

Additional Science B

General Certificate of Secondary Education

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

Mark Scheme for January 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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Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
not	=	answers which are not worthy of credit
reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant
allow	=	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
LOR	=	Level of response

Question		Expected Answers	Marks	Additional Guidance
1	(a)	difficult to digest / contain little energy / nutrients (1)	1	allow higher level answers: contain a lot of cellulose allow do not contain a lot of sugar / fat / protein / starch ignore contains no fat / sugar / starch / protein ignore do not contain a lot of carbohydrate (cellulose) not contains no energy allow idea that lots of leaves are available so they don't need to move (much)
	(b)	(i) any three from: lost from leaves / stomata (1) by diffusion / by evaporation (1) moves through xylem (1) (water) enters / absorbed by roots / root hairs (1) by osmosis (1)	3	allow through guard cells ignore if linked to other part of the plant other than the leaves ignore just moves through roots or from roots to stem ignore unless linked to water absorption or movement in roots
		(ii) cooling / (movement of) minerals (1)	1	allow photosynthesis / idea of support / temperature regulation
	(c)	any two from: wide / broad / large surface (area) – to absorb (sun)light / energy / for gas exchange / absorb carbon dioxide / lose oxygen (1) thin – for gas exchange / absorb carbon dioxide / lose oxygen / gases or light can reach all layers of leaf(1) veins – idea of support / transport (1)	2	need adaptation and explanation for each mark ignore long ignore sun allow stomata - gas exchange / absorb carbon dioxide / lose oxygen allow chlorophyll / chloroplasts – absorb light ignore green – to absorb light allow transparent cuticle / upper epidermis / top layer of cells – to allow light to reach palisade cells
		Total	7	

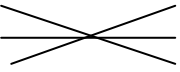
Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	movement from low to high concentrations / movement that needs energy (1)	1	allow against / up a concentration gradient ignore use of carrier proteins / reference to water
		(ii)	(to make) chlorophyll (1)	1	ignore chloroplast / to trap light / contains chlorophyll
		(iii)	producing as much food / crop / yield as possible (from the land / plants / animals available) (1)	1	ignore examples of intensive farming, eg using chemicals / hydroponics allow increases yield / increases amount of crops / grows food quickly / grows large quantities ignore it happens quickly / better crops
	(b)	(i)	ladybirds leave / fly away (1)	1	allow other things eat ladybirds / ladybirds eat other things / ladybirds do not breed as well outside ignore more space for greenfly to avoid ladybirds
		(ii)	0.5 (%) (1)	1	
		(iii)	greenflies will not eat all of the plants / (energy lost in) respiration / egestion / excretion / heat loss / movement (1)	1	not growth ignore energy loss unless qualified / digestion
		(iv)	concentration of pesticide in ladybirds is higher than concentration in greenflies (1)	1	allow (bio)accumulation (in ladybirds) / builds up in ladybirds ignore idea that pesticide is persistent ignore 'ladybirds contain more pesticide' / 'each ladybird eats several greenflies' but both statements together = 1 allow greenflies are resistant but the ladybirds are not not immune
	Total			7	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	(nitrogen is too) unreactive / inert (1)	1	
		(ii)	amino acids (1)	1	allow higher level answers: ammonia / ammonium compounds / peptides / polypeptides / named amino acids ignore ammonium on its own
	(b)		1st box / bacteria (1) 3rd box / fungi (1)	2	if more than 2 ticks, deduct 1 mark for every incorrect response
	(c)		nitrifying (bacteria) (1)	1	allow specific examples: <i>nitrosomonas</i> / <i>nitrobacter</i>
	(d)		lightning produces nitrates / lightning fixes nitrogen / lightning allows nitrogen to react with oxygen (1)	1	ignore puts nitrates in the soil / makes the nitrogen reactive
			Total	6	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	does not use water / AW (1)	1	allow stain will not dissolve in water / does not get wet allow uses an organic solvent / uses solvent that is not water not just uses a solvent not does not use a lot of water / uses steam
	(b) (i)	the higher the temperature, the better the cleaning action / AW (1)	1	must be a comparison
	(ii)	(C) cleans better at 30°C (1)	1	unless otherwise stated, assume answer refers to C allow cleans better / well at low temperatures ignore reference to score 3 not it is better at all temperatures
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	132 (1)	1	
	(b)	<p>(reactants are) ammonium hydroxide / NH_4OH / NH_3 / ammonia and sulfuric acid / H_2SO_4</p> <p>use titration / a burette</p> <p>use (named) indicator in flask</p> <p>add acid until indicator just changes colour</p> <p>repeat with same quantities but without the indicator / heat with charcoal or carbon and filter</p> <p>LOR 1 one sensible idea of adding reactants in a controlled way or names of reactants</p> <p>LOR 2 names of reagents and a sensible way of adding acid and alkali in a controlled way plus indicator use to get a neutral solution</p> <p>LOR 3 all of LOR 2 plus method that will give the required ammonium sulfate solution free from indicator</p>	3	<p>ignore ammonium on its own</p> <p>eg universal indicator / litmus / methyl orange</p>

Question		Expected Answers	Marks	Additional Guidance
	(c)	60(%) scores (2) BUT $\frac{\text{actual yield}}{\text{predicted yield}} \times 100$ or (2.1/3.5) x 100 scores (1)	2	look for correct answer first, 60(%) on own scores (2) unit not needed – ignore incorrect units allow am/pm x 100 (1)
		Total	6	

Question			Expected Answers	Marks	Additional Guidance
6	(a)	(i)	 <p>filtration traps finer particles using sand sedimentation allows larger solid particles to settle out chlorination kills microbes</p>	1	all 3 correct for mark
		(ii)	<p>1 sedimentation 2 filtration 3 chlorination</p>	1	all 3 correct for mark
	(b)		<p>(clean water) does not contain microbes or bacteria / (clean water) is not contaminated by sewage / people may become ill or die from drinking polluted water / AW (1)</p>	1	<p>allow any reasonable, but qualified, reference to a health issue ignore harm or dangerous unless qualified ignore answers related only to water</p>
	(c)		precipitation (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
	(d)		<p>$\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$</p> <p>correct reactants and products (1) correct balancing (1)</p>	2	<p>allow any correct multiple, including fractions allow = instead of \rightarrow not and / & instead of +</p> <p>balancing mark is dependent on correct formulae</p>
Total				6	

Question		Expected Answers	Marks	Additional Guidance
7	(a)	slippery / layers or molecules slide past each other / weak bonds between layers / weak intermolecular forces between the layers (1)	1	ignore soft / easily rubs off ignore just weak bonds or weak intermolecular forces
	(b)	(graphite has) electrons (1) that can move (1)	2	delocalised electrons / free electrons scores 2 negatively charged particles can move scores 1
	(c)	C ₆₀ (1)	1	not C60 / C ⁶⁰
	(d)	catalyst can be attached to nanotube / large surface area available (1)	1	
		Total	5	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	28,000 Hz	1	
	(b)	(i) area where particles / molecules have moved together / are closest together (1)	1	not merely a description of the diagram eg reference to 'lines' allow maximum / high density of particles not idea of waves being squashed or particles being squashed
		(ii) (maximum) distance a particle moves / (maximum) disturbance (of the particle) (1)	1	ignore reference to energy / pitch allow reference to loudness allow reference to how compressed or spread out the particles are allow disturbance caused by a wave but not wave disturbance
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
9	(a)	<u>electrons</u> move / transfer (to the cloth) (1)	1	not electrons move off the cloth / positive electrons allow e ⁻
	(b)	<p>any three from:</p> <p>paint is charged at the nozzle / as it leaves gun / gun charges paint (1)</p> <p>idea all particles of paint have the same charge so repel (1)</p> <p>paint and yacht are oppositely charged (1)</p> <p>opposite charges attract / paint is attracted to the yacht / no shadows / all of yacht painted / even coat of paint (1)</p>	3	<p>not molecules repel</p> <p>allow named charges</p> <p>ignore just paint sticks to the yacht</p>
	(c)	<p>dust is attracted to objects (such as TV) /</p> <p>clothes clinging or having a charge /</p> <p>hair standing on end /</p> <p>person gets a (electrostatic) shock (1)</p>	1	<p>ignore lightning / sparks unless qualified</p> <p>allow interference / damage to electrical components</p>
		Total	5	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	6 ohms (2) but if answer is incorrect $1.5 / 0.25 = (1)$	2	
	(b)	current / 0.25 = $\frac{230}{920}$ (1)	1	allow different correct rearrangements of this formula
		Total	3	

Question		Expected Answers	Marks	Additional Guidance	
11	(a)	they are unstable (1)	1	ignore they are decaying	
	(b)	idea that: α particle cannot penetrate skin / cannot get out of body / cannot be detected outside body (1)	1	allow high level ideas eg high energy / very ionising / ignore just ionising ignore merely dangerous / harms the body ignore not very penetrating / not very strong unless qualified by reference to the body	
	(c)	(i)	reduces by 2 / falls to 86 (1)	1	ignore incorrect element
		(ii)	reduces by 2 / falls to 134 (1)	1	ignore incorrect element
		(iii)	Radon (1)	1	allow Rn but if atomic number or atomic mass are given they must be correct ignore incorrect symbol if Radon is given
	(d)	Uranium and Lead (1) comparison of the percentage of the two substances AW (1)	2	allow other correct examples if both are metals eg uranium (234) and uranium (238) / lead (236/237) and lead (204) / strontium and rubidium / uranium and thorium mark independently, second marking point not dependant on first	
		Total	7		

Question		Expected Answers	Marks	Additional Guidance
12	(a)	(nuclear) fission (1)	1	not fusion allow chain reaction
	(b)	neutrons (1)	1	
		Total	2	

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