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CO-ORDINATED SCIENCES **0654/31**

Paper 3 Theory (Core) **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.

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Question	Answer	Marks
1(a)(i)	cell wall ; cytoplasm ; vacuole ;	**3**
1(a)(ii)	label line to any of the chloroplasts ;	**1**
1(b)	*LHS* carbon dioxide AND water ; *RHS* glucose AND oxygen ;	**2**
1(c)	cell membrane ; nucleus ; cytoplasm ;	**3**

Question	Answer	Marks
2(a)(i)	protons correctly labelled ; neutrons correctly labelled ; electrons correctly labelled ;	**3**
2(a)(ii)	3 ;	**1**
2(a)(iii)	lithium / Li ;	**1**
2(a)(iv)	fluorine / F ;	**1**

Question	Answer	Marks
2(b)	 elements and uses correctly connected ; uses and properties correctly connected ;	**2**

Question	Answer	Marks
3(a)(i)	A and D ;	**1**
3(a)(ii)	A or B ;	**1**
3(a)(iii)	C and E ;	**1**
3(b)(i)	increase CSA / diameter ;	**1**
3(b)(ii)	contract in cold weather ; damage cables / pylons ;	**2**
3(c)	nuclei split ;	**1**
3(d)(i)	γ / gamma ; written in left hand box ;	**2**
3(d)(ii)	α β γ ; most ionising ... least ionising	**1**

Question	Answer	Marks
4(a)	DNA ; heredity ; protein ;	**3**
4(b)(i)	Juan and Sara ;	**1**
4(b)(ii)	100% circled ;	**1**
4(b)(iii)	Ben is homozygous dominant / will always pass on a, dominant allele / T ;	**1**
4(c)	<table><tr><td></td><td>*T*</td><td>*t*</td></tr><tr><td>*T*</td><td>**TT**</td><td>**Tt**</td></tr><tr><td>*t*</td><td>**Tt**</td><td>**tt**</td></tr></table> ;	**1**

Question	Answer	Marks
5(a)(i)	78 ;	**1**
5(a)(ii)	argon / other noble gas ;	**1**
5(b)(i)	**B** absence of water (vapour) / no water ; **C** absence of <u>oxygen</u> / no oxygen ;	**2**
5(b)(ii)	no change in mass **AND** idea that nothing enters or leaves the test-tube ;	**1**
5(c)(i)	use of named indicator e.g.(red) litmus ; correct result e.g. (litmus) turns blue ;	**2**
5(c)(ii)	nitric acid ;	**1**

Question	Answer	Marks
5(c)(iii)	idea of improving crop yield ; soil does not contain enough nutrients / nitrogen (compounds) **or** to replace nitrogen compounds ; reference to use of nitrogen in plants to produce amino acids / proteins / DNA ;	**max 2**

Question	Answer	Marks
6(a)	conduction – polymer / foam / air is a poor heat conductor / is an insulator ; convection – (trapped) air is unable to move by convection ;	**2**
6(b)(i)	all symbols correct ; circuit correctly connected ;	**2**
6(b)(ii)	something vibrates ;	**1**
6(b)(iii)	large amplitude ; high frequency ;	**2**
6(c)	on off off on 2 or 3 correct ; 4 correct ;	**2**

Question	Answer	Marks
7(a)(i)	(number of new HIV infections) increases then decreases ; peak (number of infections) at 1985 / 130 000 cases ; correct data manipulation ;	**max 2**

Question	Answer	Marks
7(a)(ii)	40 000 / 80 000 × 100 ; 50 (%) ;	**2**
7(b)(i)	contaminated needles / injecting drugs ; blood transfusion ; sexual fluids / (unprotected) sexual intercourse ; blood to blood contact ; breast feeding ; during birth ;	**max 2**
7(b)(ii)	education ; provide, condoms / barrier contraception ; free testing ; needle exchange ; screening blood transfusions ;	**max 2**

Question	Answer	Marks
8(a)(i)	**Q** hydrogen **R** hydrogen **S** hydrogen **T** carbon dioxide 2 or 3 correct ; 4 correct ;	**2**
8(a)(ii)	limewater ; goes milky ;	**2**
8(a)(iii)	**R** increases AND acid is being used up / acid concentration is decreasing ; **S** increases AND reaction produces an alkaline product / calcium hydroxide concentration increases ;	**2**

Question	Answer	Marks
8(a)(iv)	endothermic (because) temperature decreases / thermal energy taken in ;	**1**
8(b)(i)	increases ;	**1**
8(b)(ii)	rate decreases ; rate increases ;	**2**

Question	Answer	Marks
9(a)	arrow vertically downwards ;	**1**
9(b)(i)	time between 0–12.5 s ;	**1**
9(b)(ii)	time between 12.5 and 22.5 s ;	**1**
9(c)(i)	B – particles close together and randomly arranged ;	**1**
9(c)(ii)	section **X** ; ice melts at 0°C / temperature is constant ;	**2**

Question	Answer	Marks
10(a)	E D B A ;	**1**
10(b)	brain / spinal cord ;	**1**
10(c)	rapid circled ; automatic circled ;	**2**
10(d)	central (nervous system) / CNS ; peripheral (nervous system) ;	**2**
10(e)	brain is closer ; (impulse) takes less time ;	**2**

Question	Answer	Marks
11(a)(i)	coal ;	**1**
11(a)(ii)	reference to long time required to form fossil fuels ;	**1**
11(b)(i)	heating / cooking ; fuel for diesel engines / fuel for named heavy vehicle ;	**2**
11(b)(ii)	no new compounds / separation of existing compounds from a mixture ;	**1**
11(c)	alkanes **K M** ; ethanol **J** ; natural gas **M** ; unsaturated **L** ;	**4**
11(d)(i)	join together (in chains) / owtte ;	**1**
11(d)(ii)	carbon dioxide ; carbon monoxide ; water ;	**max 2**

Question	Answer	Marks
12(a)	sound wave – longitudinal water wave – transverse ;	**1**
12(b)	double headed arrow showing distance between two identical points on two consecutive waves ;	**1**
12(c)(i)	kinetic (energy) ;	**1**
12(c)(ii)	(gravitational) potential (energy) ;	**1**
12(d)(i)	20 (N) ; forwards / to the right ;	**2**

Question	Answer	Marks
12(d)(ii)	the swimmers speed increases / acceleration ; resultant force / unbalanced force in direction of motion / to right ;	**2**
12(e)	energy transferred to particles from surroundings (body) ; fastest molecules escape ; average energy of the rest of particles reduced / thermal energy removed from <u>liquid</u> ;	**max 2**
12(f)	mass = density × volume **or** 996 × 480 ; 478 080 (kg) ;	**2**
12(g)	at Y reflection only is shown ; at X refraction (and reflection is shown) ; total internal reflection occurs when angle of incidence exceeds critical angle / angle of incidence = angle of reflection for reflection / refraction away from normal going from denser to less dense medium ;	**3**

Question	Answer	Marks
13(a)(i)	<table><tr><th>organ</th><th>blood vessel leading to the organ</th><th>blood vessel leading away from the organ</th></tr><tr><td>heart</td><td>vena cava</td><td>aorta</td></tr><tr><td>lungs</td><td>pulmonary artery</td><td>pulmonary vein</td></tr><tr><td>liver</td><td>Hepatic portal vein</td><td>hepatic vein</td></tr><tr><td>kidney</td><td>renal artery</td><td>renal vein</td></tr></table> 1 row correct ; 2 rows correct ; 3 rows correct ; 4 rows correct ;	**4**
13(a)(ii)	valves ;	**1**
13(b)(i)	transport / carry / deliver, **oxygen** ;	**1**

Question	Answer	Marks
13(b)(ii)	white blood cells ; platelets ; plasma ;	**max 2**