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CO-ORDINATED SCIENCES **0654/43**

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

MARK SCHEME

Maximum Mark: 120

Published

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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**