



CO-ORDINATED SCIENCES

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Paper 4 Theory (Extended)

May/June 2017

MARK SCHEME

Maximum Mark: 120

Published

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

Question	Answer	Marks
1(a)	blood travels through the heart twice for each circuit of the body ; low-pressure circulation to the lungs and high-pressure circulation to the body tissues ;	2
1(b)	B ; G ; C ; F ;	4
1(c)(i)	<u>coronary</u> arteries ;	1
1(c)(ii)	stop smoking ; exercise ; eat less fatty / salty food ; reduce stress ;	max 2

Question	Answer	Marks
2(a)(i)	A and B ; from Groups I and II / have only 1 or 2 electrons in outer shell ; are metals / have metallic properties ;	3
2(a)(ii)	D ; complete outer shell / is a noble gas / is very stable / does not need to bond / does not need, to gain / lose / share electrons ;	2
2(a)(iii)	ionic / electrovalent ; metal bonding with non-metal ;	2
2(b)	arrangement of atoms in bronze is less regular / disrupted by atoms of different size ; layers of atoms slide more easily in copper / do not slide so easily in bronze ;	2

Question	Answer	Marks
3(a)(i)	iron ;	1
3(a)(ii)	uranium ;	1
3(a)(iii)	iron ;	1
3(b)(i)	<u>temperature</u> at which all of a liquid turns to a gas ;	1
3(b)(ii)	latent heat of vapourisation ; to break bonds / to overcome attractive forces ; between the molecules / intermolecular bonds ; to increase <u>potential</u> energy of the molecules ;	max 2
3(c)	${}_{30}^{64}\text{Zn} ; ;$ ${}_{-1}^0\beta ;$	3
3(d)(i)	density = mass / volume or 44.8 / 5.0 ; = 8.96 (g / cm ³) ;	2
3(d)(ii)	0.448 (N) ;	1
3(d)(iii)	pressure = force / area or 0.448 / 0.01 ; = 44.8 (N / m ²) ;	2

Question	Answer	Marks
4(a)	B, b, b, b ; Bb, Bb, bb, bb ; brown, brown, red, red ; 1:1 ;	4
4(b)(i)	a change in a gene / chromosome ;	1
4(b)(ii)	spotted crabs less at risk from predation ; spotted crabs more likely to survive and breed ; ref to natural selection ;	max 2

Question	Answer	Marks
5(a)(i)	shaded area on the left hand side of the shoot after three days ;	1
5(a)(ii)	positive phototropism ;	1
5(b)	auxins cause <u>cells</u> to increase in, size / elongate / grow ; auxins, move / diffuse, away from light ; ref to uneven growth ;	max 2
5(c)	$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 ; ;$	2
5(d)	<i>increase in, size</i> – no mark increase in <u>dry</u> mass ; increase in <u>cell</u> , number / size ; ref to permanent ;	max 2
5(e)	glucose converted to sucrose ; ref to translocation ; in phloem ;	max 2

Question	Answer	Marks
6(a)(i)	fractional distillation ; (catalytic / thermal) cracking ;	2
6(a)(ii)	high temperature ; high pressure ; catalyst ;	max 2
6(a)(iii)	linear chain of 4 carbons ; 2 H on each C ; all single bonds ;	3
6(b)(i)	any reasonable cause of paint removal ; causing steel to, be exposed to / react with, oxygen / owtte ; causing steel to, be exposed to / react with, water / owtte ;	max 2
6(b)(ii)	protection continues when (zinc) layer damaged / reference to sacrificial protection ;	1

Question	Answer	Marks
7(a)(i)	piano ; highest frequency ;	2
7(a)(ii)	piano ; lowest frequency ;	2
7(b)(i)	$1 / R_T = 1 / R_1 + 1 / R_2$ or working ; 7.5 (Ω) ;	2
7(b)(ii)	large surface area – heat can be lost quicker from the surface / for better, conduction / convection / radiation ; black (fins) – black is a good emitter (of radiation) ; metal (fins) – metal is a good conductor (of heat) ;	max 2

Question	Answer	Marks
8(a)(i)	X anther ; Y stigma ;	2
8(a)(ii)	<i>petals</i> larger / brightly coloured ; <i>pollen</i> larger / fewer / rougher surface ;	2
8(b)	<u>meiosis</u> ;	1
8(c)	<i>advantage</i> genetic variation ; <i>disadvantage</i> two parents needed ; fertilisation is random / mutations can occur ; take more, time / energy ;	max 2
8(d)	attach to animals, coat / fur / hair ; eaten by animals, dispersed in faeces ; AVP ;	max 2

Question	Answer	Marks												
9(a)	<p>(P)</p> <p>carbon dioxide turns limewater milky ;</p> <p>carbon is more reactive than copper so can, remove / take, oxygen from copper oxide / owtte ;</p> <p>carbon is less reactive than magnesium so cannot, remove / take, oxygen from magnesium oxide / owtte ;</p>	3												
9(b)(i)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"></td> <td style="width: 30%; text-align: center;">solid reacts and dissolves</td> <td style="width: 30%; text-align: center;">gas given off</td> </tr> <tr> <td>magnesium</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓ ;</td> </tr> <tr> <td>magnesium carbonate</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓ ;</td> </tr> <tr> <td>magnesium oxide</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">X ;</td> </tr> </table>		solid reacts and dissolves	gas given off	magnesium	✓	✓ ;	magnesium carbonate	✓	✓ ;	magnesium oxide	✓	X ;	3
	solid reacts and dissolves	gas given off												
magnesium	✓	✓ ;												
magnesium carbonate	✓	✓ ;												
magnesium oxide	✓	X ;												
9(b)(ii)	copper chloride + carbon dioxide + water ;;	2												
9(c)(i)	16.25 (g) ;	1												
9(c)(ii)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">iron</td> <td style="width: 30%;">$5.60 \div 56 = 0.1$ moles ;</td> </tr> <tr> <td>chlorine</td> <td>$10.65 \div 35.5 = 0.3$ moles ;</td> </tr> </table>	iron	$5.60 \div 56 = 0.1$ moles ;	chlorine	$10.65 \div 35.5 = 0.3$ moles ;	2								
iron	$5.60 \div 56 = 0.1$ moles ;													
chlorine	$10.65 \div 35.5 = 0.3$ moles ;													
9(c)(iii)	FeCl_3 ;	1												

Question	Answer	Marks												
10(a)	mobile ions, carry charge / produce a current ; ions, are fixed / aren't mobile, in a crystal ;	2												
10(b)	<table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%; text-align: center;">anode product</td> <td style="width: 33%; text-align: center;">cathode product</td> </tr> <tr> <td>sodium chloride aqueous</td> <td style="text-align: center;">chlorine</td> <td style="text-align: center;">hydrogen ;</td> </tr> <tr> <td>sodium chloride molten</td> <td style="text-align: center;">chlorine</td> <td style="text-align: center;">sodium ;</td> </tr> <tr> <td>sulfuric acid aqueous</td> <td style="text-align: center;">oxygen</td> <td style="text-align: center;">hydrogen ;</td> </tr> </table>		anode product	cathode product	sodium chloride aqueous	chlorine	hydrogen ;	sodium chloride molten	chlorine	sodium ;	sulfuric acid aqueous	oxygen	hydrogen ;	3
	anode product	cathode product												
sodium chloride aqueous	chlorine	hydrogen ;												
sodium chloride molten	chlorine	sodium ;												
sulfuric acid aqueous	oxygen	hydrogen ;												
10(c)(i)	idea that there is only an electron difference / electrons have, no / negligible, mass ;	1												
10(c)(ii)	chloride / particle M , has a negative charge / more electrons than protons ; so is attracted to the <u>positive</u> anode / idea that opposite charges attract ;	2												
10(c)(iii)	one shared pair and all non-bonding electrons shown ;	1												

Question	Answer	Marks
11(a)(i)	diagonal line from 0, 70 ; to 60, 0 ;	2
11(a)(ii)	acceleration = change in speed / time / 70 / 60 ; = 1.17(m / s ²) ;	2
11(a)(iii)	KE = $\frac{1}{2} mv^2$ / $\frac{1}{2} \times 350000 \times 70 \times 70$; = 857500000 (J) ;	2
11(b)	distance = speed x time or working ; = $(3 \times 10^8 \times 3.3 \times 10^{-5}) / 2$ = OR $(3.3 \times 10^{-5} / 2) \times 3 \times 10^8$; distance = 4950 (m) ;	3

Question	Answer	Marks
12(a)(i)	62–70 (cm^3) ;	1
12(a)(ii)	respiration enzymes denatured / yeast killed ;	1
12(a)(iii)	increase / more, food / concentration of sugar mixture / increase / more, initial number of yeast ;	1
12(b)	alcohol, produced in anaerobic respiration in yeast / lactic acid is produced in anaerobic respiration in animals ;	1
12(c)	brewing / beer making / making alcoholic drinks ;	1

Question	Answer	Marks
13(a)(i)	$P / V = I$; $(2.5 \times 1000) / 240 = 10.4$;	2
13(a)(ii)	must be higher than 10.4 / not 10 A fuse, or else it will blow (with normal current) ; not 30 A fuse if there is a fault too much current will pass through / causes damage to washing machine / causes fire ;	2
13(b)	electromagnet / magnetic field created around solenoid coil ; soft iron (armature), attracted to magnet / turns, and closes contacts ;	2
13(c)(i)	compression correctly labelled ; rarefaction correctly labelled ;	2
13(c)(ii)	one wavelength correctly identified ;	1