OCR
Oxford Cambridge and RSA

GCSE

Additional Science B

Unit **B722/02:** Modules B4, C4, P4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations used in scoris

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

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

/ = 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

MARK SCHEME

Question	Answer	Marks	Guidance
1 a	B (1) **plus any two from** idea that its temperature range includes that of the glasshouse / AW (1) idea that its humidity range includes that of the glasshouse / AW (1) eats highest number of mites (1)	3	If C or D chosen then award zero marks for the question **ignore** just quoting of temperature figures answer needs reference to glasshouse **ignore** just quoting of humidity figures answer needs reference to glasshouse **allow** A (1) and idea that temperature range includes that of the glasshouse (1) Max 2 marks for A
b	**any two from** pesticides can enter/accumulate in food chains/ consumers (1) pesticides may harm organisms that are not pests (1) idea that pesticides may need repeat treatments / pests may return / will not kill all the pests initially (1) pests can develop resistance (1)	**2**	**assume unqualified answers refer to pesticides** **allow** reverse arguments if refer to using predators **ignore** references to pollution or cost unless qualified **allow** bioaccumulation (1) **allow** may harm other organisms / people (1) **ignore** harm or kill plants / crop **allow** disrupt the food chain **allow** will have to keep buying it **ignore** immunity

c i	31 360 (2) BUT average = 98 (1) OR average x 320 (1)	2	correct answer with no working = 2 marks
ii	**any two from:** small sample size (1) idea that it may not be representative (1) idea that large range in results of plants tested (1)	2	 **allow** only 5 plants used **allow** idea that other plants may have more or less mites than those tested
	Total	**9**	

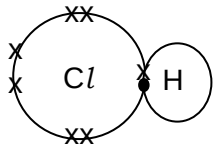
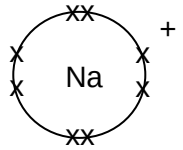
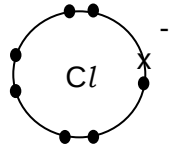
Question	Answer	Marks	Guidance
2	**[Level 3]** Gives a full explanation explaining why the cubes change colour **AND** explains why the 1.0 M solution changes colour first. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Gives a limited explanation explaining that the cubes change colour as the acid diffuses into them **AND** states that the 1.0 M solution changes colour first **OR** gives a full explanation of the acid diffusion, **OR** gives a full explanation of why the 1.0 M solution changes colour first. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Gives a limited explanation explaining that the cubes change colour as the acid diffuses into them **OR** states that the 1.0 M solution changes colour first. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A** **Indicative scientific points at level 3 may include:** • cubes change colour because **acid diffuses** into them from an area of higher concentration to an area of lower concentration • the 1.0 M solution changes colour first because this has the greatest concentration gradient. **Indicative scientific points at level 2 may include:** • cubes change colour **as acid diffuses** into them and the 1.0 M solution changes colour first. **Indicative scientific points at level 1 may include:** • cubes change colour as **acid diffuses** into them • the 1.0 M solution changes colour first. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
3 a	idea that **phosphate** needed for (normal) root growth (1) idea that **phosphate** needed for (normal) leaf colour/growth (1)	2	must make link to lack of phosphate if no other mark scored allow phosphate is needed for growth (of plant) (1) **allow higher level answers:** phosphate/phosphorous needed for DNA (1) phosphate/phosphorous needed for (cell) membranes (1)
b	**any three from:** oxygen needed for respiration / there is an increased rate of respiration (1) to release energy (1) for active transport (1) absorbs / takes in minerals more quickly / more minerals taken up (1)	3	 **not** uses the oxygen as energy **ignore** the idea that the rate of mineral transport in the plant increases
	Total	**5**	

Question	Answer	Marks	Guidance
4 a	to allow light in for photosynthesis (1)	1	
b	**any two from** starch is insoluble (1) idea that it will not move away / not move out of the cell ORA (1) Idea that it does not affect water concentration / does not cause osmotic problems / AW (1)	2	
c	reduce water loss / transpiration / evaporation (1) idea that it is cooler on the lower surface / sunlight not directly hitting lower surface (1)	2	**allow** prevents water loss **allow** ORA
	Total	**5**	

Question	Answer	Marks	Guidance
5 a	2 (1)	1	**allow** II
b	3 (1)	1	
c	(atoms) having the same atomic number / (atoms) same number of protons / **atoms** of the same element (1) different mass number / different number of nucleons / different number of neutrons (1)	2	**not** the same number of protons as neutrons **ignore** different **relative** atomic mass **allow** different atomic mass (1) **not** different number of protons to neutrons
	Total	**4**	

Question	Answer	Marks	Guidance
6	**A** is a chloride because it makes white (solid/ppt) (1) **B** is not iron(III) since should give brown or rust (solid/ppt) / **B** contains iron(II) since it makes grey-green (solid/ppt) (1)	2	**ignore yes / no** **not** chloride because it makes white (solid/ppt) with silver nitrate and blue (solid) with sodium hydroxide **but** allow chloride because it makes white (solid/ppt) with silver nitrate and a blue (solid/ppt) with sodium hydroxide is linked to presence of copper **not B** is not iron(III) since should go brown or rust with silver nitrate **allow** idea that conclusion for A is correct but conclusion for B is incorrect if no other mark scored (1)
	Total	**2**	

Question	Answer	Marks	Guidance
7 a i	$H_2 + Cl_2 \rightarrow 2HCl$ formulae (1) balancing (1)	2	**allow** = instead of arrow **not** and or & instead of + **allow** correct multiples of this equation including fractions **allow** one mark for balanced equation with minor errors in case and subscript e.g. H2 + CL2 → 2HCl
ii	 (1)	1	**allow** all dot or all crosses **allow** clear indication of shared pair of electrons drawn without orbits drawn **ignore** inner electrons in chlorine atoms must be labelled **not** if charges are included
b	 **Or** Na^+ (1)  (1)	2	**allow** all dot or all crosses **ignore** inner electrons in both ions if same electron shown in both ions then max 1 for question eg the same electron at either end of a arrow if electrons shared then zero for the question ions must be labelled if no marks awarded give **one** mark for **both** charges correct
c	giant structure / many bonds / a lattice (1) strong (ionic) bonds / bonds need lots of energy to break / bonds need a high temperature to break (1)	2	 **no marks** in question if intermolecular or covalent bonds or metallic bonding is referred to
	Total	**7**	

Question	Answer	Marks	Guidance
8	**Level 3** Gives a full description of the main processes in water purification **AND** explains why some soluble substances are not removed Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** Gives a limited description of the main processes in water purification **OR** a description of one of the main processes in water purification and explains why some soluble substances are not removed Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** Describes one of the processes in water purification **OR** explains why some soluble substances are not removed Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0marks)	6	**This question is targeted at grades up to A.** **Indicative scientific points may include:** **Processes:** • **Filtration** by a grid / sand / screen / mesh OR **filtration** removes insoluble material / sticks / large objects / fine particles • Idea that **sedimentation / addition of a chemical** lets (very small) particles settle / sink to the bottom • **Chlorination** to kill / remove microbes **Explanation** • idea that (soluble) materials not removed because the particles are **too small** **Ignore** the order of the processes
	Total	**6**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>9 a</td><td>
<table>
<tr><th>halogen</th><th>atomic number</th><th>Atomic radius in pm</th><th>melting point in ^{o}C</th></tr>
<tr><td>fluorine</td><td>9</td><td>64</td><td>-225 to -180 (1)</td></tr>
<tr><td>chlorine</td><td>17</td><td>99</td><td>-101</td></tr>
<tr><td>bromine</td><td>35</td><td>114</td><td>-7</td></tr>
<tr><td>iodine</td><td>53</td><td>133</td><td>114</td></tr>
<tr><td>astatine</td><td>85</td><td>134 to 168 (1)</td><td>200 to 330 (1)</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td>b</td><td>same number of electrons in outer shell /
all need one electron to form a stable ion /
all have one electron short of stable outer octet (1)</td><td>1</td><td>not if wrong number of electrons stated
accept seven electrons in the outer shell</td></tr>
<tr><td>c</td><td>bromine is reduced since it gains electrons (1)

iodide is oxidised since it loses electrons (1)</td><td>2</td><td>allow Br_2 / Br is reduced since it gains electrons
ignore bromide / Br^-

allow I^- is oxidised since it loses electrons

ignore iodine / I / I_2
ignore potassium

if no other mark scored then allow one mark for
oxidation is loss of electrons / reduction is gain of electrons /
if oxidation and reduction are not mentioned allow electrons are both lost and gained (1)</td></tr>
<tr><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
10 a i	waves reflect from tissues / baby (1) idea that deeper reflections take longer time to return (1)	2	**not** waves bounce **allow** echo need reference to distance linked to time, not a link to the types of tissue
a ii	(risk of) harm or damage to cells / DNA / nucleus / tissues / body / baby (1) soft tissue not detected (1)	2	**allow** can cause mutations / cancer **allow** only shows bones
b	**A** is transverse **and B** is longitudinal (1) **A** – **particles** move at 90^0 to wave (direction) / up and down (1) **B** – **particles** move along direction of wave / back and forth / idea that **particles** form compressions and rarefactions (1)	3	**both required** **allow** side to side **ignore** side to side **allow particles** move parallel to the direction of wave
c	ultrasound cannot be heard (by humans) / ORA (1) ultrasound is 20000 (Hz) / ultrasound is more than 20000 (Hz) ORA (1) ultrasound has a higher frequency ORA(1) ultrasound has a shorter wavelength ORA (1)	2	**allow** ultrasound is above human threshold (1) **allow** humans can't hear above 20000 Hz (2) **allow** 20 KHz for 20000 Hz
	Total	**9**	

Question	Answer	Marks	Guidance
11 a	(alpha and beta = 'they') they cannot penetrate (concrete / ground / pipe) / they cannot reach above ground / they are absorbed by ground / pipe / 'it' (1)	1	**allow** ORA for gamma **ignore** not strong enough to go through pipes
b	leak between 30-40m (1) possible leak as radiation levels rise (1) blockage between 50m – 60m (1) possible blockage as there is a build-up of radiation (1) after 50 – 60m levels of radiation fall to normal / background / low levels (1)	3	**allow** cannot move any further causing a build-up of radiation / cannot move any further causing (sudden) drop in radiation after 50m / at 60m (1) **allow** idea of a problem in the pipe anywhere in the stated range 30m – 60m, if no other mark scored (1)
	Total	**16**	

Question	Answer	Marks	Guidance
12 a	**[Level 3]** Correct description of removal of dust with an explanation in terms of electron transfer. Quality of written communication does not impede communication of the science at this level. **(5 – 6 marks)** **[Level 2]** Correct reference to dust particles becoming positively charged and so are removed by (negative) plate. Quality of written communication partly impedes communication of the science at this level. **(3 – 4 marks)** **[Level 1]** Simple reference to electrons having a negative charge OR Idea that the dust particles are attracted to the (negative) plates Quality of written communication impedes communication of the science at this level. **(1 – 2 marks)** **Level 0: (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted up to grade A*** **Indicative scientific points may include:** **Level 3:** • at (positive) grid electrons removed from dust particles making dust particles positive (less negative) so (negative) plates attract positively charged dust particles **Level 2:** • at (positive) grid dust particles becomes positively charged • positively charged dust particles attracted to (negative) plates **Level 1:** • idea that electrons are negatively charged • dust particles are attracted to the (negative) plate positive electrons means maximum of one mark **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
13 a	**too much current** causes the fuse to blow / melt / snap / trip (1) stops the current (flowing) / breaks the circuit / isolates the appliance (1)	2	
b	double insulated (1) they have a **case** that is non-conducting / **case** is insulating / has plastic **cover** / **case** cannot become live (1)	2	**ignore** case cannot become charged
c	690 (1) units are W / Watts (1)	2	**allow** kW or (joules per second) ie J/s (1) 690 kW = 1 mark but 0.69 kW = 2 marks
	Total	**6**	

Question	Answer	Marks	Guidance
14 a i	it must be less than 30 (per 100 000) (1)	1	**allow** the rate has dropped out of the top three **allow** the rate is lower than lung **allow** the rate is lower than lung, bowel and prostate **not** it has decreased
ii	2000 (2) but 40 x 50 (1)	2	
iii	idea that it allows comparisons to be made (even if the population size changes) (1)	1	**allow** the population may change
b	cells at the site of the tumour receive the same dose (1) (surrounding) tissue receives higher dose with method A (1)	2	figures quoted from the diagram must be qualified **allow** ORA: eg cells surrounding the tumour receive lower dose with method B (1) **allow** idea that A gives a wider spread of radiation **allow in** method A (total) amount of radiation is more (1) if no other mark awarded ORA
c i	to use patients with a variety of differences in lifestyle / diet / climate / treatment after radiation / genetics / environments / cultures or **to get reliable data** you need a large number of patients / patients with a variety of differences (1)	1	**ignore** reference to level of development of countries unless qualified **ignore** reference to fair test / accuracy **allow** to get a large number of patients in a short time

ii	**any three from :** method B results in more deaths from diseases (such as cancers elsewhere in the body) (1) explained by smaller dose to surrounding area (allowing cells to spread / replicate / reproduce) (1) method B (slightly) less/ about the same number of deaths from tumour growing back (1) explained by the same dose to site of tumour with each treatment (1)	3	ORA throughout if method A is discussed **allow** method B results in more deaths in total as long as both marking points 1 and 3 have not already been scored (1) ie needs an explanation to score three marks
	Total	**10**	

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