Cambridge IGCSE™

COMBINED SCIENCE **0653/42**

Paper 4 Theory (Extended) **February/March 2024**

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)(i)	liver labelled ;	**1**
1(a)(ii)	pancreas ;	**1**
1(b)	pieces ; molecules ;	**2**
1(c)	digest / breakdown, starch ; into (simpler) sugars ;	**2**
1(d)	*enzyme:* **A** AND works (best) at low pH / acidic conditions ; gastric juice, contains hydrochloric acid / is acidic ;	**2**

Question	Answer	Marks
2(a)(i)	helium ;	**1**
2(a)(ii)	potassium ;	**1**
2(a)(iii)	iron ;	**1**
2(a)(iv)	aluminium ;	**1**
2(b)	6 electrons shared between the two nitrogens ; lone pair in each of the N atoms ;	**2**
2(c)	nitrogen is, covalent / (simple) molecular **and** potassium nitrate is, ionic / contains ions / has a lattice structure ; strong(er) attractive forces in potassium nitrate / weak(er) attractive forces in nitrogen ; more **energy** needed to overcome or break the attractive forces / bonds, in potassium nitrate ; ORA	**3**

Question	Answer	Marks
3(a)	speed = distance ÷ time / $4.5 \times 10^8 \div 2.0 \times 10^5$; (conversion hours to days) 2250 ÷ 24 ; (= 94 / 93.8 / 93.75 days)	**2**
3(b)	white ; shiny ;	**2**
3(c)(i)	visible (light) **and** infrared ;	**1**
3(c)(ii)	800 nm seen / states idea that minimum frequency has longest wavelength ; $f = 3.0 \times 10^8 \div (800 \times 10^{-9})$; $= 3.8 \times 10^{14}$ (Hz) ;	**3**

Question	Answer	Marks
4(a)	root and stem labels are the wrong way around ; xylem label incorrect in leaf ;	**2**
4(b)	*any three from:* (description of trend) increased humidity causes decrease in rate of transpiration / ref to inverse relationship between humidity and transpiration rate ; higher humidity means higher water (vapour) concentration in air (surrounding the leaf) ; the idea that at higher humidity the concentration gradient between the leaf and the air is reduced ; reference to reduced, evaporation / diffusion (from leaf at higher humidity) ;	**3**
4(c)(i)	$6CO_2 + 6\ H_2O$; $C_6H_{12}O_6 + 6O_2$;	**2**
4(c)(ii)	chloroplast ;	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(d)</td><td>
<table>
<tr><th>organism</th><th>trophic level</th><th>feeding relationship</th></tr>
<tr><td>musk ox</td><td>2</td><td>(gets its energy by eating) grass</td></tr>
<tr><td>snowy owl</td><td>3 and 4</td><td>(gets its energy by eating)
(Arctic) fox and (Arctic) hare</td></tr>
</table>
;;;

correct trophic levels = [1]
grass = [1]
(Arctic) fox and (Arctic) hare = [1]</td><td>3</td></tr>
</table>

Question	Answer	Marks
5(a)(i)	(molten because) ions must, be free to move / be mobile / migrate ;	**1**
5(a)(ii)	(so that they) do not react / only provide a surface for electron transfer (to or from ions) ;	**1**
5(a)(iii)	gain of electrons by, cations / (zinc) ions ;	**1**
5(b)	chlorine + potassium bromide → ; (→ or = required) potassium chloride + bromine ;	**2**
5(c)	(molecule made of) two atoms, combined / bonded ;	**1**
5(d)	$Cl_2 + H_2 \rightarrow 2HCl$;; *reactants and products [1]* *balanced [1]*	**2**

Question	Answer	Marks
6(a)(i)	(nuclear) fusion ;	**1**

Question	Answer	Marks
6(a)(ii)	(nuclear) fission ;	**1**
6(a)(iii)	idea that in fusion energy is released by joining (of nuclei) **and** in fission energy is released by splitting (of nuclei) ;	**1**
6(b)	$P = V \times I$ / 240 × 8.0 ; 1920 (W) / conversion W to kW seen ; 1.9 (kW) ;	**3**
6(c)(i)	(electric) motor ;	**1**
6(c)(ii)	use of current from source = sum of currents in branches ; current in motor = 14.7 – 13.0 – 0.2 = 1.5 (A) ;	**2**
6(c)(iii)	the idea that the total resistance in the circuit increases (and as the potential difference stays the same) so total current decreases ;	**1**

Question	Answer	Marks
7(a)	<table><tr><td>absence of a nucleus</td><td>N</td></tr><tr><td>contains an energy store</td><td>E</td></tr><tr><td>has a flagellum for movement</td><td>S</td></tr><tr><td>has a jelly coating</td><td>E</td></tr><tr><td>large numbers released at any one time</td><td>S</td></tr></table> ;;; *5 correct = [3]* *3–4 correct = [2]* *1–2 correct = [1]*	**3**

Question	Answer	Marks
7(b)	(dissolved) nutrients / oxygen, pass (from the mother's blood across placenta) to fetus ; waste products pass from fetus (to mother across placenta) ; placenta provides a barrier to toxins ;	**3**
7(c)	carbon monoxide ; reduces oxygen uptake (into blood / cells / body) / binds to haemoglobin ; OR tar ; causes, lung cancer / bronchitis / emphysema ;	**2**

Question	Answer	Marks
8(a)(i)	fractional **and** distillation ;	**1**
8(a)(ii)	*refinery gas:* smaller molecules ; more volatile ; *ORA*	**2**
8(b)	(family of compounds with): same **general** formula ; similar chemical properties ;	**2**
8(c)(i)	C_2H_4 ;	**1**
8(c)(ii)	*any two from:* high temperature / 400–700 °C ; high pressure / 60–70 atmosphere ; catalyst ;	**2**
8(c)(iii)	contains only single (C-C) (covalent) bonds / does not contain double (C=C) (covalent) bonds ;	**1**

Question	Answer	Marks
9(a)(i)	**S** ;	**1**
9(a)(ii)	speed ;	**1**
9(b)(i)	reference to the need to calculate the area under graph OR one area calculated ; (calculation of area under graph t = 0 to t = 250 s) ½ × 100 × 4.8 + 150 × 4.8 / 960 ; (add in ½ (½ × 100 × 4.8) / 120 for area under curve) total = 1100 / 1080 (m) ;	**3**
9(b)(ii)	time at max. speed of 4.8 m/s = 150 s ; **and** ΔE = 2.0 × 150 ; (300 kJ)	**2**
9(b)(iii)	KE of boat = *½ mv² in any form* ; KE = ½ × 450 × 4.8^2 = 5200 (J) = 5.2 (kJ) ;	**2**