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Level 3

# Applied Science

Unit 1 Key Concepts in Science

Mark scheme

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Version/Stage: SAM

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

Further copies of this mark scheme are available from [aqa.org.uk](http://aqa.org.uk)

## Section A

Question	Answer	Additional guidance	Marks
1(a)	A = phosphate		1
	B = (ribose) sugar		1
1(b)(i)	contains uracil <b>or</b> does not contain thymine		1
1(b)(ii)	A and U / C and G pair up		1
	and the percentages of A and U or C and G are the same <b>or</b> if single stranded all four percentages would be different		1
1(c)	29%	allow 1 mark for calculating 58%	2
<b>Total</b>			<b>7</b>

Question	Answer	Additional guidance	Marks
2(a)(i)	(Blood pH) 7.35–7.45		1
	(Blood glucose) 82–110 (mg/dL)		1
2(a)(ii)	chemoreceptors		1
	send impulses to the medulla		1
2(b)	pacemaker generates an electrical impulse	do <b>not</b> allow SAN generating impulse	1
	travels across the atria (causing atria to contract)		1
	the impulse reaches the atrioventricular node (AVN)		1
	AVN sends the impulse down the Purkyne fibres		1
	to the bundle of His		1
	impulse spreads up over the ventricles, causing contraction		1
2(c)	don't know long term success rates/outcomes		1
	risk of death during implantation/operation <b>or</b> only 97% survived the operation		1
	trial flawed	allow description, i.e. small sample size, mostly men, age range not broad enough	1
<b>Total</b>			<b>13</b>

## Section B

Question	Answer	Additional guidance	Marks
3(a)	Z = s block X = group VII Y = d block Group 0 – left blank	3 correct = 2 marks 2 correct = 1 mark Apply list principle if any are repeated	2
3(b)(i)	Based on hexagonal / 6 membered rings Extended giant structure with correctly linked rings		1
3(b)(ii)	(Giant) covalent (C – C)		1
3(b)(iii)	Single layer of carbon atoms		1
3(b)(iv)	Delocalised	Accept pi electron cloud or wtte	1
	Electrons (can move/mobile)		1
3(b)(v)	Graphite/fullerene	Accept versions of fullerene	1
<b>Total</b>			<b>8</b>

Question	Answer	Additional guidance	Marks
4(a)(i)	Both axes correctly labelled (y = energy; x = reaction coordinate)	Accept x = reaction pathway (or wtte) For y, accept E for 'energy'	1
	'Reactants' and 'Products' energy levels drawn and labelled, with products lower than reactants	Accept correct formulae in place of labels for reactants and products	1
	Arrow downwards from reactants to products energy levels, labelled $\Delta H$	Ignore negative sign if present. Accept 'enthalpy change' instead of $\Delta H$  Ignore the inclusion of an activation energy 'hump' unless clearly incorrect or mis-labelled	1
4(a)(ii)	106		1
4(a)(iii)	Mol $\text{Na}_2\text{CO}_3 = 1.00/106 = 0.00943$	Ignore precision unless <2sf	1
4(b)	$q = mc\Delta T = 50 \times 4.2 \times 5.1 = 1071 \text{ (J)}$	Allow correct answer in kJ	1
<b>Total</b>			<b>6</b>

<b>Question</b>	<b>Answer</b>	<b>Additional guidance</b>	<b>Marks</b>
5(a)(i)	Correct plotting of points	Allow plots within one small square	1
	Correct lobf based on plotted points		1
5(a)(ii)	Correct value based on student lobf	Disallow if line is clearly incorrect and does not resemble a pH titration curve	1
5(a)(iii)	Correct value based on student lobf		1
5(b)	Methyl red	Allow ecf from pH of end point and acceptable justification	2
<b>Total</b>			<b>6</b>

## Section C

Question	Answer	Additional guidance	Marks
6(a)(i)	7.5	1.5 gains 2 marks 1 mark compensation for correct substitution in correct equation for resistors in parallel or for an answer of $\frac{4}{6}$ or $\frac{2}{3}$ or decimal equivalent.	3
6(a)(ii)	D		1
6(b)	X in line with lamp E and correct component symbol drawn (variable resistor)	Allow lamp E as part of a potential divider circuit.	1
<b>Total</b>			<b>5</b>

Question	Answer	Additional guidance	Marks
7(a)	B		1
7(b)	<ul style="list-style-type: none"> <li>• Soft surface provides greater stopping distance</li> <li>• (Therefore) increases stopping time/ reduces negative acceleration</li> <li>• (Therefore) rate of change of momentum is decreased</li> <li>• Force = rate of change of momentum / <math>F = ma</math></li> <li>• Therefore force on the person is reduced</li> <li>• Both foam and dry sand will be effective</li> <li>• The sand will be less effective if it has got wet</li> </ul>		6
<b>Total</b>			<b>7</b>

Question	Answer	Additional guidance	Marks
8(a)(i)	Photovoltaic cells use light to generate electricity. Solar thermal cells use heat from the sun to heat water.		2
8(a)(ii)	Black is the best absorber of infra-red radiation.		1
8(b)(i)	Turbines still generate electricity when there is little sunlight/can be used throughout the year/at night.		1
8(b)(ii)	Danger of blades breaking due to stresses/forces produced by high rotation speeds. <b>or</b> too much heat generated through friction.	Explanation and reason must match.	2
8(b)(iii)	Any two of: less efficient more visual pollution more expensive to install require more maintenance more hazardous to birds/more damage to habitats.		2
<b>Total</b>			<b>8</b>

### Coverage of assessment outcomes

Assessment outcome	Marks and % of marks available in section A	Marks and % of marks available in section B	Marks and % of marks available in section C	Total marks
<b>AO1</b> Understand Key Concepts in Biology	20 marks 33.3%	–	–	20 marks
<b>AO2</b> Understand Key Concepts in Chemistry	–	20 marks 33.3%	–	20 marks
<b>AO3</b> Understand Key Concepts in Physics	–	–	20 marks 33.3%	20 marks

Question	Assessment outcome 1	Assessment outcome 2	Assessment outcome 3
1	7	–	–
2	13	–	–
3	–	8	–
4	–	6	–
5	–	6	–
6	–	–	5
7	–	–	7
8	–	–	8
<b>Total</b>	<b>20</b>	<b>20</b>	<b>20</b>