

Mark Schemes Summer 2009

IGCSE

IGCSE Double Award Science (4437)

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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	Answer	Mark
1	(a) A;	1
	(b) A;	1
	(c) B;	1
	(d) D;	1
	(e) D;	1
	(f) D;	1
	(g) C;	1
		(7)

(Total 7 marks)

Question Number	Answer	Mark
4437 1F Q2(a)	more nitrates / nitrogen; protein / amino acids; growth; other named mineral eg Mg; function of mineral eg chlorophyll; Reject: nutrients	Max 2 (2)

Question Number	Answer	Mark
4437 1F Q2(b)(i)	choose parents / organism; desired characteristics eg stem length / increased yield; breed / mate; choose offspring; repeat;	Max 3 (3)

Question Number	Answer	Mark
4437 1F Q2(b)(ii)	milk yield / meat production / eq;	(1)

(Total 6 marks)

Question Number	Answer	Mark
4437 1F Q3(a)(i)	anther / stamen; stigma; petal;	(3)

Question Number	Answer	Mark
4437 1F Q3(a)(ii)	large petals / coloured petals; enclosed anthers/stamens; enclosed stigma;	Max 2 (2)

Question Number	Answer	Mark
4437 1F Q3(b)	transfer of pollen; by insect / wind / eq; from anther to stigma;	Max 2 (2)

(Total 7 marks)

Question Number	Answer	Mark
4437 1F Q4(a)(i)	water; carbon dioxide; oxygen;	(3)

Question Number	Answer	Mark
4437 1F Q4(a)(ii)	absorb / trap light / eq;	(1)

Question Number	Answer	Mark
4437 1F Q4(b)	destarch plant / eq; place in light; put in boiling/hot water; (boil in) ethanol; add iodine; blue / black;	Max 4 (4)

(Total 8 marks)

Question Number	Answer			Mark
4437 1F Q5(a)	Enzyme	large molecule broken down	small molecule produced	(6)
	Amylase	Starch;	Maltose;	
	Protease;	Proteins	amino acids;	
	Lipase	Lipid;	fatty acids;	

(Total 6 marks)

Question Number	Answer	Mark
4437 1F Q6(a)	Water / damp; oxygen; warmth / temperature; (allow) light;	Max 2 (2)

Question Number	Answer	Mark
4437 1F Q6(b)	5;	(1)

Question Number	Answer	Mark
4437 1F Q6(c)(i)	to produce clear beer / to remove debris / eq;	(1)

Question Number	Answer	Mark
4437 1F Q6(c)(ii)	to kill microorganisms / sterilise / stop fermentation / eq;	(1)

(Total 5 marks)

Question Number	Answer	Mark
4437 1F Q7(a)	low in numbers / risk of extinction / risk of dying out / eq;	(1)

Question Number	Answer	Mark
4437 1F Q7(b)	jellyfish in centre; arrows correct;	(2)

Question Number	Answer	Mark
4437 1F Q7(c)(i)	higher temp reduces time to hatch / eq;	(1)

Question Number	Answer	Mark
4437 1F Q7(c)(ii)	30 °C; Accept within a range of 29.9 - 30.1	(1)

Question Number	Answer	Mark
4437 1F Q7(d)(i)	29 °C; Accept within a range of 28.9 - 29.1	(1)

Question Number	Answer	Mark
4437 1F Q7(d)(ii)	24; 96; (allow one mark for 80:20 or for 96/24 wrong way round)	(2)

Question Number	Answer	Mark
4437 1F Q7(e)	eggs hatch early / eq; less developed (premature idea) / less time to develop / eq; fewer males / eq; less mating / less reproduction / eq;	(2)

(Total 10 marks)

Question Number	Answer	Mark
4437 1F Q8(a)(i)	vena cava; aorta;	(2)

Question Number	Answer	Mark
4437 1F 8(a)(ii)	Right atrium; left ventricle;	(2)

Question Number	Answer	Mark
4437 1F Q8(a)(iii)	(blood) to the lung / alveoli; collect oxygen / deoxygenated / release carbon dioxide;	(2)

Question Number	Answer	Mark
4437 1F Q8(b)	blockage or narrowing / eq; by fat / fatty deposit / cholesterol / eq; in arteries / coronary artery / aorta / blood vessels; less oxygen / less glucose; <u>anaerobic</u> respiration; lactic acid; heart attack / heart disease / angina / eq; nicotine / carbon monoxide; increased heart rate / high blood pressure / make heart work harder;	(5)

(Total 11 marks)

Question Number	Answer	Mark
4437 1F Q9(a)	increases / eq; levels /stays at 120 / stops increasing / constant / eq;	(2)

Question Number	Answer	Mark
4437 1F Q9(b)	100;; (one for 60 and 120 in working however expressed)	(2)

Question Number	Answer	Mark
4437 1F Q9(c)(i)	<u>anaerobic</u> respiration;	(1)

Question Number	Answer	Mark
4437 1F Q9(c)(ii)	more oxygen / repay oxygen debt; (more aerobic) respiration / less anaerobic respiration;	(2)

(Total 7 marks)

Question Number	Answer	Mark
4437 1F Q10(a)	nucleus; empty / enucleated; Ignore unfertilised mitosis; embryo; uterus / womb; same / identical; Ignore similar	(6)

Question Number	Answer		Mark
4437 1F Q10(b)	Animal	Sex chromosomes	(2)
	CopyCat’s mother	(XX)	
	The surrogate mother	XX;	
	Copycat	XX;	

(Total 8 marks)

PAPER TOTAL 75 MARKS

4437-2F MARK SCHEME

Question		Mark	Acceptable answers	Notes	Total
1	a	M1	7		1

Question		Mark	Acceptable answers	Notes	Total
1	b	M1	B / boron		1

Question		Mark	Acceptable answers	Notes	Total
1	c	M1	protons and neutrons		1

Question		Mark	Acceptable answers	Notes	Total
1	d	M1	10		1

Question		Mark	Acceptable answers	Notes	Total
1	e	M1	Po / polonium AND At / astatine		1

Question			Mark	Acceptable answers	Notes	Total
2	a		M1	white / off white		1
			M2	blue		1

Question			Mark	Acceptable answers	Notes	Total
2	b		M1	exothermic		1
			M2	hydration	Accept "exothermic" if neither "exothermic" nor "endothermic" for M1	1
			M3	endothermic	If M1 = endothermic, then M3 must be exothermic. If M2 = dehydration, then M4 must be hydration M3 and M4 can be in reverse order	1
			M4	dehydration		1

Question			Mark	Acceptable answers	Notes	Total
3	a		M1	nitrogen	M1 and M2 pair can be interchanged with M3 and M4 pair	1
			M2	Air / atmosphere		1
			M3	hydrogen		1
			M4	water /steam / H ₂ O / hydrocarbons / natural gas / crude oil / cracking of naphtha / methane		1

Question			Mark	Acceptable answers	Notes	Total
3	b		M1	range 100 - 350 atm / value within that range	Allow equivalent pressures in other units Unit needed for mark	1
			M2	range 350 - 500 °C / value within that range	Allow 623 – 773 K Unit needed for mark	1
					If no units in M1 and M2, award 1 mark if both within specified ranges.	

Question			Mark	Acceptable answers	Notes	Total
3	c		M1 M2	nitric acid ammonium nitrate ammonium sulphate urea ammonium phosphate	Any two for 1 each	2

Question			Mark	Acceptable answers	Notes	Total
4	a		M1	g		1
			M2	turns white / bleached / decolourised	Ignore references to red	1
			M3	colourless	Allow misty (fumes) Reject white	1
			M4	turns red / pink		1
			M5	colourless	Ignore clear	1
			M6	aq		1

Question			Mark	Acceptable answers	Notes	Total
4	b	i	M1	chlorine + sodium bromide → bromine + sodium chloride		1

Question			Mark	Acceptable answers	Notes	Total
4	b	ii	M1	displacement / redox / reduction / oxidation		1

Question			Mark	Acceptable answers	Notes	Total
4	c		M1	bromine less reactive than chlorine / chlorine more reactive than bromine / bromine is a poorer/weaker oxidising agent than chlorine / chlorine is a stronger/better/more powerful oxidising agent than bromine	Need reference to both elements Reject bromide and chloride	1

Question			Mark	Acceptable answers	Notes	Total
5	a		M1	$\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$	reactants	1
			M2		Products	1
					Additional incorrect balancing max 1	

Question			Mark	Acceptable answers	Notes	Total
5	b		M1	lilac	Reject pink / purple	1
			M2	yellow / orange	Reject any other colours	1
			M3	Cream/off white precipitate		1
			M4	silver bromide / AgBr		1
			M5	sodium nitrate / NaNO_3		1

Question			Mark	Acceptable answers	Notes	Total
6	a	i	M1	evaporates		1
		ii	M1	condenses		1
		iii	M1	lower		1
		iv	M1	lower		1

Question			Mark	Acceptable answers	Notes	Total
6	b		M1	gasoline / petrol / petroleum spirit		1
			M2	diesel (oil)		1

Question			Mark	Acceptable answers	Notes	Total
6	c		M1	octane + oxygen $\rightarrow$ carbon dioxide + water	reactants	1
			M2		products	1

Question			Mark	Acceptable answers	Notes	Total
6	d		M1	carbon monoxide / CO		1
			M2	correct statement about effect on blood / haemoglobin	Ignore suffocation / asphyxiation Not dependent on M1	1

Question			Mark	Acceptable answers	Notes	Total
E						
7			M1	zinc		1
			M2	more reactive (than iron)	Accept higher in reactivity series / very reactive / more reactive than metal underneath / reacts with air or water in preference to iron Reject rusts	1
			M3	copper		1
			M4	(good electrical) conductor	Ignore ductile / conductor of heat	1
			M5	iron / steel	Reject stainless steel / cast iron	1
			M6	strong	Accept hard / tough / durable Ignore malleable	1
					,6 dependent on M1,3,5 stainless steel given in M5, M6 c ed	

Question		Mark	Acceptable answers	Notes	Total
C					
8	a		M1	Fr / francium	1

Question		Mark	Acceptable answers	Notes	Total
C					
8	b		M1	NaF	1

Question			Mark	Acceptable answers	Notes	Total
C						
8	c		M1	cross in 2nd box	If crosses in more than 3 boxes, then deduct 1 mark for each wrong choice	1
			M2	cross in 5th box		1
			M3	cross in last box		1

Question		Mark	Acceptable answers	Notes	Total	
G						
8	d		M1	more reactive down the group / less reactive up the group	Allow easier to react instead of more reactive Allow harder to react instead of less reactive Allow specific example, eg xenon more reactive than argon	1

Question		Mark	Acceptable answers	Notes	Total
G					
9	a		M1	carbon and hydrogen (atoms)	1
			M2	only	1

Question		Mark	Acceptable answers	Notes	Total
G					
9	b		M1	only single bonds / no double bonds (between carbon atoms)	1

Question		Mark	Acceptable answers	Notes	Total
C					
9	c		M1	alkane(s)	1

Question		Mark	Acceptable answers	Notes	Total
E					
9	d		M1	two carbon atoms joined together by single bond	1
			M2	rest of structure correct	1
				Must show 6 single bonds to H atoms Dependent on M1	
				Ignore names, non-displayed and general formulae	

Question			Mark	Acceptable answers	Notes	Total
G						
9	e	i	M1	C ₄ H ₁₀	Allow H ₁₀ C ₄	1

Question			Mark	Acceptable answers	Notes	Total
G						
9	e	ii	M1	isomers		1

Question			Mark	Acceptable answers	Notes	Total
E						
9	f		M1	repeat unit showing single C-C bond and four C-H bonds	Accept one or any multiples, eg four carbon atoms	1
			M2	extension bonds and subscript n	Accept extension bonds as – or - Balancing for n must be correct CQ on M1	1

Question			Mark	Acceptable answers	Notes	Total
G						
10	a		M1	all green / green at bottom / green spreads out / water is green	more cloudy	1
			M2	crystals smaller/disappeared ' break up / disintegrate	Ignore dissolved	1
					act bubbles Ignore water level drops	

Question		Mark	Acceptable answers	Notes	Total
C					
10	b	M1	diffusion		1

Question		Mark	Acceptable answers		Notes	Total
E						
10	c		M1	colour spreads faster / more spread out / more is green / crystals dissolve faster / diffusion is faster	ect mention of reaction	1
			M2	particles/ions/molecules move faster/more energy	Ignore collisions	1

Question			Mark	Acceptable answers	Notes	Total
G						
10	d		M1	(add) sodium hydroxide (solution)	Accept other Group 1 hydroxide, eg potassium hydroxide Accept calcium hydroxide (solid) but not limewater	1
			M2	(test gas evolved with damp) red litmus paper	Allow UI or neutral litmus instead of red litmus	1
			M3	turns blue	Accept purple only if UI used Accept pH > 7 or specified pH only if UI used If definite statement that the indicator is put into solution then M3 cannot be scored	1
					M2 and M3 independent of M1	

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	Acceptable Answers	Extra Information	Mark
1 (a)	250 (metres)		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (b)	6 (minutes) Six		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)	C B A	correct order essential	1

Question Number	Acceptable Answers	Extra Information	Mark
1 (d)	5 (minutes) five (minutes)		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (e)	17 (minutes)		1

Question Number	Acceptable Answers	Extra Information	Mark
2 (a)	flat		1

Question Number	Acceptable Answers	Extra Information	Mark
2 (b)(i)	reflection	accept minor misspellings but not anything which could be refraction	1

2 (b)(ii)	$a = g$	accept $g = a$	1
2 (b)(iii)	normal	do not credit 'horizontal' or 'perpendicular'	1

Question Number	Acceptable Answers	Extra Information	Mark
2 (c)(i)	virtual (image)		1
2 (c)(ii)	rays/light (only) seem/appear to come from behind the mirror dop	or real rays/light do(es) not come from behind the mirror or cannot be seen on a screen or cannot touch the person behind mirror	1

Question Number	Acceptable Answers	Extra Information	Mark
3 (a)(i)	only the blade		1

Question Number	Acceptable Answers	Extra Information	Mark
3 (a)(ii)	(danger of) electric shock	accept 'electrocution' '(severe) burn'	1
3 (b)(i)	kettle/soldering iron/(electric) fire etc. accept any of a large variety of answers in which the heat is the useful output but not, for example '(electric) drill'	do not credit television do not credit lamp unless specified as an incandescent lamp (bulb)	1
3 (c)(i)	through the wire ignore reference to cap	do not credit any suggestion that the glass is part of the path	1
3 (c)(ii)	electrical heat/thermal / internal	correct order essential	1 1

Question Number	Acceptable Answers	Extra Information	Mark
3 (c)(iii)	increase		1

Question Number	Acceptable Answers	Extra Information	Mark
3 (c)(iv)	any two • if the current is too big • fuse wire will melt/circuit breaks • (so) appliance/wiring protected from overheating • fire risk reduced/removed	or if the circuit/wires/cable is overloaded do not credit prevents electric shock do not credit just 'safer' / 'less dangerous'	2

Question Number	Acceptable Answers	Extra Information	Mark
4 (a)(i)	wavelength		1
4 (a)(ii)	yellow ... blue	either order	1

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)(i)	frequency	allow for (1) if both correct	1
	wavelength	but order reversed	1

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)(ii)	infra-red /i.r. ultraviolet /u.v.	either order	1
4 (b)(iii)	speed velocity		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)(iv)	food/medical equipment	accept any appropriate example e.g. prawns/forceps	1
	germs/bacteria/microorganisms	accept any appropriate example e.g. streptococcus	1

Question Number	Acceptable Answers	Extra Information	Mark
5 (a)	(A) = B + C + D	accept lower case and any order	1

Question Number	Acceptable Answers	Extra Information	Mark
5 (b)	electrical		1
5 (c)	heat/thermal/internal		1

Question Number	Acceptable Answers	Extra Information	Mark
5 (d)	(efficiency =) $\frac{B}{A} (\times 100 \%)$ or any correct definition of efficiency	or (efficiency =) $B \div A (\times 100 \%)$ or (efficiency =) $\frac{B}{B + C + D} (\times 100 \%)$ or (efficiency =) $\frac{\text{useful output}}{\div (\text{total}) \text{ input}} (\times 100\%)$ or (efficiency =) $\frac{\text{useful energy}}{\div \text{kinetic energy}} (\times 100\%)$	1

Question Number	Acceptable Answers	Extra Information	Mark
6 (a)(i)	(in) parallel		1
6 (a)(ii)	otherwise they could not be switched (on and off) independently dop	or otherwise they would either all be off or all on do not credit unless part (a)(i) correct	1

Question Number	Acceptable Answers	Extra Information	Mark
6 (b)	mA	credit any unambiguous method used to identify the correct response	1

Question Number	Acceptable Answers	Extra Information	Mark
6 (c)(i)	current		1

Question Number	Acceptable Answers	Extra Information	Mark
6 (c)(ii)	cell battery rectified mains		1
6 (d)	alternating current	accept minor misspellings but do not credit 'alternative current'	1

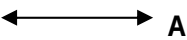
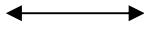
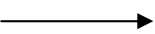
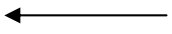
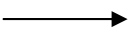
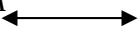
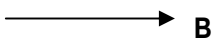
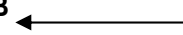
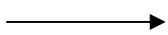
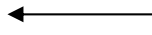
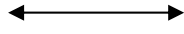
Question Number	Acceptable Answers	Extra Information	Mark
7 (a)(i)	electron(s)		1
7 (a)(ii)	neutron(s)		1
7 (a)(iii)	electron(s)		1
7 (a)(iv)	neutron(s) proton(s)	either order but both required	1

Question Number	Acceptable Answers	Extra Information	Mark
7 (b)(i)	(the) nucleus	accept 'the centre'	1

Question Number	Acceptable Answers	Extra Information	Mark
7 (b)(ii)	Geiger-Muller counter	deduct (1) each, up to (2) marks, for additional boxes ticked	1
	photographic film		1

Question Number	Acceptable Answers	Extra Information	Ignore	Mark
9(a)(i)	move hand further up and down or Increase size of vibration or increase A	owtte		1
9 (a)(ii)	change or reduce frequency (1) increase frequency/ decrease period hand (up and down) faster/more often	scores both marks	moves the chair closer uses rope of different length	2

Question Number	Acceptable Answers	Extra Information	Mark
9 (b)	Use of $v = f \times \lambda$ 1.5×0.8 $= 1.2 \text{ (m/s)}$	nwn	1 1 1

Question Number	Acceptable Answers	Reject	Mark
9 (c)(i)	 A A  seen anywhere along spring A  and  with at least one labelled	 A 	1
9 (c)(ii)	 B B  dop	unlabelled   	1

Question Number	Acceptable Answers	Extra Information	Mark
10 (a)	expands less <u>reduces</u> no ecf convection conduction ecf radiation ecf	 either order	1 1 1 1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
10 (b)	Use of $W = m \times g$ and/or $3\,500 \times 10 = 35\,000$ (N)	nwn allow use of 9.8 or 9.81 (34 300 or 34335)	1 1

Question Number	Acceptable Answers	Extra Information	Mark
11(a)(i)	Becquerel(s) Bequerel(s) Becuerel(s) Becqerel(s) Beckerel(s)		1

Question Number	Acceptable Answers	Extra Information	Mark
11 (a)(ii)	2 half lives 2 500 (Bq)	nwn 2 500 scores both marks	2

Question Number	Acceptable Answers	Ignore	Mark
11 (b)(i)	same number of protons atomic number element different number of neutrons nucleons mass number nucleon number dop	electrons particle molecule atom	2

Question Number	Acceptable Answers	Extra Information	Mark
11 (b)(ii)	<u>background</u> (radiation) <u>background</u> (activity) <u>background</u> (radioactivity)		1

Question Number	Acceptable Answers	Reject	Mark
11 (c)	tracer/leak detector dating smoke detector/fire alarm thickness or quality control/gauging crack detection sterilising/destroy bacteria ANY TWO	nuclear energy nuclear weapons	2

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	Answer	Mark
4437 4H Q1(a)	low in numbers / risk of extinction / risk of dying out / eq;	(1)

Question Number	Answer	Mark
4437 4H Q1(b)	jellyfish in centre; arrows correct;	(2)

Question Number	Answer	Mark
4437 4H Q1(c)(i)	higher temp reduces time to hatch / eq;	(1)

Question Number	Answer	Mark
4437 4H Q1(c)(ii)	30 (⁰ C); Accept within a range of 29.9-30.1	(1)

Question Number	Answer	Mark
4437 4H Q1(d)(i)	29 (⁰ C); Accept within a range of 28.9-29.1	(1)

Question Number	Answer	Mark
4437 4H Q1(d)(ii)	24; 96; (allow one mark for 96 24 / 20:80/eq)	(2)

Question Number	Answer	Mark
4437 4H Q1(e)	eggs hatch early / eq; less developed (premature idea) / less time to develop / eq; OR if graph (d) used fewer males / eq; reject no males less mating / less reproduction / eq;	(2)

(Total 10 marks)

Question Number	Answer	Mark
4437 4H Q2(a)(i)	vena cava; aorta;	(2)

Question Number	Answer	Mark
4437 4H Q2(a)(ii)	left ventricle;	(1)

Question Number	Answer	Mark
4437 4H Q2(a)(iii)	(blood) to lung / alveoli; obtain oxygen / oxygenated / release carbon dioxide/ de oxygenated eq;	(2)

Question Number	Answer	Mark
4437 4H Q2(b)	blockage / narrowing; blood vessels /arteries / coronary artery / aorta; fat / fatty deposit / cholesterol; less oxygen / less glucose; anaerobic respiration; lactic acid; heart attack / heart disease / angina/ heart stops /eq; nicotine / carbon monoxide; increased heart rate / high blood pressure / make heart work harder;	(5)

(Total 10 marks)

Question Number	Answer	Mark
4437 4H Q3(a)	increases / eq; levels / stays at 120 / stops increasing / constant / eq;	(2)

Question Number	Answer	Mark
4437 4H Q3(b)	100; (one for 60 and 120 in working however expressed)	(2)

Question Number	Answer	Mark
4437 4H Q3(c)(i)	anaerobic respiration;	(1)

Question Number	Answer	Mark
4437 4H Q3(c)(ii)	(more) oxygen / repay oxygen debt; (more) (aerobic) respiration / less anaerobic respiration;	(2)

(Total 7 marks)

Question Number	Answer	Mark
4437 4H Q4(a)	nucleus; empty / enucleated/ eq; Ignore unfertilised mitosis; embryo; uterus / womb; identical / same; Ignore similar	(6)

Question Number	Answer		Mark
4437 4H Q4(b)	Animal	Sex chromosomes	(2)
	CopyCat's mother	(XX)	
	The surrogate mother	XX;	
	Copycat	XX;	

(Total 8 marks)

Question Number	Answer	Mark
4437 4H Q5(a)	shape (oblong with an extension); cell labelled with at least two from nucleus, membrane, cell wall, cytoplasm, vacuole; max one if generalised cell	(2)

Question Number	Answer	Mark
4437 4H Q5(b)	osmosis; Ignore active transport high conc of water to low conc of water / eq; selectively permeable membrane / eq;	(2)

(Total 4 marks)

Question Number	Answer	Mark
4437 4H Q6(a)(i)	F;	(1)

Question Number	Answer	Mark
4437 4H Q6(a)(ii)	emulsifies / emulsification / small drops; lipid / fat / oil; large surface area; enzymes / lipase; neutralise acid / raise pH / <u>optimum</u> / alkaline / eq;	Max 4 (4)

Question Number	Answer	Mark
4437 4H Q6(b)(i)	<u>small</u> intestine / ileum / C;	(1)

Question Number	Answer	Mark
4437 4H Q6(b)(ii)	large surface area / microvilli; <u>capillaries</u> ; blood moves/circulates /eq; maintain concentration gradient; walls single cell thick / thin walls / short distance / (capillaries) close to wall; lacteal / lymph vessel; diffusion;	Max 4 (4)

(Total 10 marks)

Question Number	Answer	Mark
4437 4H Q7(a)(i)	parents: Nn and Nn; gametes: N and n and N and n; (gap, or, comma, circled must be visible) offspring: NN and Nn and Nn and nn; phenotypes no PKU, no PKU, no PKU and PKU; Allow not affected/affected / normal / abnormal eq Allow term carrier for Nn ECF 3 max	(4)

Question Number	Answer	Mark
4437 4H Q7(a)(ii)	$\frac{3}{4}$ / 3:1 / 75% / 3 in 4 / 0.75 / eq; No ECF	(1)

Question Number	Answer	Mark
4437 4H Q7(b)	diet lacking phenylalanine / dialysis / removal of phenylalanine /eq restrict / reduce protein in diet / gene therapy /eq ;	(1)

(Total 6 marks)

Question Number	Answer	Mark
4437 4H Q8(a)	shape; (3 bars reducing in size from bottom to top) allow smooth order; (trees then primary consumers then secondary consumers) names; (regardless of position)	(3)

Question Number	Answer	Mark
4437 4H Q8(b)	energy lost / used up / respiration / heat / movement / excretion / egestion / uneaten / indigestible / death / eq;;;;	(4)

(Total 7 marks)

Question Number	Answer	Mark
4437 4H Q9(a)	gene / DNA / allele; cut /eq; restriction (endonuclease) enzyme; plasmid; same restriction (endonuclease); ligase; join / stick / glue /eq; <u>recombinant DNA</u> ; vector; Agrobacterium / gene gun / virus;	(5)

Question Number	Answer	Mark
4437 4H Q9(b) (but only one reason asked)	more plants / lots of plants / eq /quicker / faster / same / identical / clones/ all have desired characteristic / eq;	(1)

(Total 6 marks)

Question Number	Answer	Mark
4437 4H Q10(a)	insulin pancreas; blood; liver; glycogen;	(5)

Question Number	Answer	Mark
4437 4H Q10(b)(i)	glucose normal / lower glucose level / glucose level only due to drink / food contains glucose / eq;	(1)

Question Number	Answer	Mark
4437 4H Q10(b)(ii)	starting / fasting level is within normal limits / eq; blood glucose level does not rise above 9 / rises to 8; blood glucose level falls (to normal levels); insulin released; allow converse for each point	Max 3 (3)

(Total 9 marks)

Question Number	Answer	Mark
4437 4H Q11(a)(i)	Iceland and Japan;	(1)

Question Number	Answer	Mark
4437 4H Q11(a)(ii)	13;; allow one for 130 or 100 and 30 in working	(2)

Question Number	Answer	Mark
4437 4H Q11(a)(iii)	amino acids / new cells / enzymes / tissues / muscle/ bone/ repair / membranes/ DNA / hormones/ antibodies/ eq;	(1)

Question Number	Answer	Mark
4437 4H Q11(b)(i)	remove waste / faeces / urine / eq; Ignore clean / disease / pollution oxygen / prevent stagnation / eq; respiration;	Max 2 (2)

Question Number	Answer	Mark
4437 4H Q11(b)(ii)	less wasted / all eaten / prevent oxygen depletion / less decomposition / less bacterial growth / eq;	(1)

Question Number	Answer	Mark
4437 4H Q11(c)	large fish / more growth / eq; from small amount of food / eq; economic benefit / eq;	Max 2 (2)

Question Number	Answer	Mark
4437 4H Q11(d)	(Intraspecific competition): no overcrowding / increase cage size / eq; separate sizes/ ages; Ignore gender supply enough food; (ONCE) (Interspecific competition): one species / type of fish per cage / stop other fish entering cage; (by) cover cage / size of mesh / use different cages / eq; eg separating species in different pens/cages = 2	Max 4 (4)

(Total 13 marks)

PAPER TOTAL 90 MARKS

4437-5H MARK SCHEME

Question			Mark	Acceptable answers	Notes	Total
1			M1	zinc		1
			M2	more reactive (than iron)	Accept higher in reactivity series / very reactive / more reactive than metal underneath / reacts with air or water in preference to iron Reject rusts	1
			M3	copper		1
			M4	(good electrical) conductor	Ignore ductile / conductor of heat	1
			M5	iron / steel	Reject stainless steel / cast iron	1
			M6	strong	Accept hard / tough / durable Ignore malleable	1
					,6 dependent on M1,3,5 ainless steel given in M5, M6 ed	

Question		Mark	Acceptable answers	Notes	Total
2	a		M1	Fr / francium	1

Question		Mark	Acceptable answers	Notes	Total
2	b		M1	NaF	1

Question			Mark	Acceptable answers	Notes	Total
2	c		M1	cross in 2nd box	If crosses in more than 3 boxes, then deduct 1 mark for each wrong choice	1
			M2	cross in 5th box		1
			M3	cross in last box		1

Question		Mark	Acceptable answers	Notes	Total	
2	d		M1	more reactive down the group / less reactive up the group	Allow easier to react instead of more reactive Allow harder to react instead of less reactive Allow specific example, eg xenon more reactive than argon	1

Question		Mark	Acceptable answers	Notes	Total
3	a		M1	carbon and hydrogen (atoms)	1
			M2	only	

Acceptable answers for Question 3a:

- Accept hydrocarbons described as compounds / molecules / substances
- Reject hydrocarbons described as elements
- Reject carbon and hydrogen described as molecules / compounds

Notes for Question 3a:

- Dependent on M1 containing carbon and hydrogen

Question		Mark	Acceptable answers	Notes	Total
3	b		M1	only single bonds / no double bonds (between carbon atoms)	1
				If single bonds alternative chosen, then must contain only / solely / alone or equivalent	

Question		Mark	Acceptable answers	Notes	Total
3	c		M1	alkane(s)	1

Question		Mark	Acceptable answers	Notes	Total
3	d		M1	two carbon atoms joined together by single bond	1
			M2	rest of structure correct	1
				Must show 6 single bonds to H atoms Dependent on M1	
				Ignore names, non-displayed and general formulae	

Question			Mark	Acceptable answers	Notes	Total
3	e	i	M1	C_4H_{10}	Allow $H_{10}C_4$	1

Question			Mark	Acceptable answers	Notes	Total
3	e	ii	M1	isomers		1

Question			Mark	Acceptable answers	Notes	Total
3	f		M1	repeat unit showing single C-C bond and four C-H bonds	Accept one or any multiples, eg four carbon atoms	1
			M2	extension bonds and subscript n	Accept extension bonds as – or - Balancing for n must be correct CQ on M1	1

Question		Mark	Acceptable answers	Notes	Total
G					
4	a		M1	all green / green at bottom / green spreads out / water is green	more cloudy 1
			M2	crystals smaller/disappeared / break up / disintegrate	Ignore dissolved 1
					act bubbles Ignore water level drops

Question		Mark	Acceptable answers	Notes	Total
C					
4	b		M1	diffusion	1

Question		Mark	Acceptable answers	Notes	Total
4	c		M1	colour spreads faster / more spread out / more is green / crystals dissolve faster / diffusion is faster	ect mention of reaction 1
			M2	particles/ions/molecules move faster/more energy	Ignore collisions 1

Question		Mark	Acceptable answers	Notes	Total
4	d		M1	(add) sodium hydroxide (solution)	Accept other Group 1 hydroxide, eg potassium hydroxide Accept calcium hydroxide (solid) but not limewater 1
			M2	(test gas evolved with damp) red litmus paper	Allow UI or neutral litmus instead of red litmus 1
			M3	turns blue	Accept purple only if UI used Accept pH > 7 or specified pH only if UI used If definite statement that the indicator is put into solution then M3 cannot be scored 1
					M2 and M3 independent of M1

Question			Mark	Acceptable answers	Notes	Total
5	a	i	M1	air	Accept atmosphere	1
			M2	water /steam / H ₂ O / natural gas / hydrocarbons / crude oil	Accept naphtha Reject sea water Ignore methane	1

Question			Mark	Acceptable answers	Notes	Total
5	a	ii	M1	$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$	all species correct	1
			M2		balancing Accept multiples Accept → instead of ⇌ dependent on M1 Ignore state symbols	1
					If all species correct but either or both of + and ⇌ missing than award M1 but not M2	

Question			Mark	Acceptable answers	Notes	Total
5	b		M1 M2 M3	increased decreased increased	Allow other words with similar meanings	3
			M4 M5	decreased decreased	Allow other words with similar meanings	2

Question			Mark	Acceptable answers	Notes	Total
5	c	i	M1	cooled / temperature decreased	pre-compressed	1
			M2	liquefied / condensed / becomes a liquid	Reject liquidised no references to melting and boils / fractional distillation	1

Question			Mark	Acceptable answers	Notes	Total
5	c	ii	M1	recycled / recirculated / put back into reactor	are used again	1

Question			Mark	Acceptable answers	Notes	Total
5	d	i	M1	ammonium sulphate		1
			M2	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$	formula of ammonium sulphate	1
			M3		everything correct Ignore state symbols M3 dep on M2	1

Question			Mark	Acceptable answers	Notes	Total
5	d	ii	M1	neutralisation / proton transfer / acid-base	Accept exothermic	1

Question			Mark	Acceptable answers	Notes	Total
6	a		M1	shared electron(s) (between atoms)	Reject between molecules	1

Question			Mark	Acceptable answers	Notes	Total
6	b		M1	weak forces between molecules / intermolecular forces	Accept correctly named inter forces (ie van der Waals' temporarily induced dipole attractions / London forces / forces Reject bonds between atoms / bonds breaking	1
			M2	little energy needed to overcome	M2 dependent on M1	1
					If neither M1 nor M2 scored, allow 1 mark for boiling point lower than room temperature/lower than 30 °C	

Question			Mark	Acceptable answers	Notes	Total
6	c		M1	dot-and-cross pair between O and both H atoms	Allow any combinations of dots and crosses	1
			M2	four other electrons around O AND no more electrons around H	Ignore inner shell of oxygen Element symbols not needed, but if wrong then no marks bonding electrons do not have to be shown M2 dependent on M1	1

Question			Mark	Acceptable answers	Notes	Total
6	d	i	M1	exothermic		1

Question			Mark	Acceptable answers	Notes	Total
6	d	ii	M1	negative / -		1

Question			Mark	Acceptable answers	Notes	Total
6	d	iii	M1	energy/heat needed to break bonds / bond breaking is endothermic		1
			M2	energy/heat released when bonds are formed / bond formation is exothermic		1
			M3	bonds in reactants are weaker than those in products / more energy released when bonds are formed than is needed to break bonds		1

Question			Mark	Acceptable answers	Notes	Total
6	e		M1	decreases / slower		1
			M2	decreases / closer	cept more tightly packed	1

Question			Mark	Acceptable answers	Notes	Total
6	f		M1	$\text{CuSO}_4(\text{s}) + 5\text{H}_2\text{O}(\text{l}) \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$	CuSO ₄ AND CuSO ₄ ·5H ₂ O both correct	1
			M2		H ₂ O AND consequentially correct balancing Accept ⇌ in place of →	1
			M3		All state symbols correct, dependent on correct formulae (including CuSO ₄ ·2H ₂ O etc)	1

Question			Mark	Acceptable answers	Notes	Total
7	a		M1	atoms of same element/with same atomic number /with same number of protons	Do not award M1 if no mention of atoms re same number of electrons Reject different number of electrons ect compounds / molec	1
			M2	different mass numbers / different numbers of neutrons	same mass number / atomic mass as contradiction of M2	1
					Accept amount / quantity in place of number	

Question			Mark	Acceptable answers	Notes	Total
7	b	i	M1 M2 M3	29 34 29 65	M1 is for BOTH 29 values M2 is for 34 M3 is for 65	1 1 1

Question			Mark	Acceptable answers	Notes	Total
7	b	ii	M1	$\frac{(63 \times 69) + (65 \times 31)}{100}$ OR $(63 \times 0.69) + (65 \times 0.31)$ OR $43.47 + 20.15$		1
			M2	63.6	CQ from their table values Ignore units Correct final answer to 1 dp scores 2 marks Correct final answer to wrong number of dp scores 1 mark (63.62)	1

Question			Mark	Acceptable answers	Notes	Total
7	c		M1	carbon / C		1
			M2	12	re position of 12 Ignore (relative) atomic mass	1

Question			Mark	Acceptable answers	Notes	Total
7	d		M1	same number of (outer) electrons / isoelectronic / same electronic configuration	Ignore reference to same number of protons ot award mark if no reference ber/amount/quantity etc	1

Question			Mark	Acceptable answers	Notes	Total
7	e		M1 M2	variable valency/oxidation state form coloured (compounds/solutions) form complexes / complex ions act as catalysts	Accept more than one combining power / differently charged ions / Cu ⁺ and Cu ²⁺ Any two for 1 mark each	2

Question			Mark	Acceptable answers	Notes	Total
7	f		M1	(from) green (solid) / colourless (solution)	re clear	1
			M2	(to) blue (solution)	Ignore pale / dark A single correct colour with no indication of whether it is the starting or final colour does not score either M1 or M2	1
			M3	$\text{CuCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$	reactants AND products AND correct balancing	1
			M4		all state symbols correct Dep on correct formulae in M3	1

Question			Mark	Acceptable answers	Notes	Total
7	g	i	M1	$\text{Cu}(\text{OH})_2$	cept $\text{Cu}(\text{H}_2\text{O})_4(\text{OH})_2$ ept correct formula in incorrec tion	1
			M2	blue	re pale Reject dark / royal / navy	1

Question			Mark	Acceptable answers	Notes	Total
7	g	ii	M1	precipitate dissolves / forms solution		1
			M2	dark/deep/royal/navy blue	Dark etc blue solution scores both marks even if precipitate mentioned as still present re inky	1

Question			Mark	Acceptable answers	Notes	Total
8	a		M1	filter / centrifuge and decant	Accept allow (precipitate) to settle and pour off water	1
			M2	wash / rinse		1
			M3	warm / heat / leave to dry/to evaporate/in warm place	Accept mention of drying with filter paper / Bunsen burner / hairdryer / oven	1
					M2 and M3 dependent on attempt at M1	

Question			Mark	Acceptable answers	Notes	Total
8	b	i	M1	$5.55 \div 111$		1
			M2	0.05	re units Correct answer scores both marks	1

Question			Mark	Acceptable answers	Notes	Total
8	b	ii	M1	0.05 / answer to (b)(i)	re units	1

Question			Mark	Acceptable answers	Notes	Total
8	b	iii	M1	136	re units	1

Question			Mark	Acceptable answers	Notes	Total
8	b	iv	M1	0.05×136 / answer to (b)(ii) x answer to b(iii)		1
			M2	6.8	Correct answer CQ on (b)(ii) and b(iii) scores both marks If (b)(ii) incorrect, accept 6.8 if evidence of using mass ratios Ignore units	1

PAPER TOTAL 90 MARKS

4437-6H MARK SCHEME

Abbreviations used in mark scheme:

OWTTE - or words to that effect

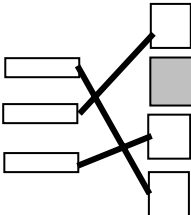
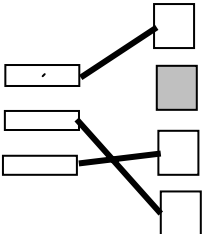
dop - depending on previous

ecf - error carried forward

ora - or reverse argument

sfs - start from scratch

UP - unit penalty

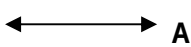
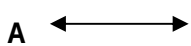
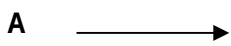
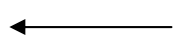
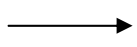
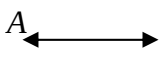
Question Number	Acceptable Answers	Reject	Mark
1 (a)	 or 	two lines going from one object or two lines going to one graph.	3

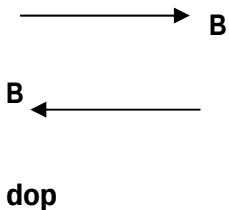
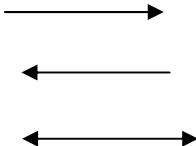
Question Number	Acceptable Answers	Mark
1 (b)(i)	force weight load mass F stress extension x strain distance elasticity length stretch <i>either order</i> <u>directly</u> dop	1 1

Question Number	Acceptable Answers	reject	Mark
1 (b)(ii)	(graph) D just the straight line	spring metal wire	1

Question Number	Acceptable Answers	Extra Information	Ignore	Mark
2 (a)(i)	move hand further up and down or Increase (size of) vibration or increase A	owtte		1
2 (a)(ii)	change or reduce frequency (1) increase frequency/ decrease period hand (up and down) faster/more often	scores both marks	moves the chair closer uses rope of different length	2

Question Number	Acceptable Answers	Extra Information	Mark
2 (b)	Use of $v = f \times \lambda$ 1.5×0.8 $= 1.2 \text{ (m/s)}$	nwn	1 1 1

Question Number	Acceptable Answers	Reject	Mark
2 (c)(i)	  seen anywhere along spring  and  with at least one labelled	 	1

2 (c)(ii)		unlabelled 	1
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Question Number	Acceptable Answers	Extra Information	Mark
3 (a)	expands less <u>reduces</u> no ecf convection conduction ecf radiation ecf	either order	1 1 1 1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
3 (b)	Use of $W = m \times g$ and/or $3\,500 \times 10 = 35\,000$ (N)	nwn allow use of 9.8 or 9.81 (34 300 or 34335)	1 1

Question Number	Acceptable Answers	Extra Information	Mark
4 (a)(i)	Becquerel(s) Bequerel(s) Becuerel(s) Becqerel(s) Beckerel(s)		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (a)(ii)	2 half lives / 2 divisions by 2 2 500 (Bq)	nwn 2 500 scores both marks	2

Question Number	Acceptable Answers	Ignore	Mark
4 (b)(i)	same number of protons atomic number element different number of neutrons nucleons mass number nucleon number dop	electrons particle molecule atom	2

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)(ii)	<u>background</u> (radiation) <u>background</u> (activity) <u>background</u> (radioactivity)		1

Question Number	Acceptable Answers	Reject	Mark
4 (c)	tracer/leak detector dating smoke detector/fire alarm thickness or quality control/gauging crack detection sterilising/destroy bacteria ANY TWO	nuclear energy nuclear weapons	2

Question Number	Acceptable Answers	Reject	Mark
5 (a)	variable resistance variable resistor	resistance resistor	1

	rheostat	thermistor	
5 (b)	rate charge or any named charged particle		1
5 (c)	coulomb(s) amp(ere)(s) sec(ond)(s)	C A s ignore quantity e.g charge	1 1 1
5 (d)(i)	electrons		1
5 (d)(ii)	negatively charged or attracted to positive or repelled from negative		1

Question Number	Acceptable Answers	Extra Information		Mark
6 (a)(i)	acceleration = $\frac{\text{change in velocity}}{\text{time (taken)}}$ $a = (v - u) / t$	or any correctly transposed version allow 'speed' instead of 'velocity'		1
6 (a)(ii)	correct pair of readings from the graph			1

	e.g. 45 m/s and 30 minutes			
	45/1800 = 0.025	45/30 = 1.5	45/0.5 = 90	1
	nwn	nwn	nwn	1
	m/s ²	m/s/min	m/s/h	

Question Number	Acceptable Answers	Ignore	Mark
6 (b)	50 <u>m/s</u> scores 2 marks or constant velocity steady speed uniform motion or not accelerating scores only 1 mark	terminal velocity	2 1
6 (c)	km or kilometre		1

Question Number	Acceptable Answers	Ignore	Mark
7 (a)(i)	weight/gravity is greater than friction/drag ora or downward force greater than upward force ora	upthrust	1
7 (a)(ii)	air resistance air friction drag	upthrust wind	1
7 (a)(iii)	increases (gets) bigger (gets) larger builds up		1

Question Number	Acceptable Answers	Reject	Mark
7 (a)(iv)	terminal velocity terminal speed		1

Question Number	Acceptable Answers	Extra Information	Mark
7 (b)(i)	(kinetic energy) = $\frac{1}{2}$ mass $\times$ speed ²	or (KE) = $\frac{1}{2}$ m v ² or any correctly transposed version	1
7 (b)(ii)	$32.4 = \frac{1}{2} \times 0.80 \times v^2$ $v = 9$ nwn m/s or metres/second	$v^2 = 81$ or $v = \sqrt{81}$ scores 1 st mark	1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
8 (a)	Use of $p_1V_1 = p_2V_2$		1
	$\frac{250 \times 450}{200}$		1
	= 560 (kPa)	562.5 scores 2	1
8 (b)	no change in temperature	or the gas does not get any hotter/cooler	1
	mass stays constant	or no gas escapes (from the gas-holder)	1
		<i>answers in either order</i>	

Question Number	Acceptable Answers	Reject	Mark
8 (c)	kilopascal(s)	kN/m ²	1
	1000 pascals	pascal	
	<i>any recognisable spelling</i>	ignore pressure	

Question Number	Acceptable Answers	Extra Information	Mark
9 (a)(i)	(GPE =)		1
	mass × acceleration due to gravity × height	or any correctly transposed version	
	mass × gravitational field strength × height		

	mass × gravity × height weight x height gravitational force (on mass) x height mgh		
9 (a)(ii)	$400 \times 10 \times 8$ = <u>32 000</u> (J) nwn	scores both marks	1 1
9 (a)(iii)	32 000 (J)	or candidate's answer for (a)(ii)	1

Question Number	Acceptable Answers	Extra Information	Mark
9 (b)(i)	<i>either (1)</i> short stopping time large deceleration or large negative acceleration force = mass x deceleration/acceleration or $F = m \times a$ or F is proportional to a	<i>or(2)</i> short stopping distance large amount of energy transferred work done = force x distance $W = F \times d$ <i>no mix and match (1) and (2)</i>	1 1 1
9 (b)(ii)	up(wards)		1

Question Number	Acceptable Answers	Extra Information	Mark
10 (a)	-273 0/zero	do not credit 273	1

Question Number	Acceptable Answers	Extra Information	Mark
10 (b)(i)	increases		1

	faster speeds up		
10 (b)(ii)	increases		1

Question Number	Acceptable Answers	Ignore	Mark
10 (c)	(average) (kinetic energy)doubles	pressure doubles	1

Question Number	Acceptable Answers	Reject	Mark
11 (a)	magnetic field electromagnetic field	field electric field magnetic force	1

Question Number	Acceptable Answers	Extra Information	Mark
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11 (b)	(Fleming's) left hand (rule)	Reject 'left hand grip rule'	1
	thumb - motion/movement/force first finger - (magnetic) field second finger - current	may be given either in writing or on a diagram but do not credit if there is a contradiction	1
	field from north/N to south/S or left to right <i>and</i> current from positive/+ to negative/- or downwards	may be given either in writing or on a diagram but do not credit if there is a contradiction	1

Question Number	Acceptable Answers	Extra Information	Mark
11 (c)	any one • increase the current or voltage • use a stronger/more powerful magnet • move magnets closer together • longer length of wire in the field • reduce the resistance/use a thicker wire	not : bigger magnet	1

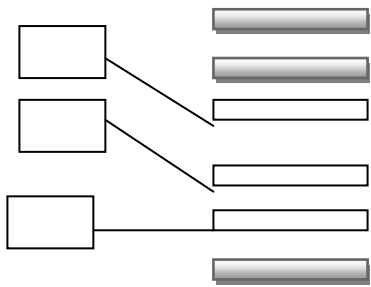
Question Number	Acceptable Answers	Extra Information	Mark
11 (d)	(loud)speaker headphones		1

Question Number	Acceptable Answers	Extra Information	Mark
12 (a)	path continues along the surface as a horizontal line to the right	arrow not essential but a contradictory arrow cancels the mark	1
12 (b)	<i>either</i> for refraction to take place the <u>angle</u> of incidence must be <u>smaller</u> than or equal to the critical angle or angle of incidence for which	<i>or</i> if the <u>angle</u> of incidence is <u>greater</u> than the critical angle (total internal) reflection will occur	1

	<u>angle</u> of refraction is 90 degrees.		
12 (c)	sine of = $\frac{1}{\text{refractive index}}$. critical angle	or $\sin c = \frac{1}{n}$ or any correctly transposed version	1

Question Number	Acceptable Answers	Extra Information	Mark
12 (d)(i)	it will be (totally internally) <u>reflected</u> (towards the sea- bed)	allow minor misspellings but do not credit any word which could just as well be refracted	1
12 (d)(ii)	total internal reflection	all three words essential allow minor misspellings but do not credit any word which could just as well be refraction	1

Question Number	Acceptable Answers	Extra Information	Mark
12 (e)	continued in a straight line and reflected at the <u>inside face</u> of the optical fibre two, three or four reflections seen in total	angle of incidence = angle of reflection as judged by eye further arrows not essential but a contradictory arrow loses a mark	1 1

Question Number	Acceptable Answers	Extra Information	Mark
13 (a)		if more than one arrow links a feature or an observation box do not credit either arrow	1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
13 (b)	${}^4_2\text{He}$	must be correct in every detail	1

Question Number	Acceptable Answers	Extra Information	Mark
13 (c)(i)	${}^{14}_7\text{N} + {}^0_{-1}\text{e}$	must be correct in every detail	1
13 (c)(ii)	beta/ β (radiation) electrons are emitted <i>independent marks</i>		1 1

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	Answer		Mark
1(a)(i)	Name of apparatus	Letter of apparatus	(4)
	Bunsen burner	D;	
	Tripod	C;	
	Crucible	A;	
	Gauze	B;	

Question Number	Answer	Mark
1(a)(ii)	protect <u>eyes</u> / eq;	(1)

Question Number	Answer	Mark
1(b)	oven / dryer / heat / in dry area / drying agent / eq; time / until constant mass / leave longer (until dry);	(2)

Question Number	Answer	Mark
1(c)	5.0;; one mark in working for 2.0 - 1.9 or 0.1	(2)

Question Number	Answer	Mark
1(d)(i)	2.4 / sample 5 for sandy beach;	(1)

Question Number	Answer	Mark
1(d)(ii)	seaweed / (more) plants / dog faeces / human error / confusion with other samples / still wet / eq;	(1)

Question Number	Answer	Mark
1(d)(iii)	(more) leaves / idea of more plants;	(1)

(Total 12 marks)

Question Number	Answer	Mark
2(a)	finger on wrist/neck/pressure point / use inflated cuff idea; watch / clock / eq;	(2)

Question Number	Answer	Mark
2(b)(i)	names of <u>four</u> students; pulse / heart rate / bpm; rest + 10 (sit ups) + 20 (sit ups); correct values in table;	(4)

Question Number	Answer	Mark
2(b)(ii)	oxygen; glucose; respiration; ATP / energy; muscles / cells / tissues; Ignore body	max (3)

Question Number	Answer	Mark
2(c)	More accurate / closer to true value / eq; heart rate slows / eq; Allow converse eg higher in first 15s less chance of (counting) error / eq;	max (2)

(Total 11 marks)

Question Number	Answer	Mark
3(a)	S scale at least half of each axis + linear; L line straight + through points; A axes correct; A labelled conc (%) + time (s); P points plotted accurately;;	(5)

Question Number	Answer	Mark
3(b)(i)	as enzyme conc. increases time taken decreases; Allow converse Reject as time increases conc. decreases	(1)

Question Number	Answer	Mark
3(b)(ii)	breakdown/digestion (protein/paste) / more collisions; liquid/fluid/watery/runny / more soluble / eq;	(2)

Question Number	Answer	Mark
3(c)	temperature / pH / time of mixing / time to pour / <u>volume</u> of (enzyme) solution / size of funnel;; Ignore mass of jelly/paste	(2)

Question Number	Answer	Mark
3(d)	0.5g in 100 cm ³ / 1g in 200cm ³ / eq; or take stated volume of 1.00 % solution + add same stated volume of water / eq;	(1)

(Total 11 marks)

Question Number	Answer	Mark																					
4(a)(i)	<table border="1"> <thead> <tr> <th>Type of animal</th><th>Tally</th><th>Total number caught</th></tr> </thead> <tbody> <tr> <td>Ant</td><td> </td><td>8</td></tr> <tr> <td>Beetle</td><td> </td><td>20</td></tr> <tr> <td>Slug</td><td> </td><td>8</td></tr> <tr> <td>Spider</td><td> </td><td>4</td></tr> <tr> <td>Woodlouse</td><td> </td><td>22</td></tr> <tr> <td></td><td></td><td></td></tr> </tbody> </table> tally ;;;;; number transfer ;	Type of animal	Tally	Total number caught	Ant		8	Beetle		20	Slug		8	Spider		4	Woodlouse		22				(6)
Type of animal	Tally	Total number caught																					
Ant		8																					
Beetle		20																					
Slug		8																					
Spider		4																					
Woodlouse		22																					

Question Number	Answer	Mark
4(a)(ii)	used 10 traps / repeated trapping / many traps / eq;	(1)

Question Number	Answer	Mark
4(a)(iii)	at night: wet / less risk of drying out / eq; avoid predators / eq; more food / prey / feed / eq; cool / eq; hard to see trap; Ignore more active	(2)

Question Number	Answer	Mark
4(b)	(yes) dead animals cannot escape / dead carnivores cannot eat other animals; or (no) adverse reason for killing eg cruel / not right / inhuman / unnecessary / disrupt food chain / cannot escape / put off by detergent / eq;	(1)

(Total 11 marks)

Question Number	Answer	Mark
5	C seeds sown at different distances apart; O same species of seed / same age / eq; R repeat; Ignore many seeds at each distance M1 (growth measured) mass / length / height / no of leaves / eq; M2 ref to time; S1 + S2 same LI / water / soil / temperature / fertiliser / nutrients / pH / eq;;	(6)

(Total 6 marks)

PAPER TOTAL 50 MARKS

4437-08 MARK SCHEME

Question			Mark	Acceptable answers	Notes	Total
1	a		M1	thermometer		1
			M2	condenser		1
			M3	round bottom flask		1
			M4	Bunsen (burner)		1
			M5	tripod		1

Question			Mark	Acceptable answers	Notes	Total
1	b		M1	thermometer / A		1

Question			Mark	Acceptable answers	Notes	Total
1	c		M1	cross in first box		1

Question			Mark	Acceptable answers	Notes	Total
2	a		M1	base line in ink/not in pencil		1
			M2	will interfere with results/run / smudge / will produce different colours / will move up paper/dissolve/mixed up with samples	Dependent on M1	1
			M3	water level too high / water too high / base line/spots under water /too much water / paper too low		1
			M4	ink will mix with water / dissolve in water / wash off paper/smudge/diffuse into water	Dependent on M3	1

Question			Mark	Acceptable answers	Notes	Total
2	b	i	M1	3		1

Question			Mark	Acceptable answers	Notes	Total
2	b	ii	M1	red AND green (in either order)	Do not award mark if yellow or blue are included	1

Question			Mark	Acceptable answers	Notes	Total
2	b	iii	M1	blue		1
			M2	did not move/ did not spread/ stayed on base line / not affected by water	Dependent on M1 Ignore does not separate	1

Question			Mark	Acceptable answers	Notes	Total
2	c	i	M1	2.1 – 2.4 cm / 21 – 24 mm		1
			M2	5.6 to 5.7cm/56 to 57mm		1
			M3	unit correct ONCE		1

Question			Mark	Acceptable answers			Notes	Total
2	c	ii	M1	red dist	solvent dist	R _f	CO on values in (c)(i) Ignore units	1
				2.1	5.6	0.375		
				2.2	5.6	0.392857143		
				2.3	5.6	0.410714286		
				2.4	5.6	0.428571429		
				2.1	5.7	0.368421053		
				2.2	5.7	0.385964912		
				2.3	5.7	0.403508772		
				2.4	5.7	0.421052632		
				1 or more sig figs				

Question		Mark	Acceptable answers	Notes	Total
3	a		M1 volume of acid M2 concentration of acid <u>starting</u> temperature (of acid) particle size/surface area/form of magnesium hydroxide stir same speed / stir in same way / stir for same time	ignore “amount of acid”– but if no other mark awarded give 1 mark for “amount of acid” not just “keep temp the same” – ignore, neutral reject mass of $Mg(OH)_2$ reject record maximum temperature after same length of time.	2

Question		Mark	Acceptable answers	Notes	Total
3	b		M1 insulate / use polystyrene cup/ wrap in (named) insulation /lid eg cotton wool / bubble wrap / mineral wool accept digital thermometer/ thermometer that has smaller divisions (may be specified)	ignore methods of measuring volume / finding mass / stirring	1
			M2 Reduces (accept “prevents”) heat loss / poor conductor (of heat) (Temperature) more accurate (allow “precise”) / read to more decimal places	Reject keeps temperature constant M2 dependent on M1	1

Question			Mark	Acceptable answers	Notes	Total
3	c		M1	21.5 21 ½		1
			M2	55(.0)		1
			M3	33.5 33 1/2	CQ on M1 and M2	1

Question			Mark	Acceptable answers	Notes	Total
3	d		M1 M2	7.5	Award 2 marks for 7.5 Award 1 mark for 7.53 LOOK IN THE TABLE	2

Question			Mark	Acceptable answers	Notes	Total
3	e		M1	too much (accept excess) magnesium hydroxide used magnesium hydroxide bigger surface area /smaller bits starting temperature of acid too high acid too concentrated	Reject volume of acid too big. Ignore non directional changes, reject wrong directional changes.	1

Question			Mark	Acceptable answers	Notes	Total
3	f		M1	2.5 (g)		1

Question			Mark	Acceptable answers	Notes	Total
3	g	i	M1 M2	all points plotted correctly	Tolerance of half small square Deduct 1 mark for each error	2
			M3	straight line through first 4 points	not freehand	1
			M4	straight line through last three points	ignore portion between 2g and 2.5g	1

Question			Mark	Acceptable answers	Notes	Total
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3	g	ii	M1	goes up	temp increase (directly) proportional to mass gets M1 and M3 "they are proportional" is not sufficient for either M1 or M3	1
			M2	goes down	ignore references to where temperature increase ends/decrease starts	1
			M3	increase is (directly) proportional (can be expressed either way round) / decrease more slowly than increase	accept "goes up quickly and down slowly" or similar. "goes down slowly" without reference to increasing quickly is not sufficient.	1

Question			Mark	Acceptable answers	Notes	Total
4	a	i	M1	y-axis labelled (mass or g) and mass scale correct (4 cm rep 0.1 g)units not required	units on axis do not replace mass / volume labels	2
			M2	x-axis labelled (volume or cm³) and volume scale correct (1 cm rep 1 cm³)units not required	scales on each axis must consist of two or more numbers (one of which can be zero).	

Question			Mark	Acceptable answers	Notes	Total
4	a	ii	M1	A correct volume reading from either part of line (2.5 or 8.5/8.6)	units not required, but penalise wrong units once in M1 and M2	1
			M2	Correct units (cm ³)	Independent of M1	1
			M3	some CORRECT indication on graph for any one reading	correct construction with wrong value read off still scores M3	1

Question			Mark	Acceptable answers	Notes	Total
4	a	iii	M1	more readings between 4 and 6 cm ³ /around 5 / repeat between 4 and 6/around 5 smaller intervals between specified volumes as above accept list of suitable values. Accept answers based on more values around suitable mass of precipitate	Not just more readings or repeat not just “add 0.1cm ³ at a time” – must give indication of volume limits.	1

Question			Mark	Acceptable answers	Notes	Total
4	b		M1	weigh filter paper	can be implied (such as “use a filter paper of known mass” or after M4 “subtract the mass of the filter paper”)	1
			M2	filter		1
			M3	wash and dry	ignore how it is dried – an attempt at drying after washing is what is required	1
			M4	reweigh filter paper (with ppt)	M4 can only be awarded if the precipitate has been obtained by filtering	1
			M1	filter / centrifuge and decant		

			M2	wash and dry	ignore how it is dried – an attempt at drying after washing is what is required	
			M3	remove from filter paper / remove from centrifugation tube	this cannot be implied – it must be clear the precipitate is removed from the paper	
			M4	weigh (ppt)	M4 can only be awarded if the precipitate has been obtained, by filtering or centrifuging and decanting	

Question			Mark	Acceptable answers	Notes	Total
4	c	i	M1	zinc has the same results / metal could be zinc		1

Question			Mark	Acceptable answers	Notes	Total
4	c	ii	M1	add ammonia (solution) to excess /		1
			M2	White / precipitate (does not dissolve/remains)	M2 dependent on M1	1

PAPER TOTAL 50 MARKS

4437-09 Mark Scheme

Question Number	Acceptable Answers	Extra Information	Mark
1 (a)(i)	1.12 (seconds) 1.12 1.12 s		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (a)(ii)	1. getting less with time reaction time gets quicker each time getting less left to right They are all the same within the range 0.22 to 0.15 Reject they are all the same	1	2
	2. starting and stopping at will not having to react as he is the one starting the process It is not a reaction to something happening only tests how quickly he can move his finger Reject watch has a time lag	1	

Question Number	Acceptable Answers	Extra Information	Mark
1 (b)	12.5		1
	30 – 12.5	Correct subtraction from 30	1
	= 17.5		1
	Correct final answer with no working gets three marks		

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)(i)	7/seven		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)(ii)	7×0.02 $= 0.14 \text{ (s)}$ 8×0.02 scores 0/2 7×0.2 scores 0/2		1 1

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)(iii)	dots getting further apart gaps getting bigger(and bigger) dots at start closer than dots at end		1

Question Number	Acceptable Answers	Extra Information	Mark
1 (c)(iv)	0.19 s ecf Allow tolerance of $\pm 0.005 \text{ s}$ Allow correct time (0.19) if distance not written down. No credit for wrong time if distance not written down		1

Question Number	Acceptable Answers	Extra Information	Mark
2 (a)(i)	87 87 g 87 grams/grammes 0087	reject 86.73	1

Question Number	Acceptable Answers	Extra Information	Mark
2 (a)(ii)	- wrong units/ balance shows mass (not force) - difficult to exert same force each time - balance needs constant not momentary force/force changes as key is pressed	ANY TWO	2

Question Number	Acceptable Answers	Extra Information	Mark
2 (b)(i)	1.6 (May be on diagram) $1.6 \times 1.6 = 2.56/ 2.6$		1 1

Question Number	Acceptable Answers	Extra Information	Mark
2 (b)(ii)	0.73 /2.56 ecf for area = 0.28/0.281/0.285/0.29 2 or 3 s.f.		1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
2 (b)(iii)	Link to sf in raw data Ignore answer in terms of dp ignore description of rounding 0.29 is 3sf does not score Allow same number of figures as force (because 0.73 is the least accurate item of data) Have same margin of accuracy as data		1

Question Number	Acceptable Answers	Extra Information	Mark
3 (a)	3.6		1

Question Number	Acceptable Answers	Extra Information	Mark
3 (b)(i)	27	Working not required for mark	1

Question Number	Acceptable Answers	Extra Information	Mark
3 (b)(ii)	one reading/There is an anomalous result/ 52 taken for 2 minutes/ more than a minute DOP	Ignore distance changed Ignore another source was present	1 1

Question Number	Acceptable Answers	Extra Information	Mark
3 (c)(i)	6 / 0 to 6 (cm)		1

Question Number	Acceptable Answers	Extra Information	Mark
3 (c)(ii)	- Find background count - Place detector close to/touching source - Record counts (in one minute) / measure count rate/ measure counts per minute - Repeat for other distances - Note distance when/until count rate is about background count/ 27 - Deduct background count from readings - Reference to valid safety aspect Failure to refer to background will score points 2, 3, 4 and 7 only	ANY FIVE Reject if candidate claims real count can become zero	5

Question Number	Acceptable Answers	Extra Information	Mark
3 (d)(i)	Using tweezers to handle the radioactive source		1

Question Number	Acceptable Answers	Extra Information	Mark
3 (d)(ii)	• In darkroom could not locate source/light makes no difference (to decay rate) • Fans make no difference • Alpha particles only travel short distance in air. No need for lead screen. Reject answer about tweezers	Any two points	2

Question Number	Acceptable Answers	Extra Information	Mark
4 (a)	ammeter/cell/rheostat (any missing 0/2) working series circuit	Allow any symbol that could represent a power source Allow switch Any resistor or lamp or LED loses second mark	1 1

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)(i)	rule ruler metre rule metre ruler metre stick measuring tape		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (b)(ii)	Measure or set L and measure I move slider and note L and I further repeats Note that to gain three marks the values for both length and current must be recorded more than twice Examples Measure length and Increase L by 1 cm each time and record I for each distance (3 marks) Move slider several times noting L and I (3 marks) Measure L and I, record I for different lengths (2 marks) Take reading of I at 0 cm move 1cm at a time reading I each time (3 marks)		1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
4 (c)	.15 0.15 0.150		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (d)(i)	column headings units readings in order First Mark Amps/I/A/Current and Distance/length/ L second mark both units seen once somewhere Third mark readings ascending or descending but loses mark if one or more wrong		1 1 1

Question Number	Acceptable Answers	Extra Information	Mark
4 (d)(ii)	plots within ± 1 mm no blobs >1mm label both axes with units	2 marks -1 each wrong 1	 3

Question Number	Acceptable Answers	Extra Information	Mark
4 (d)(iii)	circle (the candidates) 6, 0.14		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (d)(iv)	curve Dot to dot with or without benefit of ruler 0/1 Curve taking in 6, 0.14 0/1		1

Question Number	Acceptable Answers	Extra Information	Mark
4 (d)(v)	measured L from wrong end	Reference to inaccurate measurements do not score	1

Question Number	Acceptable Answers	Extra Information	Mark
4 (e)	high current/overheat/higher percentage uncertainty examples Current too high for this ammeter Ammeter scale too small Reading would be more than 0.5A Result too large to plot on the graph		1

PAPER TOTAL 50 MARKS

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