly marked between incident ray and drawn normal	ecf		1
	<i>independent marks</i>			(2)

(Total 8 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
8 (a)	fracture energy = initial gpe - final gpe i.e. $E = I - F$ <u>in words</u>	$I = E + F$ $F = I - E$ <u>in words</u>	division or product of phrases	1 (1)

Question Number	Correct Answer	Acceptable Answers	Mark
8 (b)(i)	$60 \times 10 \times 0.5$ = 300 (J) nwn	$60 \times 9.81 \times 0.5 = 294.3(j)$ $60 \times 9.8 \times 0.5 = 294(j)$	1 1 (2)
8 (b)(ii)	300 / same as (i)	ecf	1 (1)
8 (b)(iii)	$\frac{1}{2}mv^2 =$ answer from (i) or (ii) = 3.16 (m/s)	ecf	1 1 (2)
8 (b)(iv)	friction / air resistance / drag not all gpe changed to ke	energy lost to a stated form e.g heat and/or sound	1 (1)
8 (b)(v)	300 - 70 = 230 (J) or 0.230 kJ	allow ecf from b(i) no ecf from (a)	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Mark
8 (c)(i)	metal any metal <i>ignore 'spring'</i>	metal spring metal wire	1 (1)

Question Number	Correct Answer	Reject	Mark
8 (c)(ii)	linear region correctly marked		1 (1)
8 (c)(iii)	<u>dop</u> proportionality between force(or mass or load or weight) and extension OWTTE	elastic behaviour	1 (1)

(Total 12 marks)

Question Number	Correct Answer	Reject	Mark
9 (a)	(Fleming's) left hand (rule)	(Fleming's)right hand left hand grip rule left hand corkscrew rule	(1)

Question Number	Correct Answer	Mark
9 (b)(i)	I out of page correct direction anywhere in circuit	1 (1)
Question Number	Correct Answer	Mark
9 (b)(ii)	M downwards allow B as a label	1 (1)
Question Number	Correct Answer	Mark
9 (b)(iii)	F to the right must ecf from b(i)&(ii)	1 (1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9 (c)	stronger magnet	magnets closer	bigger magnets electromagnet	1
	more current	larger voltage/ more batteries	bigger battery	1 (2)

Question Number	Correct Answer	Acceptable Answers	Mark
9 (d)(i)	current/voltage varies	diagram with at least 1½ cycles about axis scores 3	1
	about axis	'current changes direction' scores 1	1
	pattern repeated dop <i>maximum of 2 marks if no diagram</i>	single cycle sine wave seen anywhere e.g. on a.c. supply scores 1	1 (3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
9 (d)(ii)	(moves)backwards and forwards (quickly) vibrate (not up and down)	(moves)right and left side to side (quickly)	changes direction	1
	at (a frequency of) 50 Hz <i>independent marks</i>	at high frequency appears stationary		1 (2)

(Total 11 marks)

Question Number	Correct Answer	Mark
10 (a)(i)	n 1 0	1 1 (2)

Question Number	Correct Answer	Mark
10 (a)(ii)	Be 9 4	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Mark
10 (b)(i)	He	Helium 2 protons & 2 neutrons	1 (1)

Question Number	Correct Answer	Acceptable Answers	Mark
10 (b)(ii)	electron ignore β^+	symbol e- or β^-	1 (1)

Question Number	Correct Answer	Acceptable Answers	Mark
10 (c)(i)	same no of protons <i>ignore</i> 'electrons'	same atomic number or Z	1
	different no of neutrons or N dop <i>exception</i> : 'same element with different number of neutrons' scores 1	different mass number or A different nucleon number	1 (2)

Question Number	Correct Answer	Acceptable Answers	Mark
10 (c)(ii)	U-238 \rightarrow Th-234		1
	Th-234 \rightarrow Pa-234		1
	Pa -234 \rightarrow U-234		1
	bald answer (2)	final product has atomic number 92 score 1 if no other mark scored	(3)

(Total 11 marks)

Question Number	Correct Answer	Reject	Mark
11 (a)	daughter		1
	two/ three/more/ a few/several / some	fast / ≥ 4 / 1	1
	chain		1
	speed/velocity/ <u>kinetic</u> energy/momentum		1
			(4)

Question Number	Correct Answer	Acceptable Answers	Mark
11 (b)(i)	slow down neutrons/particles (not nuclei)	absorbs (kinetic) energy of neutrons/particles	1
	enable fission to occur	reaction is more efficient OWTTE increase rate of collision	1
			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
11 (b)(ii)	absorb neutrons	stop neutrons		1
	stop / reduce / control the rate of fission or reaction			1
				(2)

(Total 8 marks)

PAPER TOTAL 90 MARKS

4437-07 MARK SCHEME

Key

- ; indicates separate mark points
 / indicates alternatives
 eq allow for correct equivalent
 — word underlined means no alternatives allowed

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1	Benedict's; and bunsen; (or opposite) iodine; and spotting tile; (or opposite)			(4)

(Total 4 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)	increases; 30 °C / fastest at 30 °C / optimum; decreases / slows down / stops;			Max 2 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)	ref. movement of molecules / (kinetic) energy; more/faster collisions; optimum; denature / destroy enzyme/active site;			Max 3 (3)

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(i)	(3) 14; 11;			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)(ii)	scale linear + minimum of half axis; plot;; axis - number + plants 1, 2 and 3; key - smooth and wrinkled;			(5)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)	smooth dominant / wrinkled recessive; parent plants are heterozygous / Ss and Ss / carriers; genotype of offspring SS Ss Ss and ss; phenotypes correct / 3:1 / 1 in 4 / 25% / eq;			Max 3 (3)

(Total 10 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(i)	use ruler / graph paper / eq; qualified - use as template / cut all together / line up together / use straight edge / set square / method to ensure cut is perpendicular / eq;			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	temperature / volume of solution / light / eq; incubator / measuring cylinder / keep in dark / eq; same potato = max 1			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(i)	9.6 9.7 9.7; (any order) (3 correct = 2 marks, 2 or 1 correct = 1 mark)			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(ii)	-0.4 -0.3 -0.3; (from student answer) allow transfer error			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)(iii)	water out (of potato); osmosis; dilute solution to stronger solution / eq;			(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)	increase in length; water enters (potato);			(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(i)	repeat / use more cylinders / use more potatoes;			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(ii)	weigh potato / measure in mm/decimal places / use vernier callipers / eq;			(1)

(Total 14 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)	(top/chemical/mass/digital) balance / scales / any weighing machine / eq;			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)	reliability / average / less chance of anomalous/rogue result affecting average / eq;			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6	<p>C two / several temperatures / eq;</p> <p>O same person / mass / gender / body fat / age / fitness / eq;</p> <p>R repeat / eq;</p> <p>M 1 how collected / eq; 2 ref to time;</p> <p>S 1 + 2level of exercise / clothing / humidity / time of day / eq;;</p>			(6)

(Total 6 marks)

PAPER TOTAL 50 MARKS

4437-08 MARK SCHEME

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)	B	b	Any other answers	1
	E	e		1
	D	d		1
	F	f		1
				(4)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)	F	f	Any other answers	
	A	a		
	C	c		
				(1)

(Total 5 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)	22.65			1
	1.30 (<i>zero needed for mark</i>)			1
	21.35			1
				(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b) (i)	ticks under 23.10 and 23.20			
				(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b) (ii)	$\frac{23.10 + 23.20}{2}$			1
	23.15 (answer must be to 2 dp)			1
				(2)

(Total 6 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)	mass / weight / amount / number of moles			1
	(surface) area / size (of chips)			1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b) (i)	3			1
	did not do experiment for 1 minute / did not record time / waited for bubbles to stop / waited for reaction to end	OWTTE		1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b) (ii)	two correct column headings: concentration (of acid) mass of gas lost/given off carbon dioxide/CO ₂	weight	amount	1
	two correct units: % g / grams			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b) (ii)	six values correctly inserted			2
				(4)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c) (i)	vertical scale of 1 cm rep 0.1 g			1
	six points correctly plotted			2
	(straight) line of best fit ignoring anomalous point			1
				(4)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c) (ii)	0.44 / 50 circled or otherwise identified			1
				(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c) (iii)	cotton wool not put in flask/ acid (spray) escaped acid too concentrated / too much acid temperature too high gas collected for longer than 1 minute malachite pieces smaller / bigger surface area			
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c) (iv)	vertical line from 70 % to line of best fit 0.47	between 0.46 and 0.48		1 1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (d) (i)	mass (of CO ₂ given off) increases as concentration (of acid) increases / mass (of CO ₂ given off) decreases as concentration (of acid) decreases direct proportion / equivalent wording such as "mass doubles when concentration doubles"			1 1
				(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (d) (ii)	more collisions between particles / equivalent wording such as "particles bump into each other more" correct reference to frequency or time, eg "collisions are more frequent", particles bump into each other more often", "more collisions in a given time"		references to energy	1 1
				(2)

(Total 21 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(i)	40.5	40,5 40.50 40,50	Any other answers	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(ii)	10.5 16.8	10.50 16.80	Any other answers	1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)(iii)	$\frac{100 \times 10.5}{16.8}$ 62.5 cq on 4(a)(ii)			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b) (i)	six points correctly plotted			2
	smooth curve of best fit			1
				(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b) (ii)	SEE NOTES			(1)
Notes	<ul style="list-style-type: none"> If a vertical line is drawn from the intersection (within 1 small square), then award mark if the answer is within 1 °C If no vertical line drawn from the intersection, then decide what the answer should be, and award mark if within 1°C Ignore °C 			

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)	(solubility) stays the same increase(d) decrease(d)	Any other answers with the same meaning, eg for "stays the same", accept unchanged, does not change, remains constant eg for "increased", accept bigger, greater, larger, more eg for "decreased", accept smaller, less, lower		1 1 1 (3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(i)	add ice (to the beaker or water) / cool the water in a fridge	use water from fridge put tube in ice	add ice to tube add ice to mixture add ice to salt add ice to solution do experiment in fridge do experiment in cold room	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d)(ii)	water boils at 100 (°C) / (120 °C is) above boiling point of water	Any answer with same meaning, eg boiling point of water is 100 °C this temperature is higher than the boiling point of water Accept boiling temperature, bp and bpt in place of boiling point	Any other answers	(1)

(Total 14 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (a)	Q / chlorine / Cl ₂ S / ammonia / NH ₃ T / hydrogen / H ₂ <i>Award 1 mark each for any two</i>	q s t	Cl H	(2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
5 (b)	P / carbon dioxide / CO ₂ R / sulphur dioxide / SO ₂	p r	Any other answers	1 1 (2)

(Total 4 marks)

PAPER TOTAL 50 MARKS

4437-09 Mark Scheme

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (a)	55 (g)		any other answer	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(i)	measuring cylinder	graduated cylinder	just 'cylinder'	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(ii)	68 (cm ³)		64	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (b)(iii)	18 (cm ³)	allow candidate's answer to (b)(ii) - 50 example (64 - 50 =) 64 (cm ³)		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(i)	3.1	or correct to 2 sig. fig. from candidate's answer to (b) (iii) and mass shown as any value other than 68 or correct calculation = 3.06 or from candidate's answer to (b) (iii) and mass shown as any value other than 68		2 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (c)(ii)	readings (of mass / volume) (only) to 2 sig. fig. (so) the calculation/density cannot be more accurate (than this)			1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (d)(i)	density is the same	or 'mass is (directly) proportional to volume' (2) marks		1
	the stones are the same type/rock /material /substance	or 'volume is (directly) proportional to mass' (2) marks		1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1 (d)(ii)	no because results not particularly precise	or words to that effect	do not credit 'yes' or just 'no'	1
	e.g. she read the volume to the nearest 5 g e.g the mass of stone P is really between 29.5 and 30.5 e.g. the density of stone P could be $30.5 \div 10.5$ (= 2.9 g/cm ³ to 2 sig. fig.)	accept any reasonably qualified comment or any other similar example		1 (2)

(Total 12 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(i)	torch with slit /ray box/ laser/light box /ray projector		just 'torch' just 'lamp'	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(ii)	mark two points (with a pencil) (and connect with a ruler)		just 'use a ruler'	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (a)(iii)	22 (degrees)		any other	

			response	(1)
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Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (b)	17 (degrees)		any other response	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(i)	appropriate headings	description of x e.g. angle between start and new position of mirror		1
	<u>all</u> in order	description of y e.g. angle between incident ray and reflected ray		1
	unit given as degrees	seen anywhere at least once and no contradiction example x measured in ° y measured in		1
		6 39 11 49 17 57 19 65 23 73 25 77		(3)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(ii)	both axes labelled			1
	x on the X axis and y on the Y axis			1
	all points plotted correctly i.e. to within 1 mm	incorrect (-1) each down to (0) for points		3
		a 'blob' (more than half a small square across is incorrect)		1
	17,57 identified as anomalous/unexpected			1
	straight line for the <u>other</u> points	do not give consequential		(7)

		credit for mistakes		
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Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2 (c)(iii)	67 (degrees)	correct reading from candidate's graph to within 1 mm (half a small square)		(1)

(Total 15 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (a)	to reduce heat loss (from the (small) beaker)	allow 'to stop/prevent heat loss' or to insulate the beaker	do not credit any suggestion of electrical insulation or prevention of breakage	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (b)	(gently) stir (the water before taking the temperature)			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(i)	5.4 6.8	5.40... 6.80...		1 1 (2)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(ii)	ammeter	ameter ametre	ampmeter a meter current meter	(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (c)(iii)	voltmeter	volt meter	Voltameter voltage meter	(1)

(Total 12 marks)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (a)	straight line drawn and instructions followed and point D marked			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (b)	instruction followed			(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (c)	instructions followed	must be labelled 'normal' and must point to 'l a' in the words 'oil and' or must be at 90° to the surface		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d) (i)	60 (degrees)	in the range 59 ↔ 61		(1)

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4 (d) (ii)	35 (degrees)	in the range 34 ↔ 36		(1)

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