



General Certificate of Secondary Education

**Applied Science (Double Award)
4861**

APSC/2H Science for the Needs of Society

Mark Scheme

2009 examination – January series

STANDARDISATION

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APSC Higher / 2H

question	answers	extra information	marks
1(a) E	<i>Any sensible named features/ characteristics for example:</i> disease resistance / higher yield	<i>Ignore shelf life/ healthy</i> <i>Accept grows faster</i>	1
1(b) E	<i>Natural, no foreign genes</i> <i>If the converse is the answer candidate must specify GM foods e.g.</i> not natural / foreign genes may spread into environment/ 'belief' that they are harmful	<i>Ignore cost/ taste/ pure/ chemicals</i>	1
1(c)(i) E	carbon dioxide oxygen	<i>Allow CO₂ / O₂ correct formulae</i>	1 1
1(c)(ii) E	need to put in energy / light/ heat		1
1(d)(i) E	any two from: <ul style="list-style-type: none"> • cell wall • chloroplast/ <i>chlorophyll</i> • (large) vacuole 		2
1(d)(ii) E	large surface area/ long	<i>Ignore thin/ hair</i>	1

1(d)(iii) G	osmosis	1
Total		9

question	answers	extra information	marks
2(a) E	high melting point/ <i>unreactive insulator/ heat resistant</i>		1
2(b) G	calcium oxide/ <i>CaO / OCa</i> carbon dioxide/ <i>CO₂ / O₂C</i>	any order <i>Ignore quick lime</i>	1 1
2(c) E	<p><i>any two from:</i></p> <ul style="list-style-type: none"> <i>Idea of (the reducing agent) removes oxygen (from iron oxide)</i> <i>Idea of by chemically combining it</i> <i>Idea of oxide of carbon forms</i> <p>or</p> <p>2 marks for correct symbol equation</p> <p>i.e. $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$</p> <p>or</p> <p>word equation:</p> <p>iron oxide + carbon monoxide \rightarrow iron + carbon dioxide</p> <p>or</p> <p>iron oxide + carbon \rightarrow iron + carbon oxide</p>		2

question	answers	extra information	marks
2(d) E	any two from: <ul style="list-style-type: none"> steel is an alloy iron is an element steel contains carbon 	<i>Not compound</i> <i>ignore mixture/ uses/ other properties</i> <i>Allow steel is harder/ stronger</i>	2
2(e)(i) E	$C + O_2 \rightarrow CO_2$ accept alternatives e.g. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ or $CaCO_3 \rightarrow CaO + CO_2$	<i>Credit correct word equation</i>	1
2(e)(ii) E	air pollution / sulfur dioxide / dust / mining / quarrying/ acid rain/ noise/ poisonous gases/ toxic gases	<i>Any sensible environmental pollution not linked with CO₂ / global warming</i> <i>Ignore carbon monoxide</i>	1
Total			9

question	answers	extra information	marks
3(a) E	<i>More miles per gallon/ uses less petrol / fuel / finite resource</i>	<i>Answer must be comparative</i>	1
	<i>produce less carbon dioxide/ emissions</i>		1
3(b) E	$221 \times \frac{1}{60}$ (<i>0.016 or 0.017</i>) $= 3.7$	<i>Answer range 3.5 – 3.8 to allow for rounding</i>	1 1
3(c)(i) E	number of seconds in one hour = $60 \times 60 = 3600$ $100000 / 3600$ (= 27.78) Or $27.78 \times 3600 = (100,000)$ Or $100000 / 27.78 = 3600$		1 1
3(c)(ii) E	acceleration = change in velocity / time taken $= 27.78 / 8.8$ $= 3.16$ (m/s ²) $= 3.1568182$ (m/s ²)	<i>Allow correct rounding</i>	1 1 1
Total		9	

question	answers	extra information	marks
4(a)(i) E	<i>any food made by microorganisms</i> <i>for 1 mark:</i> <i>bread/ beer/ wine/ cheese/ alcohol/</i> <i>marmite/ yogurt/ soy/ soya</i>	<i>mark independently but must be</i> <i>linked for 2 marks</i>	1
	<i>name of microorganism:</i> <i>yeast/ bacteria/ fungus/ mould</i>		1
4(a)(ii) E	<i>penicillin/ antibiotic</i>	<i>second mark must be correctly</i> <i>linked</i>	1
	<i>mould/fungus</i> <i>or</i> <i>insulin</i> <i>bacteria</i>		1
4(a)(iii) E	<i>(transfer of foreign) genes/ DNA/</i> <i>chromosomes/ genetic information</i> <i>idea of putting something into</i> <i>something cells/ microorganisms/</i> <i>bacteria</i> <i>(so cells have desired</i> <i>characteristics)</i>		1 1
4(b)(i) E	<i>pig / sheep / cow / chicken</i> <i>cow / pig / sheep</i> <i>sheep</i>	<i>same animal can be used more</i> <i>than once</i> <i>apply list principle</i>	1

question	answers	extra information	marks
4(b)(ii) E	any three from: <ul style="list-style-type: none"> • <i>select/ chose a desirable characteristic/ trait</i> • <i>breed together/ cross them</i> • <i>repeat (over generations)</i> 		3
Total			10

question	answers	extra information	marks
5(a) E	Answer of 250 = 2 marks	0.25 = 1 mark	1
	For one mark either $(1000 \times 5) = 5000$ Or $\left(\frac{1000}{20}\right) = 50$	0.25 litres = 2 marks Allow ecf if 1litre not correctly converted to 100cm ³ but rest of calculation is correct	
5(b) E	prevent growth of bacteria/ make it last longer/ prolong shelf life/ stop it going off/ stops it fermenting	<u>Not</u> kill bacteria <u>Ignore</u> keep it fresh	1
5(c)(i) E	solid particles/ bits/ lumps		1
	Any idea of not being dissolved		1
5(c)(ii) E	Solvent/ liquid/ water		1
	Any idea of solute being dissolved		1
5(d)(i) E	Idea of solid being measured out/ solid left behind		1
	Idea of Mass is lower		1

question	answers	extra information	marks
5(d)(ii) E	<i>Idea that filter paper is wet/ water has not evaporated</i>		1
	<i>The idea of the mass being higher</i>		1
Total			11

question	answers	extra information	marks
<p>6(a)(i) E</p>	<p>any three from:</p> <ul style="list-style-type: none"> • fossil fuels produce CO₂/global warming/climate change/ <i>acid rain/ sulphur dioxide/ nitrogen oxides/ acidic gases</i> • fossil fuels have limited deposits/ <i>non-renewable/ will run out</i> • <i>mining damages the environment</i> • Nuclear fuels have radioactive emissions • <i>Fossil fuels supply is controlled by other countries</i> • disposal of nuclear waste is a problem 	<p><i>Accept reverse argument</i></p>	<p>3</p>
<p>6(a)(ii) E</p>	<p>any two from:</p> <ul style="list-style-type: none"> • small scale (except HEP)/ <i>does not generate enough electricity</i> • unreliable (e.g. poor record of sunshine in UK) • effect on environment (e.g. wind turbines are an eyesore) 	<p><i>Ignore reference to cost</i></p>	<p>2</p>
<p>6(b)(i) E</p>	<p>contains carbon and hydrogen <u>only</u></p>	<p>1</p>	

question	answers	extra information	marks
6(b)(ii) E	any two from: <ul style="list-style-type: none"> • small molecules/ <i>short chains</i> • low boiling point • temperature decreases up the column 	<i>Ignore lighter</i> <i>Ignore melting point</i>	2
6(c)(i) E	CH ₄	Allow H ₄ C	1
6(c)(ii) E	any two from: <ul style="list-style-type: none"> • incomplete combustion/ <i>not enough oxygen</i> • <i>(produces) carbon monoxide/CO</i> • <i>(produces) soot/ carbon/ C</i> • Toxic/ <i>poisonous</i> combustion products (e.g. CO reduces oxygen carrying capacity of the blood/ <i>CO could suffocate you</i>) 	<i>Not harmful</i>	2
Total			11

question	answers	extra information	marks
7(a)(i) E	<p>all five points plotted correctly = 2 marks (plus or minus one small square)</p> <p>one plotting error = 1 mark</p> <p>smooth curve or point to point</p>	<p><i>Not drawn with a ruler</i></p>	<p>2</p> <p>1</p>
7(a)(ii) E	<p>115000 – 130000 or correct value from their graph</p>		<p>1</p>
7(b) E	<p>any two from:</p> <ul style="list-style-type: none"> • wear a condom/ <i>protection</i> • restrict number of partners • <i>not have sex with someone you know is infected</i> • wait longer until sexually active 	<p><i>Ignore contraception</i></p>	<p>2</p>
7(c) E	<p>any two from:</p> <ul style="list-style-type: none"> • <i>surround/ engulf/ digest/ kill cells/microorganisms/ bacteria/ virus/ pathogens</i> • <i>(produce) antibodies</i> • <i>(Produce) antitoxins</i> 	<p><i>Ignore disease or infection</i></p> <p><i>Antibodies kill bacteria for 1 mark</i></p>	<p>2</p>

7(d) E	viruses are not killed by antibiotics/ <i>antibiotics only kill bacteria</i>	1
	bacteria develop resistance to antibiotics/ <i>become immune to them</i>	1
Total		10

question	answers	extra information	marks
8(a)(i) E	Cl ⁻ / <i>chloride</i> could combine with other ions Other compounds could be made Na ⁺ / <i>sodium</i> could combine with other ions	allow more Cl ⁻ than Na ⁺	1
8(a)(ii) E	eg magnesium sulfate MgSO ₄ /Mg ²⁺ SO ₄ ²⁻	<i>Allow CaCO₃</i> <i>Formula must be correct</i> <i>Ignore charges</i>	1 1
8(b)(i) E	weak forces/ <i>bonds (of attraction)</i> between molecules	1 mark for small molecules	1 1
8(b)(ii) E	any two from: <ul style="list-style-type: none"> • high melting point/boiling point • strong forces/ <i>bonds</i> of attraction • between ions • giant structure 	<i>Strong ionic bonds = 2 marks</i>	2

question	answers	extra information	marks
<p>8(c)(i) E</p>	<p>any two from:</p> <ul style="list-style-type: none"> • potassium / K^+ • magnesium / Mg^{2+} • nitrate / NO_3^- • phosphate / PO_4^{3-} • ammonium / NH_4^+ • sulphate / SO_4^{2-} • calcium / Ca^{2+} 		2
<p>8(c)(ii) E</p>	<p>pesticide / herbicide / fungicide / <i>insecticide</i></p>		1
<p>Total</p>		<p>10</p>	

question	answers	extra information	marks
9(a)(i) E	Conduction/ <i>correct description of conduction</i>		1
	<i>Sensible example of wall insulation</i>	<i>allow cavity wall insulation</i>	1
9(a)(ii) E	convection/radiation		1
	<i>Sensible example of roof insulation</i>	<i>allow loft insulation</i>	1
9(b)(i) E	energy = power × time	$Power = \frac{energy}{time} = 1 \text{ mark}$	1
	= 0.5 × 3		1
	= 1.5 (kWh)	<i>The answer alone scores full marks</i>	1
9(b)(ii) E	% efficiency = (useful energy transferred/total energy supplied) × 100	<i>Allow ecf from 9(b)(i) e.g. 1.1/answer from 9(b)(i) × 100</i>	1
	= (1.1/1.5) × 100	<i>Answer alone scores full marks</i>	1
	= 73 %	<i>0.73 gets 2 marks</i>	1
		<i>Allow 73.3% or full calculator display</i>	
9(b)(iii) E	more spread out/not as concentrated/ <i>energy lost as heat or sound/ converted to heat or sound</i>		1
Total			11
Overall mark = 90			