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COMBINED SCIENCE

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Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

Published

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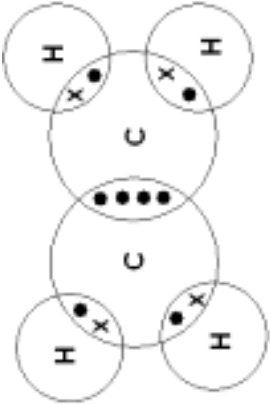
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This document consists of **10** printed pages.

Question	Answer	Marks
1(a)(i)	27.3–25.6 = 1.7 ; (1.7) / 25.6 × 100 = 6.64(%) ;	2
1(a)(ii)	high water potential outside and low water potential inside bag / higher water potential outside bag / water moves from high to low water potential ; <i>and one of</i> water moves in by osmosis ; use of the term diffusion ; water moves so as to try to equalise water potential ;	2
1(b)	protein ;	1
1(c)(i)	$6\text{H}_2\text{O} + 6\text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ 1 mark for formulae ; 1 mark for balancing dependent on formulae ;	2
1(c)(ii)	<i>any two of</i> (used) in respiration / release energy ; stored as starch ; avp ;	max 2

Question	Answer	Marks
2(a)	high temperature / high pressure / catalyst ;	1
2(b)(i)	A, B and E ;	1
2(b)(ii)	A, B and E ;	1
2(b)(iii)	A, B, C, D and E / all of them ;	1
2(c)	 two bonding pairs between carbon atoms ; all else correct ;	2
2(d)	family of compounds with a general formula ; similar chemical properties ;	2

Question	Answer	Marks
3(a)(i)	14 000 (N) ;	1
3(a)(ii)	1400 (kg) ;	1
3(b)(i)	(speed =) distance / time or 5400 / 3600 ; = 1.5 (m/s) ;	2

Question	Answer	Marks
3(b)(ii)	(work done =) force $\times$ distance / $W = F \times d = 500 \times 2000$; = 1 000 000 (J) ;	2
3(b)(iii)	(KE =) $\frac{1}{2} mv^2$; = $\frac{1}{2} \times 1400 \times (1.5)^2 = 1575$ (J) ;	2
3(c)(i)	speed of sound in liquid / water faster than in gas / air ;	1
3(c)(ii)	range of human hearing = 20 to 20 000Hz ; so beluga can produce sound that lies within the range of human hearing ; beluga sounds very high-pitched (to humans) ;	max 2

Question	Answer	Marks
4(a)	A – enzymes ; B – flagellum ;	2
4(b)(i)	oviduct ;	1
4(b)(ii)	jelly coating changes form after fertilisation (to prevent further entry of sperm) ;	1
4(c)(i)	A umbilical cord ; B amniotic sac / amnion ;	2
4(c)(ii)	glucose ; amino acids ;	2

Question	Answer	Marks
5(a)(i)	sodium atom loses one electron ; oxygen atom gains two electrons / oxygen atom achieves filled outer shell by gaining electrons ;	2
5(a)(ii)	Na ₂ O ; explanation in terms of balanced charges / implication that charges need to balance ;	2
5(b)	opposite / unlike charges (attract) ;	1
5(c)	NaOH (aq) + HCl (aq) → NaCl (aq) + H ₂ O (l) all formulae correct ; balanced and at least three correct state symbols ;	2
5(d)(i)	in the range 25 °C to 55 °C (inclusive) ;	1
5(d)(ii)	melting point decreases down Group 1 ;	1
5(d)(iii)	metals are above carbon in reactivity series ;	1

Question	Answer	Marks
6(a)(i)	$(E =) IVt = 0.5 \times 2000 \times 0.1$; = 100 (J) ;	2
6(a)(ii)	$(Q =) It = 0.5 \times 0.1$; = 0.05 ; coulomb(s) / C ;	3
6(b)	$v = f\lambda$ or $f = v/\lambda$ or $f = 3.0 \times 10^8 / 184 \times 10^{-9}$; = 1.6(3) $\times 10^{15}$ (Hz) ;	2

Question	Answer	Marks
6(c)	to protect humans from touching the high voltage wires / owtte ;	1

Question	Answer	Marks
7(a)(i)	haemoglobin ;	1
7(a)(ii)	any two of not enough red blood cells / haemoglobin ; not enough oxygen taken to body / cells / muscles ; less (energy released by) respiration ;	max 2
7(b)(i)	fruit / vegetable / named example ; to add vitamins / minerals / fibre ;	2
7(b)(ii)	energy taken in by body exceeds energy needed by body ; excess (energy) is stored as fat ;	2
7(c)(i)	coronary arteries ; become blocked / narrowed ;	2
7(c)(ii)	too much fat (contained in the food) ;	1

Question	Answer	Marks
8(a)	20 electrons ; 2,8,8,2 ;	2
8(b)(i)	(carbon dioxide) gas released from the apparatus ;	1
8(b)(ii)	particles have more energy/kinetic energy / move faster ; more successful collisions / collisions with enough energy ; greater frequency of collisions ;	max 2
8(b)(iii)	curved portion steeper ; horizontal line at same mass ;	2
8(c)	calcium oxide / calcium hydroxide / calcium hydrogencarbonate / calcium ;	1

Question	Answer	Marks
9(a)	100 °C ;	1
9(b)	fuse symbol ; switch symbol + completed circuit ;	2
9(c)(i)	transfer from powder to metal tube by molecular vibrations ; transfer through metal by mobile electrons ; transfer of molecular vibrations from metal tube to vibration / movement of water molecules ; reference to the transfer of energy through the water for example by particle collisions / or by convection ;	max 2

Question	Answer	Marks
9(c)(ii)	magnesium oxide or aluminium oxide ; the idea that these materials are poor electrical conductors and good thermal conductors / owtte ;	2
9(c)(iii)	(less) resistance inversely proportional (to cross-sectional area) / the greater the cross section the lower the resistance ;	1