Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/42**

Paper 4 Theory (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 120

Published

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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)	coronary 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)	${}^{64}_{30}Zn$;; ${}^{0}_{-1}\beta$;	**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 cells to increase in, size / elongate / grow ; auxins, move / diffuse, away from light ; ref to uneven growth ;	**max 2**
5(c)	$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6O_2$;;	**2**
5(d)	*increase in, size* – no mark increase in dry mass ; increase in cell, 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)	*petals* larger / brightly coloured ; *pollen* larger / fewer / rougher surface ;	**2**
8(b)	meiosis ;	**1**
8(c)	*advantage* genetic variation ; *disadvantage* 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**) carbon dioxide turns limewater milky ; carbon is more reactive than copper so can, remove / take, oxygen from copper oxide / owtte ; carbon is less reactive than magnesium so cannot, remove / take, oxygen from magnesium oxide / owtte ;	**3**
9(b)(i)	solid reacts and dissolves gas given off magnesium ✓ ✓ ; magnesium carbonate ✓ ✓ ; magnesium oxide ✓ X ;	**3**
9(b)(ii)	copper chloride + carbon dioxide + water ;;	**2**
9(c)(i)	16.25 (g) ;	**1**
9(c)(ii)	iron 5.60 ÷ 56 = 0.1 moles ; chlorine 10.65 ÷ 35.5 = 0.3 moles ;	**2**
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)	anode product / cathode product sodium chloride aqueous / chlorine / **hydrogen** ; sodium chloride molten / chlorine / **sodium** ; sulfuric acid aqueous / **oxygen** / **hydrogen** ;	**3**
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 positive 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 = ½ mv^2 / ½ × 350000 × 70 × 70 ; = 857500000 (J) ;	**2**
11(b)	distance = speed x time or working ; = (3 x 10^8 × 3.3 × 10^{-5}) / 2 = OR (3.3 × 10^{-5} / 2) × 3 × 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 × 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**