Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/43**

Paper 4 Theory (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 120

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Question	Answer	Marks
1(a)	B / C / D ; J ;	**2**
1(b)	<u>emulsifies</u> fats ; increases <u>surface area</u> (of fat globules) ; for the action of enzymes ;	**max 2**
1(c)	increases surface area ; for absorption ;	**2**
1(d)	malnutrition / weight loss / dehydration / fatigue ;	**1**

Question	Answer	Marks
2(a)(i)	**W** and **X AND** same outer electron number ;	**1**
2(a)(ii)	17 ;	**1**
2(a)(iii)	32 ; number of electrons = number of protons / relative atomic mass OR mass number = protons + neutrons / 16 + 16 / it is **S** ;	**2**
2(a)(iv)	(no) **Z** has a complete outer shell ; so atoms are stable / inert / do not react / do not form chemical bonds / noble gas ;	**2**
2(b)	two shared pairs showing the covalent bonds ; four non-bonding electrons on **W** ; six non-bonding electrons on both **Y** atoms ;	**3**

Question	Answer	Marks
3(a)	long enough to be detected in the body ; short enough for minimal risk ;	**2**
3(b)(i)	ray of light reflects along the fibre – all angles approx. correct ;	**1**
3(b)(ii)	no refraction / light does not escape through sides / only (total) internal reflection ; angle of incidence is greater than critical angle ;	**2**

Question	Answer	Marks
4(a)(i)	*genotype of male*: **XY** *genotype of female:* **XX** ;	**1**
4(a)(ii)	gametes correct ; **X and X** for female **X and Y** for male ; offspring correct ; **XX, XX, XY, XY** ;	**2**
4(b)	two parents needed ; harmful variations can occur ;	**max 1**
4(c)(i)	change in, gene / chromosome ;	**1**
4(c)(ii)	more visible to females / mates ;	**1**
4(d)	red cardinal birds (more likely to) reproduce / mate ; pass on, allele / gene / colour, to their offspring ; ref to natural selection ;	**max 2**

		male gametes	
		X	Y
female gametes	X	XX	XY
	X	XX	XY

Question	Answer	Marks
5(a)(i)	burning splint ; pops ;	**2**
5(a)(ii)	OH^- ; need for charge balance with Li^+ ;	**2**
5(a)(iii)	electron experiences a smaller force of attraction ; (positive) ions formed more easily / electrons more easily lost ;	**2**
5(b)(i)	chlorine ;	**1**
5(b)(ii)	it is discharged / becomes an atom ; by gaining one electron ;	**2**
5(b)(iii)	hydrogen produced instead if aqueous electrolyte used ;	**1**

Question	Answer	Marks
6(a)(i)	microwaves ;	**1**
6(a)(ii)	300 000 000 / 3 × 108 m / s ;	**1**
6(b)	$\frac{V_S}{V_P} = \frac{N_S}{N_P}$ OR $(N_s) = \frac{2500 \times 5.3}{240}$; = 55 (turns) ;	**2**
6(c)	**P** then **S** ;	**1**
6(d)	use of W = F × D ; answer 0.45 J ;	**2**

Question	Answer	Marks
7(a)	*anther* produces / releases pollen ; *ovary* produces ovule ; *sepal* protects flower bud ;	**3**
7(b)	large stigma ; feathery stigma ; long filament(s) ; stigma (hanging) outside flower ; anther / stamen, (hanging) outside flower ;	**max 2**
7(c)	more pollen, wasted / lost, in wind pollination / more chance of landing on plant / stigma / fertilising / ORA ;	**1**
7(d)	(can reproduce even if) plant isolated / no other plants near / lack of pollinators / prevent extinction ;	**1**
7(e)	animal / AVP ;	**1**

Question	Answer	Marks
8(a)(i)	CO and NiO ; have not changed pH of water ;	**2**
8(a)(ii)	cobalt chloride paper ; (blue) to pink ; OR anhydrous / white copper (II) sulfate ; turns blue ;	**2**
8(a)(iii)	measure boiling point ; 100°C (if water) / the idea that the value is used to identify water ;	**2**

Question	Answer	Marks
8(b)(i)	overall decrease in pH ; (approx..) constant / gradual decrease with volume (until about 25 cm^3) / resumes gradual decrease ; very steep decrease (until about 32 cm^3) ; extra detail in terms of volume data ;	**max 3**
8(b)(ii)	30 cm^3 ;	**1**
8(b)(iii)	calculates M_r of NaOH (23 + 16 + 1) = 40 ; calculates mass 0.2 × 40 = 8 (g) ;	**2**
8(b)(iv)	(0.2 × 0.25 =) 0.05 ;	**1**

Question	Answer	Marks
9(a)(i)	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ LHS ; RHS ;	**2**
9(a)(ii)	glucose and oxygen ;	**1**
9(b)(i)	12:00 ;	**1**
9(b)(ii)	<u>respiration</u> occurs all the time ; <u>photosynthesis</u> only occurs when there is light / in daytime ;	**2**
9(b)(iii)	increase in light intensity ; increase in rate of photosynthesis ; OR increase in temperature ; increase, in enzyme activity / rate of photosynthesis ;	**max 2**

Question	Answer	Marks
10(a)(i)	evidence of area under graph ; = 160 + 240 + 75 ; 475 (m) ;	**3**
10(a)(ii)	max speed = 8 m / s ; KE = ½ m v^2 OR ½ × 8000 × 8 × 8 ; = 256 000 (J) ;	**3**
10(b)(i)	particles collide with tyre / walls / it ; exert a force (on the tyre wall) ;	**2**
10(b)(ii)	particles are moving faster / more (kinetic) energy ; greater rate of collision / more energetic collisions ; more force exerted (on tyre walls) ;	**max 2**
10(c)(i)	Q=It OR 3 × 80 OR 240 ; 2 × 240 OR 480 ; C ;	**3**
10(c)(ii)	correct formula / substitution / explanation ; 2.0 (Ω) ;	**2**
10(d)	iron magnetises quickly / steel magnetises slowly / iron loses magnetism quickly / steel loses magnetism slowly ;	**1**

Question	Answer	Marks
11(a)(i)	ethane ethene butane butane 2 or 3 correct ; 4 correct ;	**2**
11(a)(ii)	the idea that at least two carbon atoms required for double bond ;	**1**
11(b)(i)	limewater goes milky ;	**1**

Question	Answer	Marks
11(b)(ii)	$4CuO + CH_4 \rightarrow 4Cu + CO_2 + 2H_2O$ correct formulae ; correctly balanced ;	**2**
11(b)(iii)	(copper ions) gain electrons ;	**1**
11(b)(iv)	reference to time required for formation / AVP ;	**1**

Question	Answer	Marks
12(a)(i)	$I = \frac{P}{V}$; = $\frac{6000}{240}$;	**2**
12(a)(ii)	breaker would trip at working current ; breaking current should be more than current rating of device OR 20A < 25A / working current ;	**2**
12(b)(i)	0.03 (m^2) ;	**1**
12(b)(ii)	$P = \frac{F}{A}$ OR $\frac{25}{0.03}$; = 830 (Pa) ;	**2**
12(c)(i)	temp rise = 80°C ; E = m c ΔT OR 1.5 $\times$ 4200 $\times$ 80 ; = 504 000 (J) ;	**3**

Question	Answer	Marks
12(c)(ii)	evaporation can occur at any temperature / boiling only happens at the boiling point ; evaporation happens only at the surface / boiling happens throughout the liquid ; boiling takes energy in to occur / evaporation lets only the molecules with the highest kinetic energy out ; evaporation can occur using the internal energy of the system / boiling requires an external source of heat ; evaporation produces cooling / boiling does not produce cooling ; evaporation is a slow process / boiling is a rapid process ;	**max 2**

Question	Answer	Marks
13(a)	elongated / long ; increased surface area (for absorption) ;	**2**
13(b)	ref to osmosis ; movement of water from high water potential to low water potential / down a water potential gradient ; across, partially permeable membrane / cell membrane ;	**max 2**
13(c)	transpiration / water loss / evaporation from leaf ; reduces water potential at top of plant ; (causes) movement of water up xylem ; ref to cohesion of molecules ; down water potential gradient ;	**max 3**
13(d)	less transpiration / water loss / evaporation ; less / slower movement of water ;	**2**