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COMBINED SCIENCE

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Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

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Question	Answer	Marks
1(a)	three lines from 'Enzymes' to are biological catalysts ; work best in a narrow pH range ; are made from amino acids ;	3
1(b)	(correct) 46 °C is optimum temperature / rate decreases above and below 46 °C ; correct reference to denaturation ;	2
1(c)(i)	glucose / sugar / simple sugar ;	1
1(c)(ii)	glycogen ;	1
1(c)(iii)	<u>nitrogen</u> ;	1

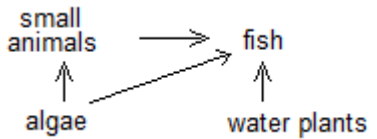
Question	Answer	Marks
2(a)(i)	A potassium / K B lithium / Li C sodium / Na 1 or 2 correct, 1 mark all 3 correct, 2 marks	2
2(a)(ii)	exothermic ; <u>chemical</u> (potential) ; two from thermal (allow heat) / light / sound / kinetic ;	3
2(a)(iii)	in the range 1 to 14 (seconds) inclusive ;	1
2(b)	(too) dangerous / (risk of) explosion ;	1
2(c)(i)	resists corrosion / does not rust ;	1
2(c)(ii)	stronger / more difficult to damage ;	1

Question	Answer	Marks
3(a)(i)	C B	1
3(a)(ii)	(D is 500 000 N) the idea that height remains constant / forces (B and D) are balanced / equal and opposite / the resultant force in the vertical direction is zero ;	1
3(a)(iii)	(decreases) the <u>weight</u> decreases ;	1
3(b)(i)	acceleration = increase in speed ÷ time / (160 – 100) ÷ 30 ; = 2 m / s ² ;	2
3(b)(ii)	potential energy change = mgh or mgΔh / 50 000 × 10 × 2000 ; = 1 × 10 ⁹ (J) ;	2

Question	Answer	Marks
4(a)(i)	valve A closes and valve B opens ;	1
4(a)(ii)	high(er) pressure required to send blood around the body / travel a long distance / ora ; high(er) pressure in aorta and low(er) pressure in pulmonary artery ; low pressure in pulmonary artery prevents damaging capillaries in lungs ;	Max 2
4(b)(i)	reduces blood flow in <u>coronary artery</u> / <u>arteries</u> ; by presence of cholesterol / fatty deposits / plaque ;	2
4(b)(ii)	less fatty diet / reduced stress / reduced smoking / more exercise ;	1
4(c)(i)	any valid fight or flight situation described ;	1
4(c)(ii)	destroyed by the <u>liver</u> ;	1
4(d)	reference to <u>auxins</u> ; greater concentration on dark side (of stem) ; cause greater (cell) elongation /growth (on that side) ;	3

Question	Answer	Marks
5(a)(i)	<u>fractional distillation</u> ;	1
5(a)(ii)	larger molecules / hydrocarbons have larger inter-molecular forces / ora ;	1
5(a)(iii)	larger inter-molecular forces means higher boiling point / ora ;	1
5(b)(i)	(D) alkane / saturated ; (E) alkene / unsaturated ;	2
5(b)(ii)	<u>bromine</u> (water / solution) ; (D) no change and (E) decolourises ;	2
5(b)(iii)	<u>cracking</u> ;	1
5(c)	$(C_7H_{16}) + \dots 11 \dots (O_2) \rightarrow \dots 7 \dots (CO_2) + \dots 8 \dots (H_2O) ; ;$	2

Question	Answer	Marks
6(a)(i)	conduction ;	1
6(a)(ii)	(kinetic) energy of air molecules inside transferred to molecules in aircraft wall (fuselage) ; (kinetic) energy transferred between molecules in aircraft wall (fuselage) ; (kinetic) energy transferred from aircraft wall (fuselage) to air molecules outside ; the idea that energy is transferred via vibrating/colliding molecules/particles ;	Max 2
6(b)(i)	(Z) molecules shown not touching / apart ;	1
6(b)(ii)	molecules in jet engine moving faster ; because they are at a higher temperature / have greater kinetic energy ; or molecules in water moving more slowly ; because they are at a lower temperature / have smaller kinetic energy ; or the idea that molecules from the jet exhaust are able to move more freely ; because they are separated / far apart ; or the idea that molecules in water have more restricted movement ; because molecules are close together / touching ;	2
6(c)(i)	total distance = speed \times time / $3 \times 10^5 \times 0.0002$; = 60 (km) ; so distance aircraft to transmitter = $\frac{1}{2} \times 60 / 30$ (km) ;	3
6(c)(ii)	(long wavelength end) it is in the microwave part of spectrum / it is a microwave / it is at the low frequency end ; lower frequency waves have longer wavelength / ref. to inverse proportionality / reference to the formula $v = f \times \lambda$;	2

Question	Answer	Marks
7(a)	an area where the organisms interact with each other ; and (interact with) their environment ;	2
7(b)	 <p>all organisms written only once ; feeding relationships shown using arrows ;</p>	2
7(c)(i)	no light ; for photosynthesis ;	2
7(c)(ii)	bacteria take in / use the oxygen ; for their respiration ;	2

Question	Answer	Marks
8(a)(i)	6 ;	1
8(a)(ii)	non-metal together with one from electrical / thermal insulator / low melting / boiling point ovp ;	1
8(b)(i)	(2), 8, 7 ;	1
8(b)(ii)	one shared pair and six non-bonding electrons on each Cl ;	1
8(c)(i)	ionic ;	1
8(c)(ii)	sodium loses one (electron) ; chlorine gains one (electron) ;	2

Question	Answer	Marks
8(d)	reference to full outer shell ;	1

Question	Answer	Marks
9(a)(i)	correct symbols for ammeter and lamp ; only the shown components connected in series ;	2
9(a)(ii)	voltmeter connected in parallel with lamp ; correct symbol for voltmeter ;	2
9(b)	$P = V \times I = 1.5 \times 0.6 = 0.9$ (W) ;	1
9(c)(i)	total resistance more, (so current decreases / so dimmer lamps) ;	1
9(c)(ii)	the idea that (compared to one bulb) the (total) potential difference (across two bulbs) is the same but the current is lower (V the same I lower) ; (if V is the same, but I is less) then less power (dissipated) / less total energy transformed per unit time ; or the relation $P = V \times I / E = V \times I \times t$ therefore shows that the power / energy per unit time is lower (when two bulbs are used) ;	2