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**COMBINED SCIENCE**

**0653/41**

Paper 4 Extended Theory

**May/June 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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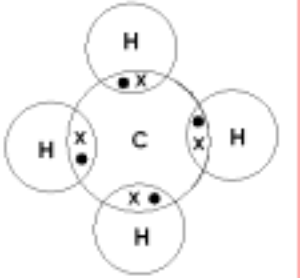
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This document consists of **10** printed pages.

Question	Answer	Marks
1(a)	lines drawn from Flowering plants to produce haploid pollen ; use auxins to respond to light ; have root hair cells which increase water uptake ;	<b>3</b>
1(b)(i)	(anthers) hang outside the flower so <b>pollen is easily picked up</b> by wind ; (stigmas) feathery / large surface area to <b>collect pollen</b> ;	<b>2</b>
1(b)(ii)	to increase the chances of pollination between plants ;	<b>1</b>
1(c)(i)	the idea that fossil fuels contain sulfur / sulfur compounds ; sulfur dioxide produced ; dissolves in water in the air ;	<b>Max 2</b>
1(c)(ii)	reduces activity / denatures <u>enzymes</u> present in the plants ;	<b>1</b>

Question	Answer	Marks
2(a)(i)	covalent ;	1
2(a)(ii)	 <p>four shared pairs between C and four H atoms ; all symbols correctly shown ;</p>	2
2(b)(i)	carbon dioxide ; water ;	2
2(b)(ii)	releases <u>heat</u> / <u>thermal</u> energy when it reacts / burns / is used ;	1
2(c)(i)	<u>natural gas</u> ;	1
2(c)(ii)	coal and petroleum ;	1

Question	Answer	Marks
3(a)(i)	<b>D</b> <b>C</b>	<b>1</b>
3(a)(ii)	(Force C is 1200 N) no mark no vertical motion / forces (A and C) are balanced ;	<b>1</b>
3(b)	line starts along the speed = 2 m / s horizontal, levelling off at speed = 4.5 m / s and 10 mins ; any curved line between these points, then level after (10,4.5) ;	<b>2</b>
3(c)(i)	$KE = \frac{1}{2} m v^2 / \frac{1}{2} \times 120 \times 3 \times 3 ;$ $= 540 \text{ (J)} ;$	<b>2</b>
3(c)(ii)	(90 kJ =) 90 000 J (= work done = energy transferred) ; distance moved = $3 \text{ (m / s)} \times 50 \text{ (s)} = 150 \text{ m} ;$ force = work done $\div$ distance / $90\,000 \div 150 = 600 \text{ (N)} ;$	<b>3</b>

Question	Answer	Marks
4(a)(i)	contain chlorophyll ; trap light (energy) ; converts (light) into chemical energy ; the idea that chemical energy is contained in glucose / starch / carbohydrate ;	<b>3</b>
4(a)(ii)	flagellum ; the idea that the flagellum is for movement ;	<b>2</b>
4(b)(i)	food chain containing the following organisms phytoplankton→zooplankton→mussel→crab→seagull ; four arrows in correct direction in the chain ;	<b>2</b>
4(b)(ii)	fewer steps / stages / organisms in chain containing mussels / ora ; use of the term <u>trophic level</u> ; energy is lost at each stage ; by heat / movement / avp ;	<b>3</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(i)	increases ; neutralisation / salt-making;	<b>2</b>
5(a)(ii)	$\text{CuSO}_4$ ; $\text{CO}_2$ and $\text{H}_2\text{O}$ ;	<b>2</b>
5(b)	filter (to remove excess solid / copper carbonate) ; heat the solution / filtrate / mixture ; reference to evaporation ; cool / leave (to allow crystals to form) ;	<b>2</b>
5(c)	the idea that the gradient decreases ; the idea that the rate decreases ; the idea that the rate becomes zero ;	<b>2</b>
5(d)(i)	less steep initial line ; levels off at a lower volume;	<b>2</b>
5(d)(ii)	(decreases rate of reaction) because particles collide less frequently / owtte ;	<b>1</b>

Question	Answer	Marks							
6(a)(i)	infra-red / radiation ; poorly absorbed / mainly reflected by white ;	<b>2</b>							
6(a)(ii)	the idea that feet lose heat / thermal energy ; the idea that heat / thermal energy is lost to the water ; <b>because</b> the water is colder ;	<b>2</b>							
6(a)(iii)	(line 1) more energetic/faster <b>and</b> (line 3) energy / speed ; (line 4) temperature ;	<b>2</b>							
6(b)	ray from <b>X</b> refracts correctly at surface ; unbroken rays drawn with a ruler to the eye with at least one arrow on a ray ;	<b>2</b>							
6(c)(i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">gamma rays</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;">Visible light</td> <td style="width: 15%;"></td> <td style="width: 15%;"><b>micro-waves</b> ;</td> <td style="width: 15%;">radio waves</td> </tr> </table>	gamma rays			Visible light		<b>micro-waves</b> ;	radio waves	<b>1</b>
gamma rays			Visible light		<b>micro-waves</b> ;	radio waves			
6(c)(ii)	$v = f\lambda / f = 3 \times 10^8 \div 0.12 ;$ $= 2.5 \times 10^9 \text{ (Hz) ;}$	<b>2</b>							

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
7(a)	energy = $37 \times 11 + 17 + 13 \times 17$ (= 645) ; $\times 2 = 1290$ (kJ) ;	<b>2</b>
7(b)	eggs (no mark) contains the most fat ;	<b>1</b>
7(c)(i)	$6\text{CO}_2$ and $6\text{H}_2\text{O}$ ;	<b>1</b>
7(c)(ii)	in red (blood) cells ; by haemoglobin ; red cells carried in plasma ;	<b>Max 2</b>
7(d)	chemical digestion:- mouth, and stomach and small intestine / duodenum / ileum ;  absorption:- small intestine / duodenum / ileum ;	<b>2</b>



<b>Question</b>	<b>Answer</b>	<b>Marks</b>
8(a)	2,8,3 ;	<b>1</b>
8(b)(i)	oxygen (gas) ;	<b>1</b>
8(b)(ii)	aluminium ions gain electrons ; gain 3 electrons / ions are discharged / become aluminium atoms ;	<b>2</b>
8(c)(i)	carbon / C / carbon monoxide / CO ;	<b>1</b>
8(c)(ii)	aluminium / Al is more reactive than carbon / C ;	<b>1</b>
8(d)(i)	Al is less reactive than Mg ;	<b>1</b>
8(d)(ii)	Al is more reactive than Cu ;	<b>1</b>

Question	Answer	Marks
9(a)	any two from one or two metals <i>or</i> alloys ( <i>other than copper</i> ) graphite / carbon	<b>1</b>
9(b)	= $2 / 0.5 = 4$ ; ohms / $\Omega$ ;	<b>2</b>
9(c)(i)	(2 A) sum of currents in parallel branches = current from source ;	<b>1</b>
9(c)(ii)	<b>P</b> and <b>Q</b> have different resistances / thicknesses ; <b>P</b> less resistance than <b>Q</b> / <b>P</b> is thicker than <b>Q</b> ;	<b>2</b>