



**General Certificate of Secondary Education
January 2011**

Applied Science (Double Award) APSC/2H

Science for the Needs of Society

Unit 2

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

- 2.1** In a list of acceptable answers where more than one mark is available ‘any **two** from’ is used, with the number of marks emboldened. Each of the following lines is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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Question 1

Question	Answers	Extra information	Mark
1(a)	<p>any three from:</p> <ul style="list-style-type: none"> • diaphragm contracts • intercostal / rib muscles contract • reference to correct volume change • reference to (correct) pressure change 	<p>accept diaphragm moves down or flattens</p> <p>as alternative to both of the first 2 bullet points, accept muscles contract for 1 mark</p> <p>accept ribs or rib cage expands / moves up / out</p> <p>ignore lungs inflate / expand ignore muscles tighten</p>	3
1(b)(i)	breaths per minute		1
1(b)(ii)	27.27(%)	<p>accept 27.27, 27.3 or 27</p> <p>accept 27.2 with no working for 2 marks</p> <p>accept 55 – 40 for 1 mark</p> <p>accept $\div 55 \times 100$ for 1 mark</p> <p>for correct procedure, using incorrect figures allow 1 mark</p>	3
1(b)(iii)	<p>breathing rate (at rest / after 10 minutes of exercise) decreased or exercise did not cause as big an increase as before</p> <p>lungs do not have to work as hard / fast or oxygen moved around the body / to the muscles more easily</p>		<p>1</p> <p>1</p>
Total			9

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Question 2

Question	Answers	Extra information	Mark
2(a)	CaCO ₃	accept CO ₃ Ca	1
2(b)(i)	any one from: <ul style="list-style-type: none"> • heat • thermal decomposition 	do not accept answer with addition of other materials do not accept burning / combustion / melting	1
2(b)(ii)	carbon dioxide	accept CO ₂ / O ₂ C	1
2(b)(iii)	global warming / greenhouse effect	accept rising sea level / climate change / extreme weather ignore pollution ignore greenhouse gas ignore acid rain	1
2(c)(i)	CaO Ca(OH) ₂	must be in correct order accept OCa accept (OH) ₂ Ca	1 1
2(c)(ii)	gives out energy / heat		1
2(d)	sand sodium carbonate	accept silicon dioxide / SiO ₂ accept Na ₂ CO ₃	1 1
Total			9

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Question 3

Question	Answers	Extra information	Mark
3(a)(i)	Jupiter plotted at (780, -150)	± one square	1
	Pluto plotted at (5910, -220)	ignore any plots around (3000, -200) for calculating Uranus in 9(a)(ii)	1
3(a)(ii)	-190	accept range of -185 to -195 do not accept 190 without minus sign if no answer given look in table	1
3(a)(iii)	Venus (it) is <u>closer</u> to the Sun	must be a comparison accept Venus has a higher CO ₂ concentration	1
3(a)(iv)	water would freeze		1
3(b)	any two from: <ul style="list-style-type: none"> • above clouds / fog / mist • no light pollution • can use 24 hours a day 	accept less atmospheric pollution / distortion if qualified	2
3(c)(i)	stars / galaxies are moving away	accept correct reference to red shift accept the wavelength is stretched accept light appears more red or is shifted towards red end of the spectrum do not accept light is red	1

Question 3 continues on the next page

APSC/2H**Question 3 continued**

Question	Answers	Extra information	Mark
3(c)(ii)	(Universe) is expanding	accept Universe is getting bigger / larger	1
Total			9

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Question 4

Question	Answers	Extra information	Mark
4(a)(i)	O ₂		1
	CO ₂	accept O ₂ C	1
	H ₂ O	accept OH ₂	1
	correctly balancing formula (6 in front of each of inserted formula)	CO ₂ and H ₂ O can be in either order on the right hand side	1
4(a)(ii)	diffusion		1
4(a)(iii)	movement of particles / sugar / oxygen	do not accept water	1
	high concentration <u>outside</u> cell		1
	low concentration <u>inside</u> cell	accept moves from a high concentration to a low concentration for 1 mark ignore moves from outside the cell to inside the cell	1
4(b)	osmosis		1
	<u>water</u> moves into cell		1
	higher solute concentration inside cell or lower water concentration inside cell	accept lower solute concentration outside cell or higher water concentration outside cell	1
Total			11

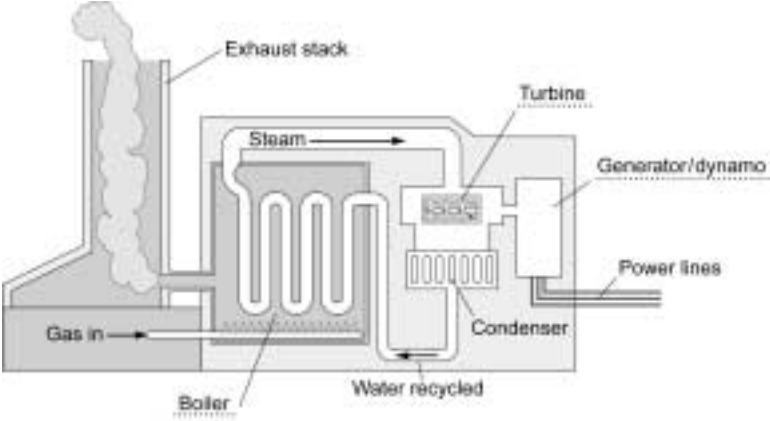
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Question 5

Question	Answers	Extra information	Mark
5(a)(i)	any four from: <ul style="list-style-type: none"> (fractional) distillation boil / heat (methanol / alcohol) evaporates (methanol / alcohol) condenses collected in a beaker 	do not accept burn accept turns into a <u>liquid</u> accept collected in a suitable container	4
5(a)(ii)	organic	accept non-aqueous	1
5(b)(i)	solid dispersed in a liquid	owtte	1
5(b)(ii)	(solid parts so) not too runny / (so) abrasive	accept solid parts remove dirt / bacteria	1
	(liquid parts so) freely moving	accept can be easily squeezed out of tube	1
5(c)	aerosol		1
	solute <u>dissolved</u> in a solvent	accept solid <u>dissolved</u> in a liquid	1
	emulsion		1
Total			11

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Question 6

Question	Answers	Extra information	Mark
6(a)	 <p style="text-align: right;">accept <u>water</u> heater or furnace for boiler</p>	<p style="text-align: right;">1 1 1</p>	<p style="text-align: right;">1 1 1</p>
6(b)(i)	<p>oxygen / O₂</p> <p>carbon dioxide / CO₂</p> <p>water / H₂O</p>	<p>carbon dioxide / CO₂ and water / H₂O on the right hand side can be in either order</p>	<p style="text-align: right;">1 1 1</p>
6(b)(ii)	<p>any one from:</p> <ul style="list-style-type: none"> • wood • biomass • <u>bio</u> ethanol / fuel / gas / diesel 	<p>accept animal / plant waste</p> <p>do not accept household waste</p>	<p style="text-align: right;">1</p>
6(c)(i)	<p>accept suitable named metals eg copper / brass / <u>stainless</u> steel</p>	<p>do not accept lead / iron / steel</p>	<p style="text-align: right;">1</p>

Question 6 continues on the next page

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Question 6 continued

Question	Answers	Extra information	Mark
6(c)(ii)	any two from: <ul style="list-style-type: none"> • does not corrode or unreactive with water / steam • waterproof / non-porous • conducts (heat) • malleable • <u>high</u> melting point • strong 	ignore cost accept does not rust ignore durable / sturdy / hardwearing	2
6(d)	22 620	allow useful energy = $\frac{\text{efficiency} \times \text{total}}{100}$ for 1 mark allow $0.58 \times 39\,000$ for 1 mark allow $\frac{58 \times 39\,000}{100}$ for 1 mark allow 58×390 for 1 mark	2
Total			12

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Question 7

Question	Answers	Extra information	Mark
7(a)	any three from: <ul style="list-style-type: none"> • insulin produced (by pancreas) when glucose levels high • liver converts glucose to glycogen • glycogen stored (in the liver / muscle) • when blood glucose levels fall insulin is no longer produced 		3
7(b)(i)	DNA / chromosome		1
7(b)(ii)	any three from: <ul style="list-style-type: none"> • enzymes used • <u>plasmid</u> removed from bacteria • human / insulin gene put into plasmid or bacterial DNA • plasmid / human / insulin gene put into bacterium • bacteria multiply / reproduce / make copies 	can be used only once	3

Question 7 continues on the next page

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Question 7 continued

Question	Answers	Extra information	Mark
7(c)	any two from: <ul style="list-style-type: none"> • rejection (of pig insulin) • allergic reaction or side effects • transferring disease from pig to human 	ignore references to pig insulin not being the same as human insulin ignore references to production of insulin ignore cost ignore quality unreliable ignore reference to religious / ethical objections	2
7(d)	(endocrine) glands blood	ignore named organs allow <u>blood</u> vessels / stream allow plasma do not accept blood cells	1 1
Total			11

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Question 8

Question	Answers	Extra information	Mark
8(a)	CH ₄ CO ₂ NH ₃ H ₂ O	4 correct for 2 marks 2 or 3 correct for 1 mark 1 correct gains 0 marks	2
8(b)	condensed / cooled seas / oceans	ignore clouds / rain / rivers / atmosphere	1 1
8(c)(i)	plants releasing / producing oxygen by / due to / because of photosynthesis		1 1
8(c)(ii)	less carbon dioxide used (in plants) for photosynthesis		1 1
Total			8

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Question 9

Question	Answers	Extra information	Mark
9(a)	alpha – 2 protons and 2 neutrons / helium nucleus	ignore particle with +2 charge	1
	beta – electrons		1
	gamma – wave	allow short wavelength or high frequency / energy wave	1
9(b)(i)	the more radiation the darker the film goes	accept the badge cannot detect alpha radiation for 1 mark	1
	can detect gamma behind the aluminium window		1
	can detect beta and gamma behind the plastic window		1
9(b)(ii)	it cannot penetrate our skin / clothing or has a short range	ignore it does not harm you	1
9(c)(i)	the tracer / (radioactive) material emits radiation that can be detected		1
	the tracer / (radioactive) material is stopped behind the blockage		1
9(c)(ii)	detecting cancer tumours or monitoring blood flow around the body or checking named organs for blockage / uptake of a named substance		1
Total			10
Overall Mark = 90			