# Cambridge IGCSE™

**COMBINED SCIENCE** **0653/43**

Paper 4 Theory (Extended) **October/November 2022**

MARK SCHEME

Maximum Mark: 80

**Published**

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| Question | Answer | Marks |
|---|---|---|
| 1(a)(i) | **A** stigma ;<br>**B** anther ; | **2** |
| 1(a)(ii) | ovary labelled ; | **1** |
| 1(a)(iii) | *any two from:*<br>stigma feathery ;<br>anther outside (flower) ;<br>no petals ; | **2** |
| 1(b)(i) | grass → vole (→ coyote) → wolf<br><br>correct order of organisms ;<br>arrows in correct direction ; | **2** |
| 1(b)(ii) | coyote / wolf ; | **1** |
| 1(b)(iii) | coyote ; | **1** |
| 1(c) | $6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$<br><br>correct substrates (in either order) ;<br>correct products (in either order) ; | **2** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | chloride ion has: (ORA chloride atom)<br>(one) more electron / a full (outer) shell of electrons / 8 electrons in outer shell / 18 electrons ;<br>a negative (charge) / charge of –1 ; | **2** |
| 2(b)(i) | the number of electrons in the atom (17) is the same as the proton number ; | **1** |
| 2(b)(ii) | the number of shells is the same as the period / AW ; | **1** |
| 2(b)(iii) | *element **X*** bromine / iodine / astatine ;<br>*reason* further down the group (so less reactive) ; | **2** |
| 2(c) | chlorine has simple, molecules / covalent structure OR sodium chloride has, (giant) ionic structure / ionic lattice ;<br><br>attractive forces between ions in sodium chloride are strong(er) than (attractive forces between) molecules in chlorine / attraction between ions is high due to opposite electrical charges / strong electrostatic attraction between ions ;<br><br>more energy is required to separate ions in sodium chloride (hence higher melting point) / ORA ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 3(a)(i) | N ; | **1** |
| 3(a)(ii) | resultant force (to right) means boat, accelerates / goes faster / speed increases ; | **1** |
| 3(b)(i) | (142 × 3600 ÷ 1000 =) 511 (km / h) ; | **1** |
| 3(b)(ii) | evidence of, $W = Fd$ / 15 000 × 504 ;<br>7 600 000 ;<br>J ; | **3** |
| 3(c)(i) | 130 (m / s) ; | **1** |
| 3(c)(ii) | recognition that area under graph is used to calculate distance ;<br>correct calculation of an area, e.g. ½ x 40 × 130 = 2600 OR (80 – 40) × 130 = 5200 ;<br>7800 (m) ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | ***Q*** coronary artery ;<br>*explanation* (CHD occurs) when it becomes blocked ; | **2** |
| 4(a)(ii) | *any two from:*<br>stress ;<br>genetic predisposition ;<br>age ;<br>gender / sex ; | **2** |
| 4(b)(i) | correct numbers from graph / calculation of percentage, e.g. 144 and 60 or (144 – 60) ÷ 60 × 100 ;<br>140(%) ; | **2** |
| 4(b)(ii) | *any three from:*<br>increase blood flow to muscle ;<br>muscles require (more), energy / oxygen ;<br>increased muscle contraction ;<br>reference to respiration ;<br>need to remove more carbon dioxide from muscle ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 5(a)(i) | $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$<br><br>carbon dioxide shown ;<br>equation balanced with 2 AND 3 ; | **2** |
| 5(a)(ii) | *reducing agent* carbon monoxide AND<br>*explanation* because it takes oxygen from iron (oxide) ; | **1** |
| 5(b)(i) | idea that, oxidation is gain of oxygen ; | **1** |
| 5(b)(ii) | *method* suitable method stated, e.g. painting / coating ;<br>*description* corresponding description given, e.g. (stops oxidation) by providing a barrier against, water / oxygen ; | **2** |
| 5(c)(i) | $FeCl_2$ ; | **1** |
| 5(c)(ii) | bond breaking, absorbs / takes in, energy ;<br>bond forming releases energy ;<br>exothermic means, net release of energy / temperature rises ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 6(a) | correct voltmeter symbol AND in parallel with heating element ; | **1** |
| 6(b)(i) | ($R_T = R_1 + R_2 = 54 + 36 =$) 90 (Ω) ; | **1** |
| 6(b)(ii) | (total resistance decreases so) current increases ;<br>thermal energy proportional to current / $E = VIt$ ; | **2** |
| 6(c)(i) | evidence of, $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ ;<br>$\frac{1}{41.0} + \frac{1}{53.0}$ OR $\frac{2173}{94}$ = 23.1(1702128) (Ω) ; | **2** |
| 6(c)(ii) | evidence of, $I = V \div R$ / 240 ÷ 60.0 ;<br>(current in main branch =) 4.0 (A) ;<br>(heater 2 current = 4.0 – 2.3 =) 1.7 (A) ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 7(a)(i) | *any three from:*<br>(tar causes an) increased production of mucus by goblet cells ;<br>mucus blocks airways ;<br>(tar) damages cilia ;<br>(cilia) cannot (re)move, particles / pathogens ; | **3** |
| 7(a)(ii) | (carbon monoxide) combines with <u>haemoglobin</u> ;<br>idea of, reduced ability to transport oxygen ; | **2** |
| 7(b) | good blood supply ;<br>good ventilation (with air) ; | **2** |

| Question | Answer | Marks |
|---|---|---|
| 8(a)(i) | argon ; | **1** |
| 8(a)(ii) | the relative amounts of constituents can be changed in a mixture ;<br>the relative amounts of constituents are fixed in a compound ;<br><br>OR<br><br>a mixture contains two or more substances not combined / joined / bonded ;<br>a compound contains two or more elements chemically combined / joined / bonded ;<br><br>OR<br><br>mixtures maintain the properties of constituents ;<br>compounds have properties different to those of the elements it contains ; | **2** |
| 8(b) | (oxygen) is used in the, combustion / burning ;<br>of, fuel / carbon compounds / hydrocarbons ; | **2** |
| 8(c) | climate change / named environmental impact due to climate change ; | **1** |
| 8(d) | sulfur dioxide ; | **1** |

| Question | Answer | Marks |
|---|---|---|
| 9(a)(i) | (gamma radiation) \| \| \| (visible light) \| infrared (radiation) ; \| \| | **1** |
| 9(a)(ii) | $3.0 \times 10^8$ (m / s) ; | **1** |
| 9(a)(iii) | remote controllers for televisions / intruder alarms / AVP ; | **1** |
| 9(b)(i) | *convection* (reduced by) vacuum / stopper ;<br>*radiation* (reduced by) silver (coating) ; | **2** |
| 9(b)(ii) | (conduction) through the, solid material / plastic outer case / rubber supports / walls of glass container / plastic stopper ;<br>molecular vibrations passed from one molecule to the next ; | **2** |
| 9(b)(iii) | *component* nitrogen AND<br>*reason* lowest boiling point (of the 3 components) ; | **1** |