Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/42**

Paper 4 Theory (Extended) **October/November 2019**

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 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: • the specific content of the mark scheme or the generic level descriptors for the question • the specific skills defined in the mark scheme or in the generic level descriptors for the question • the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: • marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate • marks are awarded when candidates clearly demonstrate what they know and can do • marks are not deducted for errors • marks are not deducted for omissions • answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)(i)</td><td>6 ;</td><td>1</td></tr>
<tr><td>1(a)(ii)</td><td>any two from
there is an optimum temperature ;
above which rate decreases ;
as enzyme denatured ;

max 2</td><td>2</td></tr>
<tr><td>1(a)(iii)</td><td>increase the concentration of glucose / nutrients / sugar or more yeast ;</td><td>1</td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><td>type of respiration</td><td>carbon dioxide is produced</td><td>lactic acid is produced</td><td>oxygen is required</td><td>releases energy</td></tr>
<tr><td>aerobic</td><td>✓</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>anaerobic respiration in animals</td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>anaerobic respiration in yeast</td><td>✓</td><td></td><td></td><td>✓</td></tr>
</table>
;;;</td><td>3</td></tr>
</table>

Question	Answer	Marks
2(a)(i)	same general formula ; similar chemical properties ;	**2**
2(a)(ii)	alkenes ;	**1**
2(b)	correct arrangement of atoms ; 2 carbon atoms sharing 2 bonding pairs ; 2 hydrogen atoms sharing bonding pair with each carbon atom ;	**3**
2(c)(i)	$C_2H_4 + H_2 \rightarrow C_2H_6$ LHS ; RHS ;	**2**
2(c)(ii)	to make propane ; same homologous series / similar or same reactions / ref. to double bond / it is also an addition reaction ;	**2**

Question	Answer	Marks
3(a)(i)	X rays to right of UV ; gamma in far right box ;	**2**
3(a)(ii)	cancer treatment / sterilising medical instruments / radioactive tracers ;	**1**
3(b)(i)	chemical energy to thermal energy ; thermal to kinetic energy ; kinetic energy to electrical energy ;	**3**
3(b)(ii)	25% of energy input is transferred to, useful output / electrical energy ;	**1**
3(c)	^{89}Y ; $_{39}$; ^{0}e ; $_{-1}$;	**2**

Question	Answer	Marks
4(a)	*any three from* best horses selected ; these horses allowed to breed ; (offspring observed and) best offspring selected ; process repeated (over many generations) ; **max 3**	**3**
4(b)	*similarity* features are inherited ; *difference* humans select the feature in selective breeding / the environment selects the feature in natural selection ;	**2**
4(c)	adaptation results from natural selection not artificial selection / AW ;	**1**

Question	Answer	Marks
5(a)(i)	CH_4 + **2**H_2O → **4**H_2 + CO_2 ;	**1**
5(a)(ii)	oxygen ;	**1**
5(b)	catalyst ; speeds up reaction ; lowers activation energy ; **max 2**	**2**
5(c)(i)	product stores less energy than reactants ; (surplus) energy released (from system) ;	**2**
5(c)(ii)	high temperature provides molecules with more (kinetic) energy / increases speed of molecules ; more molecules have the activation energy / sufficient energy to react ; increased frequency of (successful) collisions ;	**3**
5(d)	14 + 3(1) (=17) ; $(\frac{3.4 \times 10^9}{17} =)\ 2.0 \times 10^8$; $(\frac{3 \times 2.0 \times 10^8}{2}) = 3.0 \times 10^8$; $3.0 \times 10^8 \times 24 = 7.2 \times 10^9$ (dm^3) ;	**4**

Question	Answer	Marks
6(a)	20 (Hz) to 20 000 (Hz) ;	**1**
6(b)(i)	(time =) distance / speed or 40 / 1500 ; = 0.027 (s) ;	**2**
6(b)(ii)	(wavelength =) velocity / frequency or 1500 / 50 000 ; = 0.03 (m) ;	**2**
6(b)(iii)	time remains the same because wave velocity doesn't change ;	**1**
6(c)	any speed lower than 1500 m / s (no mark) ultrasound waves travel slower in a gas compared to a liquid ;	**1**
6(d)	*transverse waves* – direction of propagation perpendicular to direction of oscillation / vibration ; *longitudinal* – direction of propagation parallel to direction of oscillation / vibration ;	**2**
6(e)	stronger forces of attraction between water molecules in ice ; water molecules are able to move / ice molecules can only vibrate ;	**2**

Question	Answer	Marks
7(a)(i)	liver ; correctly labelled ;	**2**
7(a)(ii)	centre of X drawn on the pancreas ;	**1**
7(a)(iii)	mouth / stomach ;	**1**
7(b)(i)	fatty acids ;	**1**
7(b)(ii)	41 (seconds) ;	**1**
7(b)(iii)	bile emulsifies fats ; increasing the surface area ; lipase / enzyme, break down fat at a faster rate / faster production of fatty acids ;	**3**

Question	Answer	Marks
8(a)	diagram, does not have / should have, a regular arrangement ; diagram, does not have / should have, alternating ions ; diagram, does not have / should have, equal number of Na^+ and Cl^- ; **max 2**	**2**
8(b)(i)	reactant salts must be soluble ; to provide lead ions and chloride ions ;	**2**
8(b)(ii)	lead nitrate + sodium chloride → sodium nitrate + lead chloride ;	**1**
8(c)(i)	bleached / turns colourless ;	**1**
8(c)(ii)	Cl^- / chloride ions ; lose electrons / are oxidised ;	**2**

Question	Answer	Marks
9(a)(i)	radiation ;	**1**
9(a)(ii)	black surfaces absorb, heat / thermal energy / infra-red more than white surfaces / ORA ;	**1**
9(a)(iii)	white train would be hotter (than previously) because dull surfaces are poorer reflectors of radiation ;	**1**
9(b)	force = mass × acceleration or 450 000 × 0.6 ; = 270 000 (N) ;	**2**
9(c)(i)	(current =) power / voltage ; = 350 / 75 ; (= 4.67 / 4.7 A)	**2**
9(c)(ii)	(resistance of lamp =) voltage / current or 75 / 4.7 = 16.0 (Ω) ; $1 / R_T = 1 / R_1 + 1 / R_2$ or 1 / 16.0 + 1 / 16.0 ; = 8.0 (Ω) ; **OR** use of R = V / I ; (combined resistance =) voltage / total current or 75 / (2 × 4.7) ; = 8.0 (Ω) ;	**3**

Question	Answer	Marks
10(a)(i)	molecules ; dilute ; membrane ;	**3**
10(a)(ii)	long and thin / elongated / have a large surface area ;	**1**
10(b)	cohesion ;	**1**
10(c)(i)	mm / min ;	**1**
10(c)(ii)	increase in concentration of water (vapour) outside leaf ; less, diffusion / evaporation, of water ; less transpiration pull / movement of water, through the shoot ;	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>11(a)(i)</td><td>melts ;
bubbles ;
flame ;
moves across surface / floats ;

max 2</td><td>2</td></tr>
<tr><td>11(a)(ii)</td><td>more vigorous / owtte ;
reactivity increases down the group ;</td><td>2</td></tr>
<tr><td>11(b)(i)</td><td>
<table>
<tr><td>isotope</td><td>number of protons</td><td>number of neutrons</td><td>number of electrons</td></tr>
<tr><td>potassium-39</td><td>19</td><td>20</td><td>19</td></tr>
<tr><td>potassium-41</td><td>19</td><td>22</td><td>19</td></tr>
</table>
protons ;
neutrons ;
electrons ;</td><td>3</td></tr>
<tr><td>11(b)(ii)</td><td>no difference ;
because of same number of electrons ;</td><td>2</td></tr>
</table>

Question	Answer	Marks
12(a)	weight ;	**1**
12(b)(i)	slip rings labelled correctly ;	**1**
12(b)(ii)	induced voltage changes every half turn ; same side of coil remains connected to same slip ring ;	**2**
12(b)(iii)	approx. sine curve ; regular frequency and amplitude ;	**2**
12(c)	(charge =) current × time or 20 × 1 × 60 × 60 ; 72 000 ; C ;	**3**
12(d)	ray drawn correctly through first prism and through second prism ;	**1**

Question	Answer	Marks
13(a)	in the, blood / plasma ;	**1**
13(b)(i)	(glucose needed) for respiration / to release energy ; for, flight / fight / AW ;	**2**
13(b)(ii)	*any two from* pupil dilation ; increase in pulse rate ; increase in breathing rate ; avp ; **max 2**	**2**
13(c)(i)	<u>negative feedback</u> ;	**1**
13(c)(ii)	pancreas produces insulin ; glucose converted to glycogen ; glycogen stored in the liver ;	**3**