

Additional Science B

General Certificate of Secondary Education

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

Mark Scheme for January 2012

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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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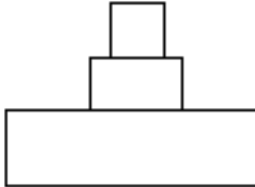
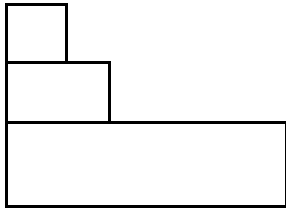
Annotations

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt not given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

Subject-specific Marking Instructions

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

Question			Answer	Marks	Guidance
1	(a)	(i)	allow gas exchange (1)	1	allow let CO ₂ into leaves / lets O ₂ out of leaves allow let gases in and out of leaves allow lets gases/ carbon dioxide /oxygen through (the stomata) ignore diffuse not references to breathing ignore reference to water
		(ii)	as light intensity increases, rate of transpiration increases (1)	1	allow positive correlation / as one rises so does the other allow reference to lag
		(iii)	by absorbing water (by osmosis) from surrounding cells (1) changed / increased turgidity / become turgid (1) alters shape of guard cell / bends guard cell opening up stoma (1)	2	allow photosynthesis produces glucose in the guard cell allow osmosis moves water into guard cell
		(iv)	idea of conserving water (by opening mainly at night reducing water loss through stoma)/ AW /ORA (1)	1	Not stops water loss / does not lose any water
	(b)		any two from: for (good root) growth / ora (1) for respiration / photosynthesis (1) to prevent discoloured leaves (1)	2	allow higher level responses eg to make DNA / RNA / ATP / cell membrane / proteins / enzymes ignore to make amino acids ignore to repair allow to give it colour
			Total	7	

Question		Answer	Marks	Guidance
2	(a)	trying to produce as much food as possible (from the land, plants and animals available) AW(1)	1	allow maximising yields,/ to get highest yield allow max production in minimum space allow idea that fertilizer and pesticides are needed
	(b)	<p>humans (area 60)</p> <p>chickens (area 120)</p> <p>wheat (wheat 360)</p>  <p>correct labelled pyramid i.e. chickens in middle and humans on top (1)</p> <p>correct bar sizes to give accurate scale diagram (1) allow $\pm \frac{1}{2}$ square tolerance on width and height of bars</p>	2	<p>second mark is dependent on first marking point</p> <p>allow scale drawing non-pyramid e.g.</p>  <p>If all bars are same height (10 small squares) then bar for chickens is 12 squares wide and bar for humans is 6 squares wide.</p> <p>If bars not all same height then bar for chickens must occupy area of 120 small squares and humans 60 small squares</p>
	(c)	<p>energy is transferred to less useful forms / heat from respiration / egestion / movement(1)</p> <p>energy transfer is less efficient as food move up the chain (1)</p>	2	allow energy is “lost” as it is transferred along the food chain / at each trophic level
	(d)	nitrifying (bacteria) (1)	1	allow nitrosomonas / nitrobacter not nitrogen fixing
	(e)	<p>avoids pesticide accumulation (1)</p> <p>avoids pesticides harming animals that are not pests (1)</p> <p>avoids use of chemicals (1)</p>	1	<p>allow idea that doesn't lead to pollution</p> <p>allow only affects the pest / dermanyssus gallinae</p> <p>allow does not disrupt the food chains</p> <p>allow no bioaccumulation</p> <p>ignore reference to harming environment</p>
Total			7	

Question		Answer	Marks	Guidance
3	(a)	120 (1)	1	
	(b)	(i) removes water preventing bacteria / fungi from reproducing (1) prevents bacteria growing on them prevents bacteria build up bacteria need water to grow/reproduce	1	allow removing water increases the concentration of sugar allow increases osmotic potential ignore feeding
		(ii) <p>Water moves from a low concentration to a high concentration of water. <input type="checkbox"/></p> <p>Water moves out of the sugar solution into bacteria. <input type="checkbox"/></p> <p>Water moves from a high concentration to a low concentration of water. <input checked="" type="checkbox"/></p> <p>Water moves out of the bacteria into sugar solution. <input checked="" type="checkbox"/></p> <p>Water does not move between the bacteria and sugar solution <input type="checkbox"/></p>	2	each incorrect tick loses 1 mark down to zero
	(c)	active transport can move substances from low concentrations to high concentrations / against the concentration gradient / ORA(1) active transport uses energy (from respiration) / ORA (1)	2	Osmosis Moves solvent from dilute solution to conc solution From high conc of solvent to low conc of solvent
Total			6	

Question		Answer	Marks	Guidance
4	(a)	ammonium hydroxide / ammonia (1)	1	allow NH ₃ / NH ₄ OH ignore ammonium on its own
	(b)	20 (1)	1	
	(c)	28% (2) 42 / 149 scores (1)	2	mark answer line first allow full marks for correct answer with no working out allow 28.19; 28.2
Total			4	

Question		Answer	Marks	Guidance
5	(a)	any one from dissolved in a solvent (1) allow named solvent crushed (1) and chromatography (1)	2	allow distillation / solvent extraction (1)
	(b)	buckminster fullerene acts as a cage for drug (1)	1	allow the drug is trapped inside the molecule / the drug is inside the molecule / the drug is released over a period of time
Total			3	

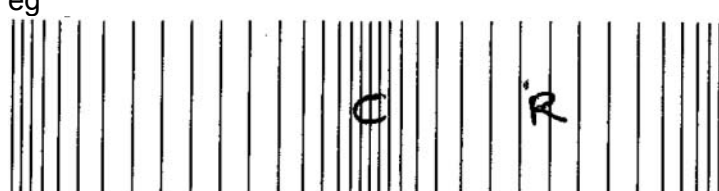
Question		Answer	Marks	Guidance
6	(a)	nitrogen + hydrogen → ammonia (1)	1	allow = or ⇌ sign instead of → but not 'and' or '&' for + allow mix of names and correct formula allow $N_2 + H_2 \rightarrow NH_3$ ignore balancing if symbols used not '+ catalyst' in equation, but allow catalyst above arrow
	(b)	(i) temperature 350°C pressure 500 (1)	1	both temperature and pressure must be correct for mark
		(ii) decreases / goes down / gets lower (1)	1	
	(c)	Catalyst catalyst increase rate of/ speeds up reaction (1) decrease energy costs (1) Pressure idea that increasing pressure increases yield / shifts equilibrium to right(1) idea that pressure above 200 increase cost too much(1) Temperature low temperature maximises yield / shifts equilibrium to right(1) temperature chosen keeps reaction rate from being too slow (1)	3	at least two conditions must be referred to for maximum marks to be awarded allow two marks for a condition and extra amplification to prevent it getting too expensive with larger pressure 200 does not need much safety equipment / limiting costs Allow idea of low cost / yield ratio If no values stated assume that description starts at room temperature and atmospheric pressure. Eg. 200atmos increases yield, 450°C decreases yield
		Total	6	

Question		Answer	Marks	Guidance
7	(a)	from fertiliser run off /AW(1)	1	Not pesticides
	(b)	(i) $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgCl}$ (1)	1	allow = sign instead of \rightarrow but not and or & for + allow any correct multiples
		(ii) 33.3 (2) BUT % yield = $\frac{\text{actual mass}}{\text{predicted mass}} \times 100$ or $0.24 / 0.72 \times 100$ (1)	2	mark answer line first allow full marks for correct answer with no working out allow 33 allow $\frac{\text{am}}{\text{pm}} \times 100$ (1)
		Total	4	

Question		Answer	Marks	Guidance
8	(a)	acid is neutralised by the alkali (1)	1	allow higher level answers hydrogen ions are removed / there are fewer hydrogen ions allow neutralisation
	(b)	$H^+ + OH^- \rightarrow H_2O$ (2) 1 mark for correctly identifying H^+ and OH^- but unable to complete equation correctly	2	allow = sign instead of \rightarrow but not and or & for + allow any correct multiples allow 1 mark for balanced equation with minor errors of case, subscript and superscript eg $H^+ + OH^- \rightarrow H_2O$
		Total	3	

Question		Answer	Marks	Guidance
9	(a)	B (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
	(b)	idea of correct earthing of the TV / correct discharging / AW (1) use of insulating mats / use of shoes with insulating soles / insulating clothing / AW (1)	2	allow examples of earthing eg make sure it is earthed / connect an earth wire to it allow named examples eg put it on a rubber mat / wear rubber gloves / wear rubber soled shoes ignore anti static spray
	(c)	Any three from charged metal plates in chimneys (1) charged metal grids put in chimneys (1) particles charged by plates /charged by grid/ particles charged by induction (1) ideas of dust particles attracted to plate / dust particles attracted together to form larger particles (1) heavy particles fall (down the chimney) (1)	3	allow metal plates charged by a high pd (1) not just charged
		Total	6	

Question		Answer	Marks	Guidance
10	(a)	stops the metal case / toaster becoming live (1)	1	not just to prevent a shock / for safety
	(b)	50 (ohms) (2) but if answer incorrect $\frac{230}{4.6}$ (1)	2	
Total			3	

Question		Answer	Marks	Guidance
11	(a)	letter C correctly showing compression and letter R correctly showing rarefaction (1)	1	eg 
		number of waves / vibrations /cycles each second (1)	1	allow how many waves per second (1) allow other units of time
Total			2	

Question		Answer	Marks	Guidance	
12	(a)	<p>any two from:</p> <p>idea that alpha cannot penetrate the skin or soft tissue / is absorbed by the skin or soft tissue (1)</p> <p>idea that gamma can penetrate the skin or soft tissue / is not absorbed by the skin or tissue (1)</p> <p>alpha is not detected outside the body / gamma is detected outside the body (1)</p>	2	<p>allow data correctly used to explain penetration of skin eg alpha only has a range of 0.0005 cm in skin so could not get to the detector (1)</p> <p>allow eg gamma radiation has a range of 100 cm in skin so will easily reach the detector (1)</p> <p>allow no alpha radiation to be detected (1)</p>	
	(b)	(i)	nucleus / decay radioactive / unstable (1)	1	both answers in this order required for the mark allow correct named example eg uranium
		(ii)	high speed electrons hitting a metal target (1)	1	allow firing electrons at metal target / named metal
		(iii)	easier to control than gamma rays (1)	1	Allow x-rays can be controlled / easier to focus on cancer / can be switched off AW(1) allow less soft tissue / cell damage for x-rays (1) ignore just less damage/less harmful
			Total	5	

Question		Answer	Marks	Guidance
13	(a)	idea of <u>neutrons</u> absorbed (1)	1	allow taken in (by the nucleus) as alternative to absorbed
	(b)	any one from: looking for blockages or leakages in pipes (1) looking for (route of) underground pipes (1) track waste (1)	1	ignore thickness testing ignore in the human body
	(c)	(i) any one from rocks / granite / radon (gas) (1) soil (1) Sun (1) cosmic rays / space (1)	1	ignore animals / humans / food ignore Earth on its own
		(ii) nuclear waste / nuclear testing (bombs) / nuclear weapons / nuclear accident / (examples of) medical or hospital use / nuclear power stations(1)	1	
		Total	4	

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