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Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

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

Question	Answer	Marks
1(a)(i)	arrow drawn from the <u>plasma</u> of the blood to the air sac of alveolus ;	1
1(a)(ii)	there is a concentration / diffusion gradient / greater oxygen concentration in alveolus than the blood ;	1
1(a)(iii)	thin wall / flattened cells ; large surface area ; good blood supply ; Max 2	2
1(b)	through <u>placenta</u> ; and then one of by diffusion ; via (umbilical) cord ; Max 2	2
1(c)(i)	carbon dioxide / CO ₂ / produced / present (in smoke) ;	1
1(c)(ii)	causes cancer ; stimulates mucus production ; Max 1	1
1(c)(iii)	mucus cannot be swept out of the lungs ; pathogens / particles (in mucus) more likely to enter lungs ;	2
1(c)(iv)	combines with the haemoglobin / red blood cells ; CO replaces oxygen (on haemoglobin) ; reduces the transport of oxygen by blood / less oxygen available (for cells) ; Max 2	2

Question	Answer	Marks
2(a)(i)	covalent ;	1
2(a)(ii)	shared (pairs of) electrons ;	1
2(a)(iii)	two bond pairs ; two non-bond pairs on O atom ;	2
2(b)(i)	(electrode X) cathode ; (electrode Y) anode ;	2
2(b)(ii)	(to electrode X) copper ions / Cu^{2+} ; (to electrode Y) chloride (ions) / Cl^- ;	2
2(c)	(negative) lead ; (positive) oxygen ;	2

Question	Answer	Marks
3(a)(i)	weight / gravitational (force) ;	1
3(a)(ii)	yes (<i>no mark</i>) constant speed / no acceleration, (so forces must balance) ;	1

Question	Answer	Marks
3(b)(i)	distance = speed $\times$ time and / or work done = force $\times$ distance or $d = s \times t$ and / or $w = F \times d$ or $200\,000 \times 25 \times (500 - 200) ;$ $= 1\,500\,000\,000 ;$ J / joules ;	3
3(b)(ii)	(negative) acceleration / deceleration ; not constant (deceleration) / increasing deceleration (becoming constant deceleration) ;	2
3(b)(iii)	evidence of area under graph calculated up to $200 \text{ s} / \frac{1}{2} \times 200 \times 25 ;$ 2.5 km ;	2
3(b)(iv)	total distance = $2.5 + (500 - 200) \times 0.025 + 2.8 = 12.8 \text{ km} ;$	1

Question	Answer	Marks
4(a)(i)	seaweed $\rightarrow$ shellfish $\rightarrow$ crab $\rightarrow$ octopus $\rightarrow$ sea lion $\rightarrow$ killer $\rightarrow$ whale ; ;	2
4(a)(ii)	consists of more than 4 trophic levels ;	1
4(b)	protein synthesis / building up molecules ; cell division ; growth ; Max 2	2
4(c)	not all eaten ; not all digested / absorbed / egestion / lost in faeces ; excretion / lost in urine ; Max 2	2

Question	Answer	Marks
5(a)(i)	sulfuric_acid / H ₂ SO ₄ ; calcium oxide / CaO / calcium hydroxide / Ca(OH) ₂ calcium carbonate / CaCO ₃ ;	2
5(a)(ii)	(technique) filter / filtering / filtration ; (explanation) solid (particles) cannot pass through / remain on filter paper / liquid (particles) can pass through filter paper ;	2
5(b)(i)	(electrical conductor) good (melting point) high ; (both required)	1
5(b)(ii)	2, 8, 8, 2 ;	1
5(c)(i)	more / very rapid / explosive ;	1
5(c)(ii)	any stated value > 25 °C and < 63 °C ;	1
5(d)	(reaction) no (visible) reaction (explanation) copper is less reactive than potassium ; (both required)	1

Question	Answer	Marks
6(a)	(thermal) expansion / expansion on heating / owtte ;	1
6(b)(i)	only ethanol is a liquid at both these temperatures / both fixed points of ammonia / all others are solid at mpt of ammonia / at 78 °C ;	1
6(b)(ii)	typical room temperature / 21 °C is below 30 °C / m.pt. of gallium ; gallium would be a solid at that temperature / (kept above 30) so it does not freeze / owtte ;	2
6(c)(i)	(frequency will) increase ; use of $f = v / \lambda$ to explain increase / as λ decreases frequency increases ;	2
6(c)(ii)	 all three rays extended to meet at the same point at the detector ; (arrows on refracted rays not essential)	1

Question	Answer	Marks
7(a)	$6\text{H}_2\text{O} + 6(\text{CO}_2) \rightarrow \text{C}_6\text{H}_{12}\text{O} + 6(\text{O}_2)$ 1 mark for correct formulae ; 1 mark for balanced (dependent on formulae) ;	2
7(b)	oxygen / gas produced (by the plant and displaces water) ;	1
7(c)(i)	line (meniscus) drawn on Fig.7.1 at a lower position than in Fig. 7.2 ;	1
7(c)(ii)	reference to increased (rate of) photosynthesis ;	1

Question	Answer	Marks
7(d)(i)	due to denaturation of enzymes / damage to leaves / increased soil toxicity ;	1
7(d)(ii)	use cleaner / alternative energy sources / reduce usage of fossil fuels ; remove <u>sulfur dioxide</u> from factory emissions ; catalytic converters ; avp ; Max 2	2

Question	Answer	Marks
8(a)	(size of molecules) P smaller than Q / ora ; (intermolecular forces) P smaller than Q / ora ;	2
8(b)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ species ; balancing ;	2
8(c)(i)	alkenes have (one) (carbon-carbon) double bond / $C=C$; or alkanes have only (carbon-carbon) single bonds / $C-C$;	1
8(c)(ii)	(test) (add) bromine (water) / Br_2 ; and (propane) no (visible) change (propene) decolourises ;	2

Question	Answer	Marks
9(a)(i)	parallel ;	1
9(a)(ii)	correct lamp symbol ; heater in one branch, a motor in at least one other branch ; switch in series with the component in each branch ; lamp in series with heater only and no short circuits ;	4
9(b)(i)	power = voltage x current / $P = V \times I$ / $I = P / V = 2400 / 240$; = 10 (A) ;	2
9(b)(ii)	total current = $10 + 1.2 + 1.2 = 12.4$ (A) or 12 (A) ;	1
9(b)(iii)	any value from 13 A to 20 A ; fuse value needs to be above max working current of machine, but not too large to put machine components at risk ;	2