

# **Additional Science B**

General Certificate of Secondary Education

Unit **B623/02**: Modules B3, C3, P3 (Higher Tier)

## **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 <b>not</b> given
	error carried forward
	information omitted
	ignore
	reject
	contradiction

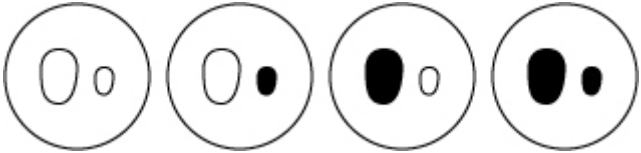
## Subject-specific Marking Instructions

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

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	smooth curve going through all points or at least touching every cross (1)	1	<b>allow</b>  (1) <b>not</b> dot to dot <b>not</b> multiple lines <b>not</b> lines starting at (4,0)
		(ii)	(no) might be faster just before / after pH 6 (1)	1	<b>allow</b> (no) not enough information / too few points (1) <b>allow</b> (yes) idea that pH6 is the lowest point or pH6 gives the fastest reaction or pH6 gives the shortest time (1) <b>ignore</b> less time
	(b)	(i)	<b>any two from:</b> in (small) intestine (1) idea that absorbed or transferred into blood (1) by diffusion (1)	2	<b>ignore</b> large intestine <b>allow</b> through villi (1)  <b>ignore</b> dissolved <b>allow</b> diffuse in to blood = 2

Question		Expected Answers	Marks	Additional Guidance
	(ii)	<b>any one from:</b> <b>B and D (1)</b> <b>B (1)</b> <b>D (1)</b>	1	any reference to <b>A</b> or <b>C</b> scores (0)
	(c)	(DNA) base <b>sequence</b> (1) determines amino acid <b>sequence</b> (1) each amino acid coded for by 3 bases / triplet code (1)	3	<b>USE TICKS ON THIS QUESTION</b> <b>allow</b> order of bases or order of A, C, G, T (1)  <b>allow</b> as an additional marking point higher level answers e.g. amino acid sequence determines shape of protein (1)  <b>if no other marks scored then reference to coding scores (1)</b>
		<b>Total</b>	<b>8</b>	

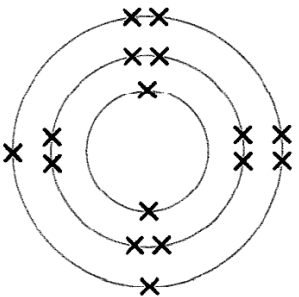
Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	provide <b>energy</b> (for swimming) (1)	1	<b>allow</b> for respiration (1) <b>ignore</b> swim / get to egg
		(ii)	(release enzymes) to <b>digest</b> egg membrane (for fertilisation) (1)	1	<b>allow</b> break down egg membrane (1) <b>allow</b> break down or digest egg wall (1) but <b>not</b> break down or digest egg cell wall <b>allow</b> digest into egg cell (1) <b>not</b> break down or digest egg <b>ignore</b> breaks up or breaks through or breaks in or penetrates <b>ignore</b> fertilisation / get into egg <b>ignore</b> references to dissolving
	(b)		radiation / chemicals (1)	1	<b>allow</b> x-rays / gamma rays / UV / alpha / beta (1) but <b>ignore</b> other forms of radiation <b>allow</b> smoking (1) <b>allow</b> drugs (1) <b>allow</b> alcohol (1)
	(c)	(i)	so can form diploid (zygote) / so (zygote) does not have too many chromosomes (1)	1	<b>allow</b> (new cell has) a full set or correct amount of chromosomes or 46 chromosomes (1) <b>allow</b> idea of doubling number of chromosomes e.g. $23+23 = 46$ or $20+20 = 40$ (1) <b>allow</b> $\frac{1}{2} + \frac{1}{2} = 1$ (1)
		(ii)	<b>all correct</b> (1) 	1	
	(d)		stem (cells) (1)	1	
<b>Total</b>				<b>6</b>	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	large surface area (to volume ratio for absorbing / releasing oxygen) (1)	1	<b>allow</b> idea of increased rate of diffusion (1)
		(ii)	<b>any one from:</b> contain haemoglobin (1)  (biconcave) disc shape (1)  lack of nucleus (1)  large surface area (to volume ratio) (1)  permeable membrane (1)  thin membrane / short diffusion pathway / AW (1)	1	<b>allow</b> dips or dents or doughnut shaped (1) <b>allow</b> (bi)concave (1)  <b>do not</b> award surface area mark if already given in (i)  <b>ignore</b> references to holes
	(b)		idea of blockage (of arteries) (1)	1	<b>allow</b> clots or low blood pressure (1) <b>allow</b> cholesterol or fat or plaque builds up (in arteries) (1) <b>allow</b> idea that lumen narrows (1) <b>not</b> veins or capillaries become blocked
	(c)	(i)	idea that there is no shortage of donor hearts / AW (1)	1	<b>allow</b> no consent required (1) <b>allow</b> (pigs heart is) similar in size (to human heart) (1) <b>allow</b> idea of reduced waiting time (1) <b>allow</b> do not need a human donor (1)
		(ii)	take an egg (cell) from a pig (1)  put the nucleus from the skin cell (of the genetically engineered pig) into the egg cell (of the non-engineered pig) (1)	2	<b>mark independently</b>  <b>allow</b> put the nucleus from the genetically engineered pig into the egg cell (1)
			<b>Total</b>	<b>6</b>	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	gas (1)	1	
		(ii)	melting point -180 to -270 (1) boiling point 260 to 350 (1)	2	<b>allow</b> values within the range
	(b)		$2\text{Na} + \text{F}_2 \rightarrow 2\text{NaF}$ formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae <b>allow</b> any correct multiple e.g. $4\text{Na} + 2\text{F}_2 \rightarrow 4\text{NaF}$ <b>allow</b> = for $\rightarrow$ <b>not</b> 'and' or '&' for + <b>allow</b> one mark for correct balanced equation with incorrect use of upper and lower case formulae eg $2\text{NA} + \text{F2} \rightarrow 2\text{NAF}$
			<b>Total</b>	<b>5</b>	



Question		Expected Answers	Marks	Additional Guidance	
5	(a)	<p><b>appropriate</b> utensil used (1)</p> <p>dip utensil in (solid) chemical (1)</p> <p>place (chemical) in Bunsen flame (1)</p>	3	<p>marks can be awarded from a <b>labelled</b> diagram</p> <p><b>allow</b> wire / splint / spoon / spatula / tongs (1)</p> <p><b>allow</b> (atomised) spray of solution introduced into flame (3)</p> <p><b>ignore</b> references to cleaning utensil in acid / AW</p> <p>any reference to using element or metal scores maximum of (2)</p> <p><b>allow</b> heat or burn (chemical) on gauze for a maximum of (1)</p> <p><b>ignore</b> put under or over a Bunsen flame</p>	
	(b)	(i)	sodium + water → hydrogen (1) + sodium hydroxide (1)	2	<p>order unimportant</p> <p><b>allow</b> correct formulae i.e. H<sub>2</sub> (1) and NaOH (1)</p> <p><b>if overall equation incorrect then max 1</b> e.g.  sodium + water → hydrogen → sodium hydroxide (1) or  water + carbon dioxide → hydrogen (1) or  water + carbon dioxide → hydrogen + sodium hydroxide (1)</p>
		(ii)	oxidation (1)	1	<b>allow</b> correct answer circled, underlined or ticked if answer line left blank
			<b>Total</b>	<b>6</b>	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	3 / 3 <sup>rd</sup> / third (1)	1	<b>allow</b> III (1)
	(b)	number of protons (in the nucleus of an atom) (1)	1	<b>allow</b> proton number (1) <b>allow</b> number of electrons (1) <b>allow</b> number of electrons or protons (1) and <b>allow</b> '/' for or <b>not</b> number of protons and electrons
	(c)		1	mark diagram first but if no diagram given <b>allow</b> 2.8.6 (1)  electrons do not need to be grouped in pairs  <b>ignore</b> nucleus
		<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
7	(a)	precipitate (1)	1	<b>allow</b> precipitation (1)
	(b)	(dark) green / grey (1)	1	<b>ignore</b> blue-green <b>allow</b> light green (1)
	(c)	$\text{Fe}^{2+} + 2\text{OH}^- \rightarrow \text{Fe}(\text{OH})_2$ formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae <b>allow</b> any correct multiple e.g. $2\text{Fe}^{2+} + 4\text{OH}^- \rightarrow 2\text{Fe}(\text{OH})_2$ (2) <b>allow</b> $\text{Fe}^{2+} + 2\text{OH}^- \rightarrow \text{Fe}^{2+} (\text{OH})_2$ (2) <b>allow</b> = for $\rightarrow$ <b>not</b> 'and' or '&' for + <b>allow</b> one mark for correct balanced equation with incorrect use of upper and lower case formulae eg $\text{Fe}^{2+} + 2\text{Oh}^- \rightarrow \text{FE}(\text{OH})_2$ eg $\text{Fe}2^+ + 2\text{OH}^- \rightarrow \text{Fe}(\text{OH})_2$
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	lithium (1)	1	<b>allow</b> Li (1)
	(b)	calcium (1)	1	<b>allow</b> Ca (1)
<b>Total</b>			<b>2</b>	

Question		Expected Answers	Marks	Additional Guidance
9	(a) (i)	balanced / equal (but opposite) (1)	1	<b>allow</b> no resultant force / in equilibrium / cancel each other out / net force is zero (1) <b>allow</b> they are the same size (1)
	(ii)	(maximum) speed will be greater (1)  idea that forces will be balanced at a higher speed (1)	2	<b>allow</b> reverse argument e.g. more drag force means slower speed (1)  <b>allow</b> less work done against drag (1) <b>allow</b> greater driving force means higher maximum speed (1)
	(b)	the speed of the lorry (1) how tired Cliff is (1)	2	2 correct and 1 incorrect = 1 2 correct and 2 incorrect = 0 1 correct and 1 incorrect = 1
<b>Total</b>			<b>5</b>	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	30 (J) (2) <b>but if answer is incorrect</b> 50 x 0.6 (1)	2	<b>ignore</b> unit e.g. 30 N = 2
	(b)	33.3 (W) (2)  <b>but if answer is incorrect</b> 30 ÷ 0.9 (1)	2	<b>allow</b> 33 (2) <b>allow</b> 33.4 scores (1) <b>allow</b> ecf e.g. if answer to 10(a) is 45 then 50 scores 2
<b>Total</b>			<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	increased stopping time / increased stopping distance (1)  decreased acceleration (1)	2	<b>allow</b> takes longer to stop (1) <b>allow</b> increased collision time or increased collision distance (1) <b>not</b> increased braking time or braking distance <b>allow</b> idea of reduced chance of collision with dashboard / windscreen / steering wheel / front seat (1)  <b>allow</b> higher level answers e.g. lower rate of change of momentum scores (2)
	(b)	20N (1)	1	more than one answer ringed = 0
<b>Total</b>			<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	idea that electricity generation or power station causes pollution (2)  <b>if idea above not awarded then a maximum of one from:</b> no fuels burnt by cars (1) cars do not produce carbon dioxide / carbon monoxide / oxides of nitrogen / sulfur dioxide / carbon emissions (1) idea that producing energy for the car produces pollution (1) manufacturing process causes pollution (1) disposal of batteries (1)	2	<b>allow</b> (fossil) fuels are burnt for electricity (generation) (2)
	(b)	2 (m/s <sup>2</sup> ) (2) <b>but if answer is incorrect</b> 32 ÷ 16 (1)	2	<b>allow</b> evidence of correct reading from graph eg 12 ÷ 6 (1)
<b>Total</b>			<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance	
13	(a)	4500 (m) (2) <b>but if answer is incorrect</b> 2 700 000 ÷ 600 (1)	2		
	(b)	(i)	kinetic energy stays the same because speed does not increase (1)	1	<b>must</b> have effect and reason <b>allow</b> kinetic energy stays the same because the idea that weight equals drag / AW (1) <b>allow</b> kinetic energy stays the same because she is not accelerating (1)
		(ii)	(gravitational potential energy) does work against friction (1)	1	<b>allow</b> GPE does work against drag or air resistance (1) <b>allow</b> (gravitational potential energy) is transferred to other forms of energy e.g. heat or kinetic energy of air (particles) (1) <b>allow</b> (gravitational potential energy) transferred to air particles / AW (1) <b>allow</b> (gravitational potential energy) converted / transferred / lost as heat (and sound) energy (1) but not sound on its own
			<b>Total</b>	<b>4</b>	

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