Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/43**

Paper 4 Theory (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 120

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & 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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance (see examples below)

For questions that require ***n*** responses (e.g. State **two** reasons …):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards ***n***
- Incorrect responses should not be awarded credit but will still count towards ***n***
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)(i)	(1.1 – 0.2) = 0.9 (cm^3) ;	**1**
1(a)(ii)	bread making ; carbonated alcoholic drinks ;	**max 1**
1(b)	high temperature denatures enzymes ; shape of active site is changed ; substrate no longer fits into, enzyme / active site ; enzymes can no longer catalyse anaerobic respiration / the reaction ;	**4**
1(c)	it is glucose / sucrose / sugar that breaks down to form carbon dioxide;	**1**
1(d)	chemical ; energy ; oxygen ;	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>
<table>
<tr><td></td><td>chemical change</td><td>physical change</td></tr>
<tr><td>burning magnesium</td><td>✓</td><td></td></tr>
<tr><td>melting ice</td><td></td><td>✓</td></tr>
<tr><td>rusting iron</td><td>✓</td><td></td></tr>
<tr><td>dissolving salt in water</td><td></td><td>✓</td></tr>
<tr><td>boiling water</td><td></td><td>✓</td></tr>
<tr><td>neutralising an acid with a base</td><td>✓</td><td></td></tr>
</table>
;;

2–3 correct for 1 mark;
all correct for 2 marks;</td><td>2</td></tr>
<tr><td>2(b)</td><td>(element) is made up of only one type of atom ;
(compound) contains (atoms of) two (or more) elements (chemically) joined together ;</td><td>2</td></tr>
<tr><td>2(c)</td><td>
<table>
<tr><td>atom</td><td>ion</td><td>molecule</td></tr>
<tr><td>(Na)

Cu

S</td><td>OH^-

Zn^{2+}</td><td>CO_2

H_2</td></tr>
</table>
;;;

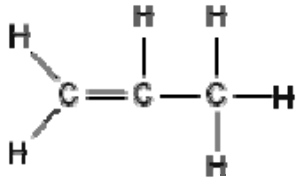
1–2 correct for 1 mark
3–5 correct for 2 marks
all correct for 3 marks</td><td>3</td></tr>
</table>

Question	Answer	Marks
2(d)	molecular mass of ammonia is less than hydrogen chloride ; ammonia particles diffuse / move faster than hydrogen chloride particles / molecules ;	**2**

Question	Answer	Marks
3(a)	compression region of high pressure / rarefaction region of low pressure; compression – molecules closer together / denser;	**1**
3(b)(i)	F = ma or 70×1.6; 112 (N);	**2**
3(b)(ii)	$\frac{1}{2}$ mv^2 or $\frac{1}{2} \times 70 \times 8 \times 8$; = 2240 (J);	**2**
3(b)(iii)	speed has magnitude only / velocity has magnitude and direction / velocity has direction but speed does not;	**1**
3(c)(i)	more molecules have enough KE to leave the liquid;	**1**
3(c)(ii)	more wind / draught; increased surface area;	**max 1**
3(d)	shiny foil is poor radiator of heat; shiny foil reflects radiation back; shiny foil traps layer of air around the body /stops convection; air is a good insulator/poor conductor;	**max 2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>
<table>
<tr><td>name</td><td>letter on Fig. 2.1</td><td>function</td></tr>
<tr><td>salivary gland</td><td>A</td><td>produces (salivary) amylase / saliva</td></tr>
<tr><td>gall bladder</td><td>H</td><td>stores bile</td></tr>
<tr><td>pancreas</td><td>D</td><td>produces lipase, protease and amylase</td></tr>
<tr><td>liver</td><td>J</td><td>produces bile</td></tr>
</table>
;;;;

each correct row for 1 mark</td><td>4</td></tr>
<tr><td>4(b)</td><td>to provide a low pH / acidic conditions ;
denatures (bacterial) enzymes ;
to kill bacteria ;
optimum pH for protease ;</td><td>max 3</td></tr>
<tr><td>4(c)</td><td>small / large, intestine ;
anus ;
mouth ;</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>C_nH_{2n+2}</td><td>1</td></tr>
<tr><td>5(b)</td><td>  </td><td>1</td></tr>
</table>

Question	Answer	Marks
5(c)	bond breaking is endothermic / owtte ; bond making is exothermic / owtte ; more energy is given out (in bond making) that is taken in (in bond breaking) ;	**3**
5(d)	any three from: sugar solution / glucose solution; yeast ; absence of air / anaerobic conditions ; temperature between 25°C and 50°C ;	**3**

Question	Answer	Marks
6(a)	mass = density $\times$ volume or $1410 \times 1.4 \times 10^{27}$; $= 2.0 \times 10^{30}$ (kg);	**2**
6(b)	only radiation can travel through a vacuum / conduction and convection need a medium;	**1**
6(c)(i)	 ;	**1**
6(c)(ii)	both travel at same speed / 3×10^8 m/s;	**1**
6(d)	**reflection** involves a change in direction of waves when they travel back from a barrier; **refraction** of waves involves a change in the direction of waves as they pass from one medium to another; **diffraction** of waves involves a change in direction of waves as they pass through an opening or around a barrier in their path;	**3**

Question	Answer	Marks
7(a)(i)	**A** iris ; **B** cornea ; **C** lens ;	**3**
7(a)(ii)	centre of **X** drawn on the blind spot ;	**1**
7(a)(iii)	ciliary muscles relax ; suspensory ligaments tighten ; lens is stretched / becomes thinner ;	**3**
7(b)	breathing ticked heart beating ticked sweating ticked ;; 1-2 correct for 1 mark; all correct for 2 marks;	**2**
7(c)	brain ; spinal cord ;	**2**

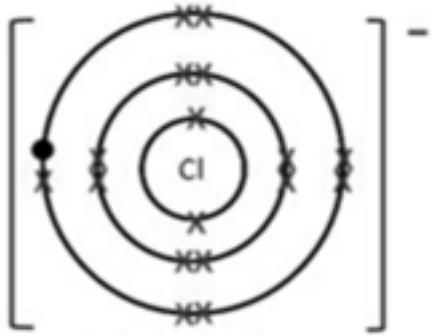
Question	Answer	Marks
8(a)	high density ; high melting point ; form coloured compounds ; act as catalysts ;	**max 2**
8(b)	lattice of positive ions ; in a ‘sea of electrons’ / delocalised electrons ;	**2**
8(c)(i)	carbon / coke reacts with oxygen to form carbon dioxide / $C + O_2 \rightarrow CO_2$; carbon reacts with carbon dioxide to form carbon monoxide / $C + CO_2 \rightarrow CO$; iron oxide / haematite reacts with carbon monoxide to form iron / $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	**3**

Question	Answer	Marks
8(c)(ii)	relative molecular mass of $CaO = 56$ **and** of $SiO_2 = 60$; $\frac{56 \times 21}{60} = 19.6$;	**2**
8(d)	molecules have higher (average) energy / particles are moving faster ; more particles with activation energy / more successful collisions; frequency of collision (of molecules) is higher / more collisions per second ;	**3**

Question	Answer	Marks
9(a)(i)	α- radiation has low penetration;	**1**
9(a)(ii)	$^{207}_{83}Bi$; $^{4}_{2}He$;	**2**
9(b)(i)	transverse wave oscillates / vibrates at right angles to direction of movement of wave energy transfer; longitudinal wave oscillates / vibrates parallel to direction of movement of wave energy transfer;	**max 1**
9(b)(ii)	frequency = speed ÷ wavelength or $3 \times 10^8 \div 1.1 \times 10^{-9}$; $= 2.73 \times 10^{17}$ (Hz) ;	**2**
9(b)(iii)	frequency greater than 20 000 Hz;	**1**
9(b)(iv)	ionisation of cells / cell damage / cancer / mutations;	**1**

Question	Answer	Marks
10(a)(i)	higher concentration of water vapour outside the leaf ; smaller concentration gradient ; less diffusion (of water vapour) ;	**3**

Question	Answer	Marks
10(a)(ii)	temperature / wind speed ;	**1**
10(b)	cohesion / refs to hydrogen bonding etc. ;	**1**
10(c)(i)	many chloroplasts ; positioned near surface of leaf ; tightly packed ;	**max 2**
10(c)(ii)	carbon dioxide **and** water ;	**1**
10(c)(iii)	light (energy) ;	**1**

Question	Answer	Marks
11(a)	group number equals the number of electrons in the outer shell (of the atom)	**1**
11(b)	2.8.2	**1**
11(c)(i)	 correct electronic structure of chloride ion / 2.8.8 ; correct charge / -1;	**2**
11(c)(ii)	regular arrangement ; of alternating positive and negative ions ;	**2**

Question	Answer	Marks
11(d)(i)	solid ;	**1**
11(d)(ii)	melting point of chlorine = (answer in range) -130°C to -90°C ; boiling point of bromine = (answer in range) 55°C to 120°C ;	**2**
11(e)	average mass of naturally occurring atoms of an element ; on a scale where the ^{12}C atoms has a mass of exactly 12 units ;	**2**

Question	Answer	Marks
12(a)	formula or correct substitution (e.g. 18/10); 1.8 (m/s^2);	**2**
12(b)(i)	I = P/V or 360/80; current = 4.5 A; resistance = 80/4.5 ;	**3**
12(b)(ii)	$1/R_T = 1/R_1 + 1/R_2$ or $R_T = R_1 R_2 / R_1 + R_2$ or correct substitution; 9.0 (Ω);	**2**
12(c)(i)	(rotating) coil cuts magnetic field / experiences a changing magnetic field; emf / current reverses every half turn;	**2**
12(c)(ii)	approximate sine curve; constant frequency and amplitude;	**2**
12(c)(iii)	amplitude / voltage increases; frequency increases;	**2**
12(c)(iv)	steel loses magnetism more slowly than iron;	**1**