

**Additional Science B**

General Certificate of Secondary Education

Unit **B624/02**: Modules B4, C4, P4

**Mark Scheme for June 2011**

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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The **Abbreviations, annotations and conventions** used in the detailed Mark Scheme are:

/	=	alternative and acceptable answers for the same marking point
<b>(1)</b>	=	separates marking points
<b>not</b>	=	answers which are not worthy of credit
<b>reject</b>	=	answers which are not worthy of credit
<b>ignore</b>	=	statements which are irrelevant
<b>allow</b>	=	answers that can be accepted
( )	=	words which are not essential to gain credit
<u>   </u>	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

Question			Expected Answers	Marks	Additional Guidance
1	a		respiration (1)	1	<b>not</b> breathing
	b	i	hydroponics (1)	1	<b>allow</b> hydroponics <b>allow</b> phonetic spellings
	b	ii	idea of better control of minerals or nutrients / idea of better control of disease (1)	1	<b>allow</b> can grow plants in barren areas / areas without soil or with poor soil / can recycle nutrients or fertiliser / pesticides can be put into water/ control pests / less space needed / less chance of getting a disease (1)  <b>ignore</b> water contains minerals <b>ignore</b> cannot get diseases or pests <b>but allow</b> cannot get soil related diseases or soil related pests (1) <b>allow</b> better yield

Question	Expected Answers	Marks	Additional Guidance
c	(cell) wall (1)	1	<b>allow</b> lignin / cellulose
d	<p><b>use ✓'s in this question</b></p> <p><b>advantages:</b></p> <p><b>up to two from</b></p> <p>idea of largest yield when grown in water (compared to other <b>plants</b>) (1)</p> <p>idea of (largest) increased yield compared to growing in <b>soil</b> (1)</p> <p>uses data to support idea of higher yield (1)</p> <p><b>disadvantages:</b></p> <p><b>up to two from</b></p> <p>low(est) percentage of the plant that can be eaten (1)</p> <p>leads to problem of disposing of remains as will not rot (1)</p>	3	<p><b>allow</b> cucumbers have the highest yield / grow the most (of all the plants) (1)</p> <p>e.g. you get more when grown in water than in soil / grows better in water than soil (1)</p> <p>e.g. 65.7 (%) in water and only 5.4(%) in soil (1)</p> <p>e.g. you get 60.3(%)more yield in water (2)</p> <p>e.g. 65.7(%) is the highest (in the table) (1)</p> <p><b>if no other advantage marks scored allow higher yield (1)</b></p> <p><b>allow</b> only 20(%) can be eaten</p> <p><b>allow</b> a lot of cucumber(s) can't be eaten / a big percentage can't be eaten /ora (1)</p> <p><b>allow in disadvantages:</b> beans contain more protein / cucumbers more difficult to digest / cucumbers have less dry mass</p>
	<b>Total</b>	<b>7</b>	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	fermentation (1)	1	<b>allow</b> it ferments / treatment with bacteria / add yeast / fungi / anaerobic respiration / decay / rotting / breakdown (of plants)
	a	ii	renewable / carbon dioxide is taken in at the same rate that it is given out / no net release of carbon dioxide / no sulfur impurities / does not lead to acid rain (1)	1	<b>ignore</b> just less / no carbon dioxide released <b>or</b> no / less greenhouse gases <b>allow</b> carbon neutral <b>allow</b> less sulfur dioxide released / less or no particulates released
	b	i	lets some molecules through but not others (1)	1	<b>allow</b> lets small molecules through <b>allow</b> lets water through but not other substances <b>allow</b> only lets water through <b>allow</b> idea of <b>only</b> some things or substances can go through <b>allow</b> idea of things or substances can go through but not others <b>ignore</b> stops salt getting through <b>ignore</b> lets water through <b>but</b> stops salt getting through and lets water through scores (1) <b>not</b> lets salt through but not water <b>ignore</b> references to holes <b>ignore</b> references to direction
	b	ii	tick in first box (1)	1	more than one box ticked scores 0
			<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
3	a	chlorophyll (1)	1	<b>ignore</b> chloroplast
	b	i palisade (mesophyll) (1) spongy (mesophyll) (1)	2	if mesophyll only written <b>twice</b> = 1
	b	ii contains (most of) the chloroplasts / chlorophyll or less photosynthesis / food or starch or sugar production (1)	1	<b>allow</b> idea of plant having less chloroplast / chlorophyll (1)  if photosynthesis linked to gas exchange then scores 0
	c	i <b>A</b> = saprophytes / decay (bacteria) / decomposers (1) <b>B</b> = nitrifying (bacteria) (1)	2	<b>allow</b> decomposition / putrifying bacteria <b>allow</b> nitrosomonas / nitrobacter
	c	ii lower rate of respiration / reproduction / enzyme action in bacteria (1)	1	<b>allow</b> decay happens more slowly <b>allow</b> idea that warmth speeds up respiration / reproduction / enzyme action in bacteria <b>ignore</b> less growth
	c	iii minerals..... <input type="checkbox"/> minerals..... <input checked="" type="checkbox"/> if respiration..... <input type="checkbox"/> diffusion..... <input type="checkbox"/> plants take..... <input type="checkbox"/> Oxygen is ..... <input checked="" type="checkbox"/> osmosis occurs.... <input type="checkbox"/>	2	each incorrect tick over two negates a correct tick
<b>Total</b>			<b>9</b>	

Question		Expected Answers	Marks	Additional Guidance
4	a	salt (1)	1	
	b	$\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$ (1)	1	order of reactants unimportant <b>allow</b> $\text{OH}_2$ / $\text{HOH}$ <b>allow</b> correct multiples subscripts and superscripts must be correct e.g. $\text{H}^2\text{O}$ scores 0
	c	87.5 (%) (2)  <b>but</b> if answer incorrect then  $\frac{4.2}{4.8} \times 100$  OR  $\frac{\text{actual mass}}{\text{predicted mass}} \times 100$ / $\frac{\text{am}}{\text{pm}} \times 100$ (1)	2	<b>allow</b> 88 (2)
	d	copper oxide + sulfuric acid $\rightarrow$ copper sulfate + water (1)	1	<b>allow</b> correct formulae i.e. $\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$ or mix of correct formulae and words <b>not</b> and or & for + <b>allow</b> = instead of $\rightarrow$ <b>allow</b> correct formulae or mix of words and correct formulae
	e	carbon dioxide (1)	1	<b>allow</b> $\text{CO}_2$
	f	30 (tonnes) scores (3) <b>but</b> if answer incorrect relative formula mass of urea = 60 scores (1) and ratio of ammonia to urea is 2:1 scores (1)	3	<b>allow</b> 60 anywhere in working for 1 mark  e.g. 34g of ammonia makes 60g of urea (2)
<b>Total</b>			<b>9</b>	



Question		Expected Answers	Marks	Additional Guidance
5	a	<p><b>use ✓'s in this question</b> crush the plant / grind up the plant (1)</p> <p>add a solvent or named solvent (1)</p> <p>(separate chemicals using) chromatography / distillation / crystallise / solvent extraction (1)</p>	3	<p><b>allow</b> cut it up or cut or chopped or squeezed or pressed or mashed or pulp it or blend it (1) <b>allow</b> 'freeze and then defrost' (1)</p> <p><b>allow</b> add water or ethanol or propanone / dissolve the chemical (1) <b>ignore</b> add a solution or boil it <b>ignore</b> add an acid</p> <p><b>allow</b> correct description of separation process (1) <b>ignore</b> evaporation <b>ignore</b> filtering</p> <p>marks can be awarded from <b>annotated</b> diagrams</p>
	b	<p><b>any two from</b> different versions made (1)</p> <p>idea of research (and development) (takes a long time) (1)</p> <p>(time required) to meet legal requirements(1)</p> <p>testing (takes a long time) (1) <b>but</b> human trials needed (2)</p>	2	<p><b>ignore</b> difficult to find raw materials <b>ignore</b> vague references to safety or technology</p> <p><b>allow</b> needs government clearance or approval</p> <p>e.g. to ensure that it works / has not got any serious side effects <b>allow</b> testing on humans = 2</p>
		<b>Total</b>	<b>5</b>	

Question		Expected Answers	Marks	Additional Guidance	
6	a	(run off from) fertilisers (1)	1	<b>allow</b> sewage / NPK	
	b	i	B (1)	1	
	b	ii	A (1)	1	
	b	iii	silver nitrate – (pale) yellow precipitate <b>and</b> barium chloride – white precipitate	1	<b>both</b> required for the mark
	b	iv	$\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$ correct formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae or mix of correct formulae and words  <b>not</b> and or & for + <b>allow</b> = instead of $\rightarrow$ <b>allow</b> correct multiples  <b>allow</b> one mark for balanced equation with minor errors of subscripts, superscripts, etc e.g. $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$ (1)
		<b>Total</b>	<b>6</b>		

Question		Expected Answers	Marks	Additional Guidance
7	a	electron (1)	1	
	b	<p>use ✓'s in this question</p> <p><b>any three from:</b>  defibrillator / defib / AW (1)</p> <p>paddles charged or at a high voltage (1)</p> <p>good electrical contact with chest (1)</p> <p>charge passed through patient / (patient given) shock / shock to heart / patient or heart given charge (1)</p> <p>heart contracts (1)</p> <p>idea of not shocking (other) staff (1)</p>	3	<p><b>allow</b> phonetic spelling</p> <p><b>allow</b> defibrillator charged (2)</p> <p><b>allow</b> shaved or dry or bare or lubricant on chest (1)  <b>ignore</b> just pads on skin or chest or body or either side of heart</p> <p><b>allow</b> (electric) current or electrons runs through body (1)  <b>but ignore</b> electricity runs through body  <b>ignore</b> shot of electricity / charge</p> <p><b>allow</b> stand back / insulating mat / insulating handles / insulating gloves / insulating shoes (1)</p>
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
8		3.75 (2)  <b>but</b> if answer is incorrect  $\frac{15}{4} = (1)$	2	<b>allow</b> 3.8 (2)
		<b>Total</b>	<b>2</b>	

Question		Expected Answers	Marks	Additional Guidance
9	a	idea that the ultrasound is reflected (1)  from the (boundary between) organs (1)  idea that ultrasound returns at different times (1)	2	<b>ignore</b> rebound / bounce back <b>allow</b> echo (1)  <b>allow</b> from (different) tissue / (named) tissue / layers / interfaces / surfaces / bones (1) <b>allow</b> ultrasound can echo off surfaces (2) <b>ignore</b> references to ultrasound shows up soft tissue <b>ignore</b> idea of ultrasound passing through tissue  <b>allow</b> reflects at different times (2) <b>ignore</b> different rates  <b>if any confusion with alpha, beta or gamma rays or electrons then scores 0</b>
	b	<b>ultrasound</b> able to produce images of soft tissue / does not damage living cells or tissues / does not cause cancer or ionisation (1) ORA for X-rays	1	<b>ignore</b> X-rays are more harmful unless qualified e.g. X-rays are more energetic therefore cause more damage (1)  <b>allow</b> X-rays only show up bones <b>ignore</b> gives a clearer picture
		<b>Total</b>	<b>3</b>	

Question			Expected Answers	Marks	Additional Guidance
10	a	i	time taken for the count rate to drop to half its original value (1)	1	<p><b>allow</b> time taken for half (radioactive) atoms or nuclei or isotope or substance to decay</p> <p><b>allow</b> time taken for half of the (radioactive) material to decay</p> <p><b>allow</b> time taken for radioactivity to halve</p> <p><b>allow</b> numerical examples</p> <p><b>not</b> half the life of the material</p> <p><b>not</b> time taken for particles to halve</p> <p><b>not</b> time taken for atomic mass to halve</p>
	a	ii	640 (2) <b>If answer is incorrect</b> evidence of two half lives = (1)	2	e.g. 160 to 80 to 40 for 1 mark
	b	i	uranium (1) lead (1)	2	must be in correct order
	b	ii	amount of uranium compared to lead (1)	1	<p><b>allow</b> ecf from 10(b)(i) or correct answer</p> <p><b>ignore</b> radio-carbon dating or uranium dating</p> <p><b>allow</b> how much of each substance there is in the rock (1) as this assumes the substances being referred to are those mentioned in part (i)</p>
			<b>Total</b>	<b>6</b>	

Question		Expected Answers	Marks	Additional Guidance
11	a	fission / chain (1)  heats/boils .....steam / (water) vapour (1)  turbine / blades.....generator / coils / magnets / electromagnets (1)	3	<b>not</b> fusion  <b>ignore</b> evaporates both needed  both needed <b>ignore</b> fan for turbine
	b	mention of neutrons (1) <b>but</b> neutrons absorbed or gained (by metals) (2)	2	mention of electrons or protons (being absorbed) scores 0  <b>allow</b> neutrons lost (1 max)
		<b>Total</b>	<b>5</b>	

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