

# Mark Scheme November 2007

IGCSE

## IGCSE Science (Double Award) (4437)

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November 2007

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**SCIENCE (DOUBLE AWARD) 4437, November 2007, MARK SCHEME**

**Key**

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

**Paper 1F**

Question Number	Question		
<b>1</b>			
	Acceptable Answers	Reject	Mark
	(a) A/ flower;		1
	(b) A/ animal;		1
	(c) D/ photosynthesis;		1
	(d) B;		1
	(e) C/3;		1
	(f) B/ the small intestine;		1
	(g) A/ XY and XX;		1
	<b>Notes</b>		
			<b>(10)</b>

**Total 10 marks**

Question Number	Question		
<b>2</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	respiration; photosynthesis; feeding;		
	<b>Notes</b>		
			<b>(3)</b>

Question Number	Question		
<b>2</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	oxygen / O <sub>2</sub> ;		
	<b>Notes</b>		
			<b>(1)</b>

**Total 4 marks**

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject Mark
	A = renal artery; B = renal vein; C = ureter;	(3)

Question Number	Question	
3	(b)	
	Acceptable Answers	Reject Mark
	urine / urea / salts;	(1)

Question Number	Question	
3	(c)	
	Acceptable Answers	Reject Mark
	(i) Two from: increases / eq.; less ADH; lots of water in the blood; less water reabsorbed;	2
	(ii) Two from: decreases / eq.; more ADH; less water in blood; sweating;	2
		(4)

Total 8 marks

Question Number	Question	
4	(a)	
	Acceptable Answers	Reject Mark
	Three from: receptor and effector stimulus response ;;;	(3)

Question Number	Question																
4	(b)																
	Acceptable Answers	Mark															
	<table border="1"> <thead> <tr> <th>Description</th><th>Hormones</th><th>Nerves</th></tr> </thead> <tbody> <tr> <td>Response is fast</td><td>Yes</td><td>No</td></tr> <tr> <td>Response lasts a long time</td><td>Yes</td><td>No</td></tr> <tr> <td>Are specialised cells</td><td>No</td><td>Yes</td></tr> <tr> <td>Are carried in blood stream</td><td>Yes</td><td>No</td></tr> </tbody> </table>	Description	Hormones	Nerves	Response is fast	Yes	No	Response lasts a long time	Yes	No	Are specialised cells	No	Yes	Are carried in blood stream	Yes	No	(3)
Description	Hormones	Nerves															
Response is fast	Yes	No															
Response lasts a long time	Yes	No															
Are specialised cells	No	Yes															
Are carried in blood stream	Yes	No															

Question Number	Question	
4	(c)	
	Acceptable Answers	Reject Mark
	adrenaline / insulin / testosterone / progesterone / oestrogen; adrenal glands / pancreas / testes / ovaries; increase heart rate ;	(3)

Question Number	Question	
4	(d)	
	Acceptable Answers	Reject Mark
	Two from: grow; towards light / positive; phototropism; auxin;	(2)

Total 11 marks

Question Number	Question	
5	(a)	
	Acceptable Answers	Reject Mark
	Three from: kill; pests / insects / organisms; less damage / less crop eaten; better yield / eq;	(3)

Question Number	Question	
<b>5</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	(i) suitable example; target organism;	2
	(ii) <b>Two</b> from: specific / does not affect other organisms / eq.; does not need to be reapplied; does not pollute / not poisonous;	2
		<b>(4)</b>

Question Number	Question	
<b>5</b>	<b>(c)</b>	
	Acceptable Answers	Reject Mark
	resistance to pests / eq.;	
		<b>(1)</b>

**Total 8 marks**

Question Number	Question	
<b>6</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	C; B; A;	
		<b>(3)</b>

Question Number	Question	
<b>6</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	(i) alveoli; capillaries / blood;	2
	(ii) water; capillaries / blood;	2
		<b>(4)</b>

**Total 7 marks**

Question Number	Question	
<b>7</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	(i) periwinkle/ (bank) vole;	1
	(ii) sun / light;	1
		<b>(2)</b>

Question Number	Question		
<b>7</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	4 links / eq, e.g. longer/more organisms/more consumers/ref tertiary consumer; they do not start with a producer / start with dead organisms;		(2)
Question Number	Question		
<b>7</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	bacteria; fungi;		2 (2)

**Total 6 marks**

Question Number	Question		
<b>8</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	lens;		(1)
Question Number	Question		
<b>8</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	(i) light doesn't pass through easily / is scattered / eq; not focussed / not on retina / eq.;		2
	(ii) Nn and nn; N n and n n; Nn Nn nn nn; cloudy clear;		4 (6)

**Total 7 marks**



Question Number	Question	
9	(a)	
	Acceptable Answers	Mark
	A nucleus; genetic material/control cell activities; B cytoplasm; chemical reactions/metabolism/respiration/eq;	(4)

Question Number	Question	
9	(b)	
	Acceptable Answers	Reject Mark
	digested / killed / destroyed / eq; enzymes / named enzyme;	(2)

Question Number	Question	
9	(c)	
	Acceptable Answers	Reject Mark
	50%; (one mark for 3500 in working)	(2)

Total 8 marks

Question Number	Question																
10																	
	Acceptable Answers		Mark														
	<table><thead><tr><th>Step</th><th>Order of step</th></tr></thead><tbody><tr><td>select early flowering offspring plants</td><td>4;</td></tr><tr><td>allow seeds from early flowering plants</td><td>3;</td></tr><tr><td>select early flowering plants</td><td>(1)</td></tr><tr><td>grow early flowering offspring plants</td><td>(5)</td></tr><tr><td>repeat the process for several generations</td><td>6;</td></tr><tr><td>collect seeds from early-flowering plants</td><td>2;</td></tr></tbody></table>	Step	Order of step	select early flowering offspring plants	4;	allow seeds from early flowering plants	3;	select early flowering plants	(1)	grow early flowering offspring plants	(5)	repeat the process for several generations	6;	collect seeds from early-flowering plants	2;		(4)
Step	Order of step																
select early flowering offspring plants	4;																
allow seeds from early flowering plants	3;																
select early flowering plants	(1)																
grow early flowering offspring plants	(5)																
repeat the process for several generations	6;																
collect seeds from early-flowering plants	2;																

Total 4 marks



**Paper 2F**

Question Number	Question		
<b>1</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	8		
	Notes		<b>(1)</b>

Question Number	Question		
<b>1</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	6		
	Notes		<b>(1)</b>

Question Number	Question		
<b>1</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	Si		
	Notes		<b>(1)</b>

Question Number	Question		
<b>1</b>	<b>(d)</b>		
	Acceptable Answers	Reject	Mark
	N		
	Notes		<b>(1)</b>

Question Number	Question		
<b>1</b>	<b>(e)</b>		
	Acceptable Answers	Reject	Mark
	6		
	Notes		<b>(1)</b>

**Total 5 marks**

Question Number	Question		
<b>2</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	Protons / electrons		
	Notes		<b>(1)</b>

Question Number	Question		
<b>2</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	Neutrons		
	Notes		<b>(1)</b>

Question Number	Question		
<b>2</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	Elements		
	Notes		<b>(1)</b>

Question Number	Question		
<b>2</b>	<b>(d)</b>		
	Acceptable Answers	Reject	Mark
	Compounds		
	Notes		<b>(1)</b>

Question Number	Question		
<b>2</b>	<b>(e)</b>		
	Acceptable Answers	Reject	Mark
	Electrons		
	Notes		<b>(1)</b>

Question Number	Question	
2	(f)	
	Acceptable Answers	Reject
	Carbon	
	Notes	
		(1)

Total 6 marks

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject
	s l aq g	
	Notes 4 correct = 2, 3/2 correct = 1 and 1/0 correct = 0.	(2)

Question Number	Question	
3	(b)	
	Acceptable Answers	Reject
	<ul style="list-style-type: none"> <li>Fizzing/effervescence/bubbles</li> <li>Moves/darts about</li> <li>Gets smaller /Disappears</li> <li>Floats</li> </ul>	Reference to flames. Reject 'dissolves'
	Notes Max 2.	
		(2)

Question Number	Question	
3	(c)	
	Acceptable Answers	Reject
	(add) red litmus/universal indicator turns blue. Allow 'purple' for UI	
	Notes	
		(2)

Total 6 marks

Question Number	Question		
4	(a)		
	Acceptable Answers	Reject	Mark
	brown / red-brown/ orange-brown/ foxy brown  <b>Notes</b>	Rusty Orange Red	(1)

Question Number	Question		
4	(b)		
	Acceptable Answers	Reject	Mark
	air / oxygen water/ moisture/ dampness  <b>Notes</b>		(2)

Question Number	Question		
4	©		
	Acceptable Answers	Reject	Mark
	iron (III) oxide accept iron oxide  <b>Notes</b> Ignore reference to hydrated	ignore oxidation state	(1)

Question Number	Question		
4	(d)		
	Acceptable Answers	Reject	Mark
	oxidation (3 <sup>rd</sup> box)  <b>Notes</b>		(1)

Question Number	Question		
4	(e)		
	Acceptable Answers	Reject	Mark
	Galvanising  <b>Notes</b>		(1)

Question Number	Question		
4	(f)		
	Acceptable Answers	Reject	Mark
	(cover with) oil / grease / paint / plastic		
	Notes		(1)

Total 7 marks

Question Number	Question		
5	(a)		
	Acceptable Answers	Reject	Mark
	hydrochloric acid	(not hydrogen chloride)	
	Notes		(1)

Question Number	Question		
5	(b)		
	Acceptable Answers	Reject	Mark
	effervescence / fizzing / bubbles / solid disappears or dissolves		
	Notes		(1)

Question Number	Question		
5	(c)		
	Acceptable Answers	Reject	Mark
	limewater cloudy / milky / white precipitate		
	Notes		(2)

Question Number	Question	
5	(d)	
	Acceptable Answers	Reject
	fish harmed/killed stonework eaten away/ OWTTE iron rusts (more quickly) plants killed  <b>Notes</b> Max 2	
		(2)

Total 6 marks

Question Number	Question	
6	(a)	
	Acceptable Answers	Reject
	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ <b>Notes</b> Ignore bond angles	
		(1)

Question Number	Question	
6	(b)	
	Acceptable Answers	Reject
	$\text{C}_3\text{H}_8$  <b>Notes</b>	
		(1)

Question Number	Question	
6	(c)	
	Acceptable Answers	Reject
	$\text{C}_n\text{H}_{2n+2}$ (2 <sup>nd</sup> option) <b>Notes</b>	
		(1)



Question Number	Question	
<b>6</b>	<b>(d)</b>	
	Acceptable Answers	Reject
	butane + oxygen → carbon dioxide + water  <b>Notes</b> (reactants = 1, products = 1)	
		<b>(2)</b>

**Total 5 marks**

Question Number	Question	
<b>7</b>	<b>(a)</b>	
	Acceptable Answers	Reject
	(i) iron oxide (III) accept iron oxide/ haematite / $\text{Fe}_2\text{O}_3$	<b>NOT</b> iron ore
	(ii) coke / carbon / C (not coal)	
	(iii) limestone / calcium carbonate / $\text{CaCO}_3$	<b>NOT</b> lime
	<b>Notes</b> marks (i) - (iii) can be awarded in any order	
	(iv) slag / calcium silicate / $\text{CaSiO}_3$	
	(v) iron / Fe	Iron (II) or iron (III)
	<b>Notes</b> award 1 if (iv) and (v) are correct but in wrong order	

Question Number	Question	
<b>7</b>	<b>(b)</b>	
	Acceptable Answers	Reject
	(i) 1	
	(ii) carbon dioxide loses oxygen/ oxidation number of carbon decreases	
	<b>Notes</b>	

Question Number	Question		
<b>7</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	toxic / poisonous/ correct effect on blood  <b>Notes</b>		<b>(1)</b>

Question Number	Question		
<b>7</b>	<b>(d)</b>		
	Acceptable Answers	Reject	Mark
	too reactive / higher than carbon in reactivity series/ very reactive  <b>Notes</b>		<b>(1)</b>

**Total 10 marks**

Question Number	Question		
<b>8</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	<b>(i) C / F</b>		<b>(1)</b>
	<b>(ii) A and B</b>		<b>(1)</b>
	<b>(iii) E</b>		<b>(1)</b>
	<b>Notes</b>		

Question Number	Question		
8	(b)		
	Acceptable Answers	Reject	Mark
	Poly(( )ethene( )). Accept polythene/Polyethylene correct repeat unit $\begin{array}{c} \text{H} \\   \\ -\text{C}- \\   \\ \text{H} \end{array}$ Or any multiple length (2 + carbons)  continuation bonds ____ or ..... ..... (only if first mark awarded)  <b>Notes</b> Ignore 'brackets' and 'n' or other subscripts		(1) (1) (1)

Total 6 marks

Question Number	Question															
9	(a)															
	Acceptable Answers		Reject	Mark												
	<table border="1"><thead><tr><th>Particle</th><th>Relative mass</th><th>Relative charge</th></tr></thead><tbody><tr><td>Electron</td><td><math>\frac{1}{1840}</math> <math>\frac{1}{2000}</math> <math>\frac{1}{1850}</math> <math>\frac{1}{1836}</math></td><td>-1</td></tr><tr><td>Neutron</td><td></td><td>0 / nil</td></tr><tr><td>Proton</td><td>1</td><td></td></tr></tbody></table> <p><b>Notes</b> Ignore negligible</p>		Particle	Relative mass	Relative charge	Electron	$\frac{1}{1840}$ $\frac{1}{2000}$ $\frac{1}{1850}$ $\frac{1}{1836}$	-1	Neutron		0 / nil	Proton	1		0 for mass	(4)
Particle	Relative mass	Relative charge														
Electron	$\frac{1}{1840}$ $\frac{1}{2000}$ $\frac{1}{1850}$ $\frac{1}{1836}$	-1														
Neutron		0 / nil														
Proton	1															

Question Number	Question		
<b>9</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	(i) helium / carbon / nitrogen / oxygen / neon / magnesium / silicon / sulphur / calcium		(1)
	(ii) silicon		(1)
	(iii) hydrogen		(1)
	<b>Notes</b> Max penalty 1 if give symbols for all 3 rather than names		

Question Number	Question		
<b>9</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	7		
	<b>Notes</b>		(1)

Question Number	Question		
<b>9</b>	<b>(d)</b>		
	Acceptable Answers	Reject	Mark
	(i) full / complete ignore saturated		(1)
	(ii) unreactive/inert/do not undergo reactions		(1)
	<b>Notes</b>		

**Total 10 marks**

Question Number	Question		
<b>10</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	zinc is less reactive than magnesium Magnesium is more reactive than Zinc <b>Notes</b> Or correct reference to positions in reactivity series	<u>It</u> is more reactive	(1)

Question Number	Question		
10	(b)		
	Acceptable Answers	Reject	Mark
	(i) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$ reagents products  <b>Notes</b> incorrect balancing = -1 be generous with cases  (ii) (dark) grey (1) to pink-brown (1) blue (1) to green (1)  <b>Notes</b> Ignore additional information		(1) (1)   (2) (2)

Question Number	Question		
10	(c)		
	Acceptable Answers	Reject	Mark
	hydrogen more reactive than copper hydrogen less reactive than iron  <b>Notes</b> Hydrogen between Fe + Cu for both marks	Iron(II) or Copper (II)	(1) (1)

Total 9 marks

Question Number	Question		
11	(a)		
	Acceptable Answers	Reject	Mark
	(i) shared electron pair all other electrons correct (ignore inner shells even if wrong)  (ii) bottom box crossed  <b>Notes</b>		(1) (1)   (1)

Question Number	Question		
<b>11</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	same number of electrons / same electronic configurations 'Same protons' negates <b>Notes</b>		<b>(1)</b>
Question Number	Question		
<b>11</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	add sodium hydroxide (solution)/ammonia solution/ ammonium hydroxide green ppt/solid/suspension Orange/brown/orange-brown/foxy brown/rusty brown/red-brown ppt/ solid/suspension <b>Notes</b> If miss out ppt then give 1 mark for 2 correct colours result marks only given if test correct	Powder/crystals/bits	<b>(1)</b>
		Orange/rusty/red	<b>(1)</b>
			<b>(1)</b>

**Total 7 marks**

**Paper total 75 marks**

**Paper 3F**

Question Number	Question		
<b>1</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	red (1) violet (1)  <b>Notes</b> (red) at the top at the bottom accept 'purple' or 'mauve'		<b>(2)</b>

Question Number	Question		
<b>1</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	(i) decreases (1)  (ii) increases (1)  (iii) stays the same (1)  <b>Notes</b> allow any clear indication		<b>(3)</b>

**Total 5 marks**

Question Number	Question		
<b>2</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> <li>(electric) fire</li> <li>(electric) toaster</li> <li>soldering iron</li> <li>hair drier</li> <li>etc.</li> </ul> <b>Notes</b> accept any example which is clear and correct	(electric) heater lamp TV	<b>(2)</b>

Question Number	Question	
2	(b)	
	Acceptable Answers	Reject
	any two of <ul style="list-style-type: none"> <li>earthing/earth wire/green and yellow wire</li> <li>insulation</li> <li>double insulation</li> <li>circuit breakers</li> </ul>	'fuses'
		(2)

Question Number	Question	
2	(c)	
	Acceptable Answers	Reject
	any two of <ul style="list-style-type: none"> <li>(electric) shock</li> <li>(electric) burn</li> <li>water is a conductor</li> <li>electricity passes through you to earth</li> </ul>	
		(2)

Question Number	Question	
2	(d)	
	Acceptable Answers	Reject
	any two of <ul style="list-style-type: none"> <li>(electric) shock</li> <li>(electric) burn</li> <li>metal/screwdriver is a conductor</li> <li>electricity passes through you to earth</li> </ul>	
	<b>Notes</b> credit should be given even if the same point(s) has/have been credited in part (c)	(2)

Total 8 marks

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject
	heat (1) sound (1)	
	<b>Notes</b> either order accept 'noise' or 'vibration'	(2)



Question Number	Question	
3	(b)	
	Acceptable Answers	Reject
	useful	
	Notes accept if meaning clear e.g. 'functional'	
		(1)

Question Number	Question	
3	(c)	
	Acceptable Answers	Reject
	(i) chemical (energy) (1)	
	(ii) nuclear/atomic (energy) (1)	
	Notes (ii) accept 'fission' (energy)	
		(2)

Question Number	Question	
3	(d)	
	Acceptable Answers	Reject
	(i) bow (and arrow) / cross bow / catapult / (stretched/wound up) spring / etc (1)	
	(ii) water behind a dam / counterweight / drop hammer / pile driver / etc (1)	
	Notes (i) & (ii) accept any clear and correct response	
		(2)

Total 7 marks

Question Number	Question	
4	(a)	
	Acceptable Answers	Reject Mark
	<p>(i) <math>3\frac{1}{2}</math> / 3.50 / 3.5 / 3.30 hours (1)</p> <p><b>Notes</b> allow '210 minutes' if correct unit given</p> <p>(ii) half an hour / <math>\frac{1}{2}</math> / 0.5 / 0.50 (hour) (1)</p> <p><b>Notes</b> allow '30 minutes' if correct unit given</p> <p>(iii) 45 (kilometres) (1)</p> <p>(iv) graph/line/slope (1) steeper/greater (1)</p>	(5)

Question Number	Question	
4	(b)	
	Acceptable Answers	Reject Mark
	<p>(i) (average) speed = distance (moved) ÷ time (taken) (1)</p> <p><b>Notes</b> or any correctly transposed version</p> <p>(ii) metres per second (1)</p> <p><b>Notes</b> or m/s</p>	<p>'mps'</p> <p>(2)</p>

Total 7 marks

Question Number	Question	
5	(a)	
	Acceptable Answers	Reject Mark
	<p>(i) equally in all directions (1)</p> <p>(ii) equally in all directions (1)</p> <p><b>Notes</b> (i) &amp; (ii) allow any clear indication</p>	(2)

Question Number	Question	
5	(b)	
	Acceptable Answers	Reject Mark
	pressure = force ÷ area  <b>Notes</b> or any correctly transposed version	(1)

Question Number	Question	
5	(c)	
	Acceptable Answers	Reject Mark
	square metre / metre square / accept any measure of area (1)  m <sup>2</sup> (1)  pascal / any measure of pressure (1)  Pa (1)	(4)

Question Number	Question	
5	(d)	
	Acceptable Answers	Reject Mark
	<u>area</u> in contact with/ touching the floor is less (1) (same) <u>force</u> acts on this area (1)  <i>or <u>force</u> remains the same</i> <i>or <u>force</u> due to weight (of student and chair)</i>  (so) <u>pressure</u> (on floor) increase (1)  <i>or</i> <i><u>force</u> acting on each leg increases from <math>w \div 4</math> to <math>w \div 2</math></i> <i>(and) <u>area</u> in contact with the floor is less</i> <i>(so) <u>pressure</u> (on the floor) increases</i>  <b>Notes</b> underlined word must be used correctly in the correct context to gain credit	(3)

Total 10 marks

Question Number	Question	
<b>6</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	(i) time (1)	
	(ii) isotopes (1)	
		<b>(2)</b>

Question Number	Question	
<b>6</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	(i) 50 (years) (1)	
	(ii) October 2057 (1) ecf from (i)	
	<b>Notes</b> both month and year required	
	(iii) Bq (1)	
	<b>Notes</b> must be correct in every detail	
		<b>(3)</b>

Question Number	Question	
<b>6</b>	<b>(c)</b>	
	Acceptable Answers	Reject Mark
	tracers (1)	
	specimens (1)	
	radiotherapy (1) allow 'tracers' if not previously offered	
	<b>Notes</b> must be in correct order	
		<b>(3)</b>

**Total 8 marks**

Question Number	Question	
<b>7</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	(directly) proportional	
	<b>Notes</b>	
		<b>(1)</b>

Question Number	Question	
<b>7</b>	<b>(b)</b>	
	Acceptable Answers	Reject
	(i) tension /weight / gravitational force (1)  (ii) 2.5 (N) (1)  (iii) 4.0 - 5.0 (1)	
		<b>(3)</b>

Question Number	Question	
<b>7</b>	<b>(c)</b>	
	Acceptable Answers	Reject
	(i) A (1)  (ii) B (1)  (iii) large extension for small increase in force (1)	
		<b>(3)</b>

**Total 7 marks**

Question Number	Question	
<b>8</b>	<b>(a)</b>	
	Acceptable Answers	Reject
	(i) decreases (1)  (ii) increases (1)  <b>Notes</b> (ii) e.c.f	
		<b>(2)</b>

Question Number	Question	
<b>8</b>	<b>(b)</b>	
	Acceptable Answers	Reject
	(i) $V = I \times R$ (1)  (ii) Increases (1) not dop no ecf  (iii) $R$ (almost) same (1) $I$ bigger (1)  <b>Notes</b> (iii) potential divider idea can score 2	
		<b>(4)</b>

Question Number	Question	
<b>8</b>	<b>(c)</b>	
	Acceptable Answers	Reject
	voltmeter connected in parallel across buzzer or R	
		<b>(1)</b>

**Total 7 marks**

Question Number	Question	
<b>9</b>	<b>(a)</b>	
	Acceptable Answers	Reject
	(i) number of cycles (or waves) in unit time (1)	
	(ii) time for one cycle (period) (1)	
	<b>Notes</b>	<b>(2)</b>

Question Number	Question	
<b>9</b>	<b>(b)</b>	
	Acceptable Answers	Reject
	(i) $72 / 60 = 1.2$ (Hz) (1)	
	(ii) $1 / 1.2 = 0.833$ (s) (1)	
		<b>(2)</b>

Question Number	Question	
<b>9</b>	<b>(c)</b>	
	Acceptable Answers	Reject
	(i) points plotted (2), curve (1) blobs(-1)	
	(ii) off the graph (1)	
		<b>(4)</b>

**Total 8 marks**

Question Number	Question	
10	(a)	
	Acceptable Answers	Reject Mark
	(i) proton number (1)	
	(ii) number of protons and neutrons (1)	
	(iii) same number of protons / different number of neutrons (1)	
		(3)

Question Number	Question	
10	(b)	
	Acceptable Answers	Reject Mark
	(i) 11 (1)	
	(ii) 12 (1)	
	(iii) 11 (1)	
		(3)

Question Number	Question	
10	(c)	
	Acceptable Answers	Reject Mark
	gamma	gamma particle
		(1)

Question Number	Question	
10	(d)	
	Acceptable Answers	Reject Mark
	mutations, cancer, damage tissue, cells, waste problems allow 'deforming'	
		(1)

Total 8 marks

Paper total 75 marks

**Paper 4H**

Question Number	Question	
<b>1</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	C; B; A;	(3)

Question Number	Question	
<b>1</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	(i) alveoli; capillaries / blood;	2
	(ii) water; capillaries / blood;	2
		(4)

**Total 7 marks**

Question Number	Question	
<b>2</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	(i) periwinkle / (bank) vole;	1
	(ii) sun / light;	1
		(2)

Question Number	Question	
<b>2</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	4 links / eq, e.g. longer/more organisms/more consumers/ref tertiary consumer; they do not start with a producer / start with dead organisms;	(2)

Question Number	Question	
<b>2</b>	<b>(c)</b>	
	Acceptable Answers	Reject Mark
	bacteria; fungi;	2
		(2)

**Total 6 marks**



Question Number	Question	
3	(a)	
	Acceptable Answers	Reject Mark
	lens;	(1)
Question Number	Question	
3	(b)	
	Acceptable Answers	Reject Mark
	(i) light doesn't pass through easily / is scattered / eq; not focussed / not on retina / eq.;	2
	(ii) Nn and nn; N n and n n; Nn Nn nn nn; cloudy clear;	4
		(6)

Total 7 marks

Question Number	Question	
4	(a)	
	Acceptable Answers	Mark
	A nucleus; genetic material/control cell activities; B cytoplasm; chemical reactions/metabolism/respiration/eq;	(4)

Question Number	Question	
4	(b)	
	Acceptable Answers	Reject Mark
	digested / killed / destroyed / eq; enzymes / named enzyme;	(2)

Question Number	Question	
4	(c)	
	Acceptable Answers	Reject Mark
	50%; (one mark for 3500 in working)	(2)

Total 8 marks

Question Number	Question																
5																	
	Acceptable Answers		Mark														
	<table><thead><tr><th>Step</th><th>Order of step</th></tr></thead><tbody><tr><td>select early flowering offspring plants</td><td>4;</td></tr><tr><td>allow seeds from early flowering plants</td><td>3;</td></tr><tr><td>select early flowering plants</td><td>(1)</td></tr><tr><td>grow early flowering offspring plants</td><td>(5)</td></tr><tr><td>repeat the process for several generations</td><td>6;</td></tr><tr><td>collect seeds from early-flowering plants</td><td>2;</td></tr></tbody></table>	Step	Order of step	select early flowering offspring plants	4;	allow seeds from early flowering plants	3;	select early flowering plants	(1)	grow early flowering offspring plants	(5)	repeat the process for several generations	6;	collect seeds from early-flowering plants	2;		(4)
Step	Order of step																
select early flowering offspring plants	4;																
allow seeds from early flowering plants	3;																
select early flowering plants	(1)																
grow early flowering offspring plants	(5)																
repeat the process for several generations	6;																
collect seeds from early-flowering plants	2;																

Total 4 marks

Question Number	Question	
6		
	Acceptable Answers	Reject Mark
	<b>Five from:</b> increase yield; (control / increased) temperature / use of heating (during cold months); (control / increased) light / extra light (in dark months); (control / increased) carbon dioxide; fewer pests / easier control of pests; less wind; less pollution; long wavelength reflected; enzymes; (more) photosynthesis;	(5)

Total 5 marks

Question Number	Question	
7	(a)	
	Acceptable Answers	Reject Mark
	simple sugars / glucose; amino acids / peptides; lipids / fats;	(3)

Question Number	Question	
<b>7</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	Peak / up and down; 40°C;	(2)

**Total 5 marks**

Question Number	Question	
<b>8</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	(i) A Bowman's capsule / renal capsule; B (proximal) convoluted tubule; C collecting duct;	3
	(ii) movement of small molecules (from the blood into the kidney); (under) pressure;	2 (5)

Question Number	Question	
<b>8</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	(i) 66 / 66.6 / 66.7;	1
	(ii) less water / water reabsorbed;	1 (2)

Question Number	Question	
<b>8</b>	<b>(c)</b>	
	Acceptable Answers	Reject Mark
	Three from: pituitary; less ADH / eq; collecting ducts less permeable; less water reabsorbed (into blood);	(3)

**Total 10 marks**

Question Number	Question	
<b>9</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	dotted line remains high after the peak;	(1)

Question Number	Question		
<b>9</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	zygote; embryo; amniotic;		<b>(3)</b>

Question Number	Question		
<b>9</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	sexual;		<b>(1)</b>

**Total 5 marks**

Question Number	Question		
<b>10</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	respiration;		<b>(1)</b>

Question Number	Question		
<b>10</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	O <sub>2</sub> and H <sub>2</sub> O on left and right respectively; 6 on both sides; Allow one mark for oxygen and water if no other marks gained		<b>(2)</b>

Question Number	Question		
<b>10</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	<b>Two</b> from: lose heat; maintain body temp; need to generate/replace heat / eq;		<b>(2)</b>

Question Number	Question		
<b>10</b>	<b>(d)</b>		
	Acceptable Answers	Reject	Mark
	<b>Two</b> from narrowing of blood vessels (at skin surface); vasoconstriction; takes blood away from the skin; to conserve heat; decreased sweating;		<b>(2)</b>

**Total 7 marks**

Question Number	Question		
<b>11</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	B or C; D; E;		<b>(3)</b>

Question Number	Question		
<b>11</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	Leaching / run off; Increase (algal growth); Amino acids / proteins; Eutrophication;  <b>Notes</b>		<b>(4)</b>

**Total 7 marks**

Question Number	Question		
<b>12</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	genetically; identical;		<b>(2)</b>

Question Number	Question		
<b>12</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	Adv: all have / lots have good characteristics/features; Disadv: more susceptible to disease;		<b>(2)</b>

**Total 4 marks**

Question Number	Question	
<b>13</b>	<b>(a)</b>	
	Acceptable Answers	Reject Mark
	(i) label A to left atrium;	1
	(ii) two from: wall is being squeezed/space inside ventricle is small; atrioventricular closed; semilunar valve is open; blood is leaving the ventricle / heart;	2
	(iii) pulmonary vein;	1
		<b>(4)</b>

Question Number	Question	
<b>13</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	(i) 0.2 seconds;	1
	(ii) between 0.2 and 0.4 seconds;	1
	(iii) 0.3 seconds; highest pressure (in the left ventricle) / 17.3 higher than 16.0; forcing blood through semi-lunar valves and into the aorta;	3
		<b>(5)</b>

**Total 9 marks**

Question Number	Question	
<b>14</b>		
	Acceptable Answers	Reject Mark
	Gene / DNA cut; Restriction endonuclease; Plasmid / phage / virus; Vector; Inhaled / aerosol; Sticky ends; Ligase; Host DNA;	
	<b>Notes</b> Max 6	
		<b>(6)</b>

**Total 9 marks**

**Paper total 90 marks**

Paper 5H

Question Number	Question	
1	(a)	
	Acceptable Answers	Reject
	(i) C / F	
	(ii) A and B	
	(iii) E	
	Notes	
		Mark
		(1)
		(1)
		(1)

Question Number	Question	
1	(b)	
	Acceptable Answers	Reject
	Poly((ethene)).	
	Accept polythene/Polyethylene	
	correct repeat unit	
	$\begin{array}{c} \text{H} \\   \\ -\text{C}- \\   \\ \text{H} \end{array}$	Or any multiple length (2 + carbons)
	continuation bonds ____ or .....	
	..... (only if first mark awarded)	
	Notes	
	Ignore 'brackets' and 'n' or other subscripts	
		Mark
		(1)
		(1)
		(1)

Total 6 marks

Question Number	Question																
2	(a)																
	Acceptable Answers	Reject															
		0 for mass															
	<table border="1"> <thead> <tr> <th>Particle</th><th>Relative mass</th><th>Relative charge</th></tr> </thead> <tbody> <tr> <td>Electron</td><td><math>\frac{1}{1840}</math> <math>\frac{1}{2000}</math> <math>\frac{1}{1850}</math></td><td>-1</td></tr> <tr> <td></td><td><math>\frac{1}{1836}</math></td><td></td></tr> <tr> <td>Neutron</td><td></td><td>0 / nil</td></tr> <tr> <td>Proton</td><td>1</td><td></td></tr> </tbody> </table>	Particle	Relative mass	Relative charge	Electron	$\frac{1}{1840}$ $\frac{1}{2000}$ $\frac{1}{1850}$	-1		$\frac{1}{1836}$		Neutron		0 / nil	Proton	1		
Particle	Relative mass	Relative charge															
Electron	$\frac{1}{1840}$ $\frac{1}{2000}$ $\frac{1}{1850}$	-1															
	$\frac{1}{1836}$																
Neutron		0 / nil															
Proton	1																
	Notes																
	Ignore negligible																
		Mark															
		(4)															

Question Number	Question		
2	(b)		
	Acceptable Answers	Reject	Mark
	(i) helium / carbon / nitrogen / oxygen / neon / magnesium / silicon / sulphur / calcium		(1)
	(ii) silicon		(1)
	(iii) hydrogen		(1)
	<b>Notes</b> Max penalty 1 if give symbols for all 3 rather than names		

Question Number	Question		
2	(c)		
	Acceptable Answers	Reject	Mark
	7		
	<b>Notes</b>		(1)

Question Number	Question		
2	(d)		
	Acceptable Answers	Reject	Mark
	(i) full / complete ignore saturated		(1)
	(ii) unreactive/inert/do not undergo reactions		(1)
	<b>Notes</b>		

**Total 10 marks**

Question Number	Question		
3	(a)		
	Acceptable Answers	Reject	Mark
	zinc is less reactive than magnesium Magnesium is more reactive than Zinc <b>Notes</b> Or correct reference to positions in reactivity series	<u>It</u> is more reactive	(1)



Question Number	Question		
3	(b)		
	Acceptable Answers	Reject	Mark
	(i) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$ reagents products  <b>Notes</b> incorrect balancing = -1 be generous with cases  (ii) (dark) grey (1) to pink-brown (1) blue (1) to green (1)  <b>Notes</b> Ignore additional information		(1) (1)   (2) (2)

Question Number	Question		
3	(c)		
	Acceptable Answers	Reject	Mark
	hydrogen more reactive than copper hydrogen less reactive than iron  <b>Notes</b> Hydrogen between Fe + Cu for both marks	Iron(II) or Copper (II)	(1) (1)

Total 9 marks

Question Number	Question		
4	(a)		
	Acceptable Answers	Reject	Mark
	(i) shared electron pair all other electrons correct (ignore inner shells even if wrong)  (ii) bottom box crossed  <b>Notes</b>		(1) (1)  (1)

Question Number	Question	
4	(b)	
	Acceptable Answers	Reject
	same number of electrons / same electronic configurations 'Same protons' negates <b>Notes</b>	
		Mark (1)

Question Number	Question	
4	(c)	
	Acceptable Answers	Reject
	add sodium hydroxide (solution)/ammonia solution/ ammonium hydroxide green ppt/solid/suspension Orange/brown/orange-brown/foxy brown/rusty brown/red-brown ppt/ solid/suspension <b>Notes</b> If miss out ppt then give 1 mark for 2 correct colours result marks only given if test correct	Powder/crystals/bits  Orange/rusty/red
		Mark (1) (1) (1)

Total 7 marks

Question Number	Question	
5	(a)	
	Acceptable Answers	Reject
	(X) chlorine / Cl <sub>2</sub> (Y) sodium / Na (Z) aluminium / Al  <b>Notes</b>	
		Mark (1) (1) (1)

Question Number	Question	
5	(b)	
	Acceptable Answers	Reject
	Y and Z / Na and Al  <b>Notes</b>	
		Mark (1)

Question Number	Question		
5	(c)		
	Acceptable Answers	Reject	Mark
	yellow		
	Notes		(1)

Question Number	Question		
5	(d)		
	Acceptable Answers	Reject	Mark
	burns with a squeaky pop		
	Notes		(1)

Question Number	Question		
5	(e)		
	Acceptable Answers	Reject	Mark
	(products) $Z_2(SO_4)_3 + H_2O$		(1)
	(balancing) - 3 - 3		(1)
	Notes		

Total 8 marks

Question Number	Question		
6	(a)		
	Acceptable Answers	Reject	Mark
	$C_nH_{2n+2}$		(1)
	Notes		

Question Number	Question		
6	(b)		
	Acceptable Answers	Reject	Mark
	similar chemical properties / same functional group gradation in physical properties neighbouring members differ by $CH_2$		
	Notes Max 2		(2)

Question Number	Question	
6	(c)	
	Acceptable Answers	Reject
	no double bonds / only single bonds	
	Notes	(1)

Question Number	Question	
6	(d)	
	Acceptable Answers	Reject
	contains oxygen / not just carbon and hydrogen	
	Notes	(1)

Question Number	Question	
6	(e)	
	Acceptable Answers	Mark
	<div><div><div><div>H</div><div>H</div><div>H</div><div>H</div><div>H</div></div><div><div> </div><div> </div><div> </div><div> </div><div> </div></div><div>H-C-C-C-C-C-H</div><div><div> </div><div> </div><div> </div><div> </div><div> </div></div><div>H</div><div>H</div><div>H</div><div>H</div><div>H</div></div><div>pentane</div></div> <div><div><div>H</div><div>H</div><div>H</div><div>H</div></div><div><div> </div><div> </div><div> </div><div> </div></div><div>H-C-C-C-C-H</div><div><div> </div><div> </div><div> </div><div> </div></div><div>H</div><div>CH<sub>3</sub></div><div>H</div><div>H</div></div> <div>(2-)methylbutane</div> <div><div><div>H</div><div>CH<sub>3</sub></div><div>H</div></div><div><div> </div><div> </div><div> </div></div><div>H-C-C-C-H</div><div><div> </div><div> </div><div> </div></div><div>H</div><div>CH<sub>3</sub></div><div>H</div></div> <div>(2,2-)dimethylpropane</div> <div><div>Notes</div><div>(any two structures and matching names for 1 each)</div></div>	
		(4)

Total 9 marks

Question Number	Question	
7	(a)	
	Acceptable Answers	Reject
	ammonia hydrogen chloride	
	Notes	
		Mark
		(1)
		(1)

Question Number	Question	
7	(b)	
	Acceptable Answers	Reject
	(i) ammonia	
	(ii) $\text{NH}_4^+$	
	(iii) $\text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{NH}_3$	
	reactants	
	products	
	Notes	
		Mark
		(1)
		(1)
		(1)
		(1)

Question Number	Question	
7	(c)	
	Acceptable Answers	Reject
	(i) silver chloride	
	(ii) $\text{Cl}^-$	
	(iii) (products) $\text{AgCl} + \text{NH}_4\text{NO}_3$	
	(state symbols) aq aq s	
	Notes	
		Mark
		(1)
		(1)
		(1)
		(1)

Total 10 marks

Question Number	Question		
8	(a)		
	Acceptable Answers	Reject	Mark
	2,7 2.8		(1) (1)
	Notes		

Question Number	Question		
8	(b)		
	Acceptable Answers	Reject	Mark
	(ion) 2 and 8 • or × shown on diagram 2+ shown		(1) (1)
	Notes		

Question Number	Question		
8	(c)		
	Acceptable Answers	Reject	Mark
	F <sub>2</sub> / fluorine gains electrons		(1) (1)
	Notes		

Question Number	Question		
8	(d)		
	Acceptable Answers	Reject	Mark
	positive and negative ions / oppositely charged ions		(1)
	Notes		

Question Number	Question		
8	(e)		
	Acceptable Answers	Reject	Mark
	fluorine (molecules) attracted by (weak) intermolecular forces which are (much) weaker than ionic bonds/bonds in MgF <sub>2</sub>		(1) (1)
	Notes		

Question Number	Question	
8	(f)	
	Acceptable Answers	Reject Mark
	(i) $100 - (78.6 + 10.1) = 11.3$	(1)
	(ii) $(24 \times 0.786) + (25 \times 0.101) + (26 \times .113)$ $= 24.3$	(1) (1)
	Notes	

Total 12 marks

Question Number	Question	
9	(a)	
	Acceptable Answers	Reject Mark
	decreases increases increases no change	
	Notes	(4)

Question Number	Question	
9	(b)	
	Acceptable Answers	Reject Mark
	rate increases (reactant) particles closer together/more particles in given volume molecules/particles collide more frequently/ more collisions per second	Rate same/rate decreases = 0/3 atoms
	Notes If no mention of particles/molecules max 1 for explanation	(1) (1) (1)

Question Number	Question	
9	(c)	
	Acceptable Answers	Reject Mark
	recycled / put back into reactor	Used again (1)
	Notes	

Question Number	Question		
9	(d)		
	Acceptable Answers	Reject	Mark
	(i) oxidation / redox/ accept exothermic		(1)
	(ii) $2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$ all formulae correct balancing		(1) (1)
	Notes		

Question Number	Question		
9	(e)		
	Acceptable Answers	Reject	Mark
	$\text{NH}_4\text{NO}_3$		(1)
	Notes		

Question Number	Question		
9	(f)		
	Acceptable Answers	Reject	Mark
	phosphorus potassium	Phosphate	(1) (1)
	Notes		

Total 14 marks

Question Number	Question		
10	(a)		
	Acceptable Answers	Reject	Mark
	nitric acid $\text{KOH} + \text{HNO}_3 \rightarrow \text{KNO}_3 + \text{H}_2\text{O}$		(1) (1)
	Notes		



Question Number	Question		
<b>10</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	<b>(i)</b> $(K_2O) \quad M_r = 94$ $(KOH) \quad M_r = 56$  <b>(ii)</b> $(18.8 \div 94 = 0.20 \text{ mol})$ $(0.20 \times 2 \times 56 =) 22(.4) \text{ (g)}$ (answer of 11(.2) scores 1)  <b>Notes</b>		<b>(1)</b> <b>(1)</b>  <b>(1)</b> <b>(1)</b>

Question Number	Question		
<b>10</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	$RbOH + HCl \rightarrow RbCl + H_2O$  <b>Notes</b>		<b>(1)</b>

**Total 7 marks**

**Paper total 90 marks**

**Paper 6H**

Question Number	Question		
<b>1</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	(directly) proportional		<b>(1)</b>

Question Number	Question		
<b>1</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	(i) tension / weight / gravitational force (1)		
	(ii) 2.5 (N) (1)		
	(iii) 4.0 - 5.0 (1)		<b>(3)</b>

Question Number	Question		
<b>1</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	(i) A (1)		
	(ii) B (1)		
	(iii) large extension for small increase in force (1)		<b>(3)</b>

**Total 7 marks**

Question Number	Question		
<b>2</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	(i) decreases (1)		
	(ii) increases (1)		
	<b>Notes</b>		
	(ii) e.c.f		<b>(2)</b>

Question Number	Question	
2	(b)	
	Acceptable Answers	Reject Mark
	(i) $V = I \times R$ (1) (ii) Increases (1) not dop no ecf (iii) $R$ (almost) same (1) $I$ bigger (1) <b>Notes</b> (iii) potential divider idea can score 2	(4)

Question Number	Question	
2	(c)	
	Acceptable Answers	Reject Mark
	voltmeter connected in parallel across buzzer or R	(1)

Total 7 marks

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject Mark
	(i) number of cycles (or waves) in unit time (1) (ii) time for one cycle (period) (1)	(2)

Question Number	Question	
3	(b)	
	Acceptable Answers	Reject Mark
	(i) $72 / 60 = 1.2$ (Hz) (1) (ii) $1 / 1.2 = 0.833$ (s) (1)	(2)

Question Number	Question	
3	(c)	
	Acceptable Answers	Reject Mark
	(i) points plotted (2), curve (1) blobs (-1)	
	(ii) off the graph (1)	(4)

Total 8 marks

Question Number	Question	
4	(a)	
	Acceptable Answers	Reject Mark
	(i) proton number (1)	
	(ii) number of protons and neutrons (1)	
	(iii) same number of protons /different number of neutrons(1)	(3)

Question Number	Question	
4	(b)	
	Acceptable Answers	Reject Mark
	(i) 11 (1)	
	(ii) 12 (1)	
	(iii) 11 (1)	(3)

Question Number	Question	
4	(c)	
	Acceptable Answers	Reject Mark
	gamma	gamma particle (1)

Question Number	Question	
4	(d)	
	Acceptable Answers	Reject Mark
	mutations, cancer, damage tissue, cells, waste problems allow deforming	(1)

Total 8 marks

Question Number	Question	
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5	(a)		
	Acceptable Answers	Reject	Mark
	<p>(i) weight down(wards) (1) 'or' (force of) gravity down(wards)</p> <p>(water) resistance / drag / friction up(ward) (1) 'or' in opposite direction (to the movement / motion)</p> <p><b>Notes</b> - both force and direction for each either order</p> <p>(ii) (water) resistance / drag / friction increases (1) as speed/velocity increases (1) (depends on previous so do not credit unless first mark gained)</p>		(4)
Question Number	Question		
5	(b)		
	Acceptable Answers	Reject	Mark
	<p>1.25 (2) 'or' <math>F = ma</math> (1) 'or' <math>a = 15 \div 12</math> (1)</p> <p><math>m/s^2</math> or <math>ms^{-2}</math> (1)</p>		(3)

Question Number	Question		
5	(c)		
	Acceptable Answers	Reject	Mark
	<p>(i) down(wards) (1) at a steady speed (1) 'or' no acceleration / deceleration (2) 'or' constant velocity (2)</p> <p>(ii) zero/0(N) (1)</p>		(3)

Total 10 marks

Question Number	Question		
6	(a)		
	Acceptable Answers	Reject	Mark
	1.5 (V)	do not credit just '9 ÷ 6'	(1)

Question Number	Question		
6	(b)		
	Acceptable Answers	Reject	Mark
	Charge / electrons / ions		(1)

Question Number	Question		
6	(c)		
	Acceptable Answers	Reject	Mark
	19 440 (2) 'or' (energy =) $0.2 \times 9 \times 3 \times 60 \times 60$ (1)  joules/J(1) note '5.4 J' is (2), 324 J is (2), 3240 J is (2)		(3)

Question Number	Question		
6	(d)		
	Acceptable Answers	Reject	Mark
	flow/movement of (free) electrons (1) from negative to positive (1) 'or' through lattice of ions / charged atoms		(2)

Question Number	Question		
6	(e)		
	Acceptable Answers	Reject	Mark
	direct current		(1)

Question Number	Question		
6	(f)		
	Acceptable Answers	Reject	Mark
	ANY TWO (1 each)  mains supply is alternating current (1) 'or' mains is a.c.  mains supply is at a (much) higher voltage / 230 V(1)  supply from battery is limited/battery has to be replaced /recharged		(2)

Total 10 marks

Question Number	Question	
7	(a)	
	Acceptable Answers	Reject
	Communication / endoscope / decorative lighting / etc  <b>Notes</b> accept any suitable use e.g. taking light from a central unit (to various outlets)	
		(1)

Question Number	Question	
7	(b)	
	Acceptable Answers	Reject
	(i) perpendicular at point of incidence (1)  angle of incidence clearly shown as angle between incident ray and normal (1)  <b>Notes</b> - angles of incidence and reflection must look fairly equal depends on previous mark.  (ii) total internal reflection/ t.i.r. (1)  (iii) angle of incidence is greater than the critical angle (1)  <b>Notes</b> - or angle $i > \text{angle } c$	
		(4)

Question Number	Question	
7	(c)	
	Acceptable Answers	Reject
	(i) sine critical angle = $1 \div \text{refractive index}$ (1) 'or' the converse 'or' $\sin c = 1/n$  (ii) 1.51 (3) 'or' or 1.508..... (2) 'or' $1 \div 0.67$ (1) 'or' other value calculated but given 'correctly' to two places of decimals (1)  (d) total internal reflection occurs (1) angle of incidence = $45^\circ$ (1) so critical angle $< 45^\circ$ (1)	
		(7)

Total 12 marks

Question Number	Question	
<b>8</b>	<b>(a)</b>	
	Acceptable Answers	Reject
	<p><b>(i)</b> any three points (1) each</p> <ul style="list-style-type: none"> <li>• high speed</li> <li>• random/erratic</li> <li>• frequent collisions (with each other)</li> <li>• translational</li> </ul> <p><b>(ii)</b> (very) large number/millions/billions of them (1) collide with/hit (1) walls of the container (1)</p>	<p>just 'collisions'</p>
		<b>(6)</b>

Question Number	Question	
<b>8</b>	<b>(b)</b>	
	Acceptable Answers	Reject
	<p><b>(i)</b> 100 (kPa) (2) 'or' (pressure) = <math>500 \times 1.2 \div 6</math> (1)</p> <p><b>(ii)</b> no change in temperature (1) no leaks/no loss of mass /no loss of weight (1)</p>	
		<b>(4)</b>

**Total 10 marks**



Question Number	Question	
9	(a)	
	Acceptable Answers	Reject
	<p>(i) (nuclear) fission (1)</p> <p>(ii) hit other uranium/nuclei (1) neutrons emitted which go on to hit other nuclei and so on (1) <b>Notes</b> - or words to that effect but must convey the idea that the process goes on and on also depends on the previous mark</p> <p>(iii) kinetic energy (of the fission products) (1) 'or' kinetic energy of the (daughter) nuclei and neutrons <b>Notes</b> - allow 'heat' or 'thermal energy' or 'internal kinetic energy'</p> <p>(iv) alpha particle has positive charge (1) is repelled (by the positively charged nucleus) (1) (but) neutron has no charge (so it is not repelled) (1)</p>	<p>any suggestion that the neutron is attracted</p>
		(7)

Question Number	Question	
9	(b)	
	Acceptable Answers	Reject
	<p>(i) any two of</p> <ul style="list-style-type: none"> <li>• slows neutrons</li> <li>• neutron(s) more likely to hit/split nucleus/nuclei (of U235)</li> <li>• so the reactor works more efficiently</li> </ul> <p>(ii) to control the speed/rate of the (fission) reaction (1) prevent overheating/reaction getting out of control / meltdown (1)</p>	<p>'.... of U238'</p> <p>just 'they are moved in and out' just 'control reaction'</p>
		(4)

Total 11 marks

Question Number	Question		
10	(a)		
	Acceptable Answers	Reject	Mark
	(i) kinetic energy = $\frac{1}{2} \times m \times v^2$ 'or' correctly transposed version 'or' in words but do not accept '...velocity squared' for '... speed squared' (1)  (ii) 11 (m/s) (2) or $v^2 = 26.62 \div 0.22$ or $v = \sqrt{121}$ (1)		(3)

Question Number	Question		
10	(b)		
	Acceptable Answers	Reject	Mark
	(i) gravitational/potential energy = $mgh$ (1) 'or' in words  (ii) 6.05 (m) (2) 'or' (max) height = $26.62 \div 4.4$ (1)  (iii) any one of <ul style="list-style-type: none"> <li>• ball went straight up</li> <li>• all the k.e. transferred as g.p.e.</li> <li>• energy transfer 100% efficient</li> <li>• no friction/(air) resistance/drag</li> <li>• no energy transferred as heat</li> <li>• no energy transferred as sound</li> </ul>		(4)

Total 7 marks

Paper total 90 marks

## Paper 07

Question Number	Question	
1	(a)	
	Acceptable Answers	Mark
	<p>(i) B = beaker; D = tripod; E = Bunsen burner / eq; Ignore stand</p> <p>(ii) heatproof mat / safety glasses/gloves/ adjust / visible flame / keep hands away from could burn / eq; tongs / hot milk / could scald / place on centre of bench/eq; glass / could break / could cut / eq;</p> <p><b>Notes</b> (ii) max 2</p>	<p>3</p> <p>2 max</p> <p>(4)</p>

Question Number	Question	
1	(b)	
	Acceptable Answers	Mark
	(i) Q;	1
	(ii) fridge /ice bucket / ice trough / eq;	1
	Notes	(2)

**Total 6 marks**

Question Number	Question	
2	(a)	
	Acceptable Answers	Reject
	6.2; 6.0; 6.0; 5.8;	
	Notes	
		(4)

Question Number	Question	
2	(b)	
	Acceptable Answers	Reject
	(i) ice; IGN fridge	1
	(ii) kill / cruel / unethical / cause harm / eq; Ignore denatured	1
	Notes	(2)

Question Number	Question	
2	(c)	
	Acceptable Answers	Reject Mark
	S - scale linear + at least 50% of axis; L - through points and labelled; A - axes correct and labelled UNITS; P - points plotted correctly;;  <b>Notes</b>	(5)

Total 11 marks

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject Mark
	(i) measuring cylinder / syringe / pipette / burette;  (ii) 1 260;; (one for 15 x 20).  (iii) 6 300; allow TE (ii) x 5;  <b>Notes</b>	1  2  1  (4)

Question Number	Question	
3	(b)	
	Acceptable Answers	Reject Mark
	(i) 8560;  (ii) into air / atmosphere / surroundings / eq.; needle; into glass / tube; too slow moving / too far away;  <b>Notes</b> (ii) max 2	1  2 max  (3)



Question Number	Question	
5	(a)	
	Acceptable Answers	Reject Mark
	reliable to 3 <sup>rd</sup> meaning box; precise to 2 <sup>nd</sup> meaning box; valid to 1 <sup>st</sup> meaning box;  <b>Notes</b>	(3)

Question Number	Question	
5	(b)	
	Acceptable Answers	Reject Mark
	volume of bubbles / vary in size; easy to miscount/eq; composition of bubbles / not all oxygen / some CO <sub>2</sub> ; allow oxygen dissolves in water/eq;  <b>Notes</b> Max 2	2 max  (2)

Total 5 marks

Question Number	Question	
6	(a)	
	Acceptable Answers	Reject Mark
	random placing; use more quadrats; calculate % cover / eq;  <b>Notes</b> Max 2	2 max  (2)

Question Number	Question	
<b>6</b>	<b>(b)</b>	
	Acceptable Answers	Reject Mark
	C - +/- light / range of light intensities; O - same species/age / size of plant / eq; R - several plants used; M1 - growth measured in mass/height/ length; M2 - time period mentioned; S1 - named condition controlled; eg temperature S2 - named condition controlled; eg carbon dioxide  <b>Notes</b> Max 6	6 max  <b>(6)</b>

Total 8 marks

Total marks for paper 50

Paper 08

Question Number	Question																			
1																				
	Acceptable Answers	Mark																		
	<table border="1"> <thead> <tr> <th>Variable to be measured</th><th>Apparatus used</th><th>Units of variable</th></tr> </thead> <tbody> <tr> <td>time</td><td>stop watch</td><td>s</td></tr> <tr> <td>mass</td><td>balance</td><td>g / grams accept kg</td></tr> <tr> <td>length</td><td>rule</td><td>cm / centimetres / mm</td></tr> <tr> <td>volume</td><td>burette</td><td>cm<sup>3</sup> / ml / centimetres cubed / cubic centimetres / millilitres</td></tr> <tr> <td>temperature</td><td>thermometer</td><td>centigrade / Celsius / °C</td></tr> </tbody> </table> <p>Notes</p>	Variable to be measured	Apparatus used	Units of variable	time	stop watch	s	mass	balance	g / grams accept kg	length	rule	cm / centimetres / mm	volume	burette	cm <sup>3</sup> / ml / centimetres cubed / cubic centimetres / millilitres	temperature	thermometer	centigrade / Celsius / °C	(8)
Variable to be measured	Apparatus used	Units of variable																		
time	stop watch	s																		
mass	balance	g / grams accept kg																		
length	rule	cm / centimetres / mm																		
volume	burette	cm <sup>3</sup> / ml / centimetres cubed / cubic centimetres / millilitres																		
temperature	thermometer	centigrade / Celsius / °C																		

Total 8 marks

Question Number	Question	
2	(a)	
	Acceptable Answers	Reject
	<ul style="list-style-type: none"> <li>amount metal carbonate / allow mass</li> <li>form/ surface oven/particle of size metal carbonate</li> <li>volume limewater / amount limewater</li> <li>size Bunsen flame / distance of tube from Bunsen/ temp or type of flame</li> </ul> <p>Notes Max 2</p>	(2)

Question Number	Question	
2	(b)	
	Acceptable Answers	Reject
	Repeated	
	Notes	(1)



Question Number	Question	
2	(c)	
	Acceptable Answers	Reject Mark
	y scale labelled. Time (for limewater to turn cloudy) in seconds 4 bars of correct height indication of which bar is for which substance  <b>Notes</b>	(1) (1) (1)

Question Number	Question	
2	(d)	
	Acceptable Answers	Reject Mark
	magnesium (carbonate)  <b>Notes</b>	(1)

Question Number	Question	
2	(e)	
	Acceptable Answers	Reject Mark
	(i) measuring cylinder not vertical  (ii) lower volume / reduces  (iii) gas syringe  <b>Notes</b>	(1) (1) (1)

Question Number	Question	
2	(f)	
	Acceptable Answers	Reject Mark
	(i) 15 (cm <sup>3</sup> ) 44 (cm <sup>3</sup> ) 29 (cm <sup>3</sup> ) (cq)  (ii) 29 / 30 = 0.97 dividing answer to (i) by 30 correct to 2 sf  (iii) middle box ticked  <b>Notes</b>	(1) (1) (1)  (1) (1) (1)

**Total 16 marks**

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject Mark
	(i) directly proportional. Allow 1 mark for qualitative link (e.g. increasing volume, increasing time)	(2)
	(ii) quantitative link, such as - twice as big means twice as much air/oxygen = 2	(2)
	qualitative - bigger means more air/oxygen = 1	
	(iii) stop more air getting in	(1)
	Notes	

Question Number	Question	
3	(b)	
	Acceptable Answers	Reject Mark
	fill with water and pour into measuring cylinder	
	Notes	(1)

Question Number	Question	
3	(c)	
	Acceptable Answers	Reject Mark
	B / second one	(1)
	results closest together / repeats most similar	(1)
	Notes	

Question Number	Question	
3	(d)	
	Acceptable Answers	Reject Mark
	94	Anything else
	Notes	(1)

Question Number	Question	
3	(e)	
	Acceptable Answers	Reject Mark
	(i) suitable scales used (>half grid in both directions) points plotted correctly (-1 mark per error) straight line drawn; may go through origin or hit x-axis	(1) (2) (1) (1)
	(ii) point at 700 circled (cq on points)	(1)
	(iii) must correctly explain why time longer. e.g. spout not sealed air got in	(1)
	OR smaller flame/wick used up oxygen more slowly	
	OR smaller candle more air in beaker	(1)
	OR bigger beaker more air	
	(iv) more points below 240	
	Notes	

Question Number	Question	
3	(f)	
	Acceptable Answers	Reject Mark
	(i) contains 5 x as much oxygen / air only 20% oxygen (must be quantitative)	(1) (1)
	(ii) read correct value from graph correct multiplication by 5	(1)
	Notes	

Total 20 marks

Question Number	Question	
4	(a)	
	Acceptable Answers	Reject Mark
	<b>BOTH</b> being sodium one carbonate one hydrogen carbonate  <b>Notes</b>	(1) (1) (1)

Question Number	Question	
4	(b)	
	Acceptable Answers	Reject Mark
	(i) both Li and Sr give red flames  both carbonate and hydroxide turn UI blue  (ii) add (nitric) acid - does NOT fizz  <b>Notes</b>	(1)  (1) (1)

Total 6 marks

Paper total 50 marks

**Paper 09**

Question Number	Question		
<b>1</b>	<b>(a)</b>		
	Acceptable Answers	Reject	Mark
	<b>(i)</b> 13 - 14 (1) <b>Notes</b> Allow 11  <b>(ii)</b> 11 (1)  <b>(iii)</b> 39 - 40 (1)  <b>(iv)</b> vertically upwards (1)  same length (1)		<b>(5)</b>

Question Number	Question		
<b>1</b>	<b>(b)</b>		
	Acceptable Answers	Reject	Mark
	<b>(i)</b> points plotted (2) blobs (-1)  curve (1)  <b>(ii)</b> 72 - 76 (1)		<b>(4)</b>

Question Number	Question		
<b>1</b>	<b>(c)</b>		
	Acceptable Answers	Reject	Mark
	<ul style="list-style-type: none"> <li>steps equal length (1)</li> <li>only three (or four) possible directions (1)</li> <li>can not go backwards over previous step (1)</li> </ul> <b>Notes</b> ora		<b>(3)</b>

**Total 12 marks**

Question Number	Question		
2	(a)		
	Acceptable Answers	Reject	Mark
	water (spillage) near electrical connection		(1)

Question Number	Question		
2	(b)		
	Acceptable Answers	Reject	Mark
	(i) wavelengths not clearly defined, smudgy etc (1)		
	(ii) measure several wavelengths (1)		
	take average (1)		(3)

Question Number	Question		
2	(c)		
	Acceptable Answers	Reject	Mark
	(i) 29 - 30 (mm) (1)		
	(ii) 17 - 18 mm (1)		
	(iii) continue one line (1)		
	continue other line until they meet (1)		
	measure angle $26^{\circ}$ - $28^{\circ}$ (1)		
	<b>Notes</b> maximum of (2) if no lines shown		(2)

Question Number	Question	
2	(d)	
	Acceptable Answers	Reject Mark
	(i) James (1)  (ii) wavelength decreases with increase in change of direction (1) <b>dop</b>  (iii) yes or no (1) reason (1) <b>dop</b>  <b>Notes</b> (ii) varies inversely	(4)

Total 13 marks

Question Number	Question	
3	(a)	
	Acceptable Answers	Reject Mark
	place rod in flame (1)  place rod in water (1)  note highest temperature of water / rise in temperature/ compare temperature readings (1)  repeat for another part of flame (1)	(4)

Question Number	Question	
3	(b)	
	Acceptable Answers	Reject Mark
	<b>ANY FOUR</b>  amount of water in beaker (1)  (initial) temperature of water (1)  time of rod in flame (1)  size of flame (1)  same (metal) rod (1)  <b>Notes</b> award if any seen in (a)	(4)

Question Number	Question	
3	(c)	
	Acceptable Answers	Reject Mark
	(i) lagging, stirrer, stopwatch, measuring cylinder (1)	
	(ii) gloves, pliers, tongs (1)	(2)

Question Number	Question	
3	(d)	
	Acceptable Answers	Reject Mark
	54 - 28 (1) = 26 (1)	(2)

Total 12 marks

Question Number	Question	
4	(a)	
	Acceptable Answers	Reject Mark
	(i) <i>correct connection of :</i> power supply to form any complete circuit (1) ammeter in series (1) variable resistor in series (1) both rods connected (1) <i>using correct symbols</i>	
	(ii) arrows from + of power supply (1) arrows consistent throughout in circuit containing both rods (1) <b>Notes</b> ecf from first mark	
	(iii) attract because currents in same direction (1) or not attract because currents in opposite directions	(7)



Question Number	Question		
4	(b)		
	Acceptable Answers	Reject	Mark
	(i) 15 - 16 mm (1)  (ii) 3.4 - 3.5 A (1)  (iii) Less than 16 mm (1) or less than value in (i)  (iv) centre (of rod) (1)  of rod (1)  top rod remains horizontal / same extension in both springs (1)		(6)

Total 13 marks

Total marks for paper 50

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