Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENES **0654/42**

Paper 4 Theory (Extended) **October/November 2020**

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 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U 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 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.

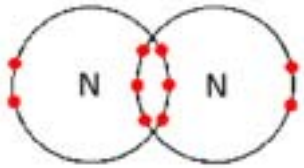
7 Guidance for chemical equations

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.

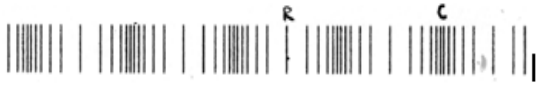
Question	Answer	Marks
1(a)(i)	sperm are smaller ; sperm, are elongated / are long and thin / have flagellum ;	**2**
1(a)(ii)	presence of enzymes / AVP ;	**1**
1(b)(i)	oviduct ;	**1**
1(b)(ii)	*any two from* vagina ; cervix ; uterus ;	**2**
1(b)(iii)	jelly coating ;	**1**
1(b)(iv)	haploid ; unpaired ;	**2**

Question	Answer	Marks
2(a)	<table><tr><td></td><td>relative charge</td><td>relative mass</td><td>location in an atom</td></tr><tr><td>protons</td><td>**+1 / +**</td><td>**1**</td><td>(in nucleus)</td></tr><tr><td>neutrons</td><td>**0 / no charge / neutral**</td><td>(1)</td><td>**in nucleus**</td></tr><tr><td>electrons</td><td>(–1)</td><td>**almost 0 / negligible / 1÷1850**</td><td>**in shells / orbits around nucleus**</td></tr></table>;;;	**3**
2(b)(i)	2, 5 ;	**1**
2(b)(ii)	(nitrogen has) five electrons in the outer shell ;	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(c)</td><td> 

;;</td><td>2</td></tr>
<tr><td>2(d)</td><td><table>
<tr><td>gas</td><td>percentage in clean air (%)</td></tr>
<tr><td>carbon dioxide</td><td>0.035</td></tr>
<tr><td>oxygen</td><td>21</td></tr>
<tr><td>nitrogen</td><td>78</td></tr>
<tr><td>(named) noble gases / water (vapour)</td><td>varies</td></tr>
</table>
;;;</td><td>3</td></tr>
<tr><td>2(e)</td><td>$2CO + 2NO \rightarrow N_2 + 2CO_2$ / $2NO \rightarrow N_2 + O_2$;;</td><td>2</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)(i)</td><td>0 (J) ;</td><td>1</td></tr>
<tr><td>3(a)(ii)</td><td>KE = 1 / $2mv^2$ or working ;
31 (J) ;</td><td>2</td></tr>
<tr><td>3(b)(i)</td><td>longitudinal wave oscillates / vibrates parallel to direction of movement of wave / energy transfer ;</td><td>1</td></tr>
<tr><td>3(b)(ii)</td><td>compression is region of, high pressure or molecules / particles, closer together / ORA ;</td><td>1</td></tr>
</table>

Question	Answer	Marks
3(b)(iii)	 compression correctly labelled ; rarefaction correctly labelled ;	**2**
3(c)	strong forces of attraction between atoms hold atoms together in a fixed position ;	**1**

Question	Answer	Marks
4(a)(i)	Between 15–29, the percentage increases ; Between 45–70+, the percentage decreases ; **AVP** ;; **max 2**	**2**
4(a)(ii)	68(%) ;	**1**
4(b)	education / legislation / link with lung cancer proved / ban / AVP ;	**1**
4(c)	component of cigarette smoke : effect on the body carbon monoxide : toxic / binds to haemoglobin (in place of oxygen) ; nicotine ; : is an addictive substance tar ; : causes cancer	**3**
4(d)	mucus traps, pathogens / particulates ; cilia unable to remove mucus ; decreases surface area of, gas exchange surface / alveoli ; bacteria multiply ; causing, infection / coughing / irritation ; **max 3**	**3**

Question	Answer	Marks
4(e)	*any two from:* stress ; age ; gender ; diet ; genetic predisposition ; **AVP** ;;	**2**

Question	Answer	Marks
5(a)	*any two from:* high density ; high melting point ; often act as catalysts ;	**2**
5(b)(i)	add a few drops of nitric acid followed by a few drops of silver nitrate ; (observe a) white precipitate ;	**2**
5(b)(ii)	relative molecular mass of $CuCO_3$ = 124 **and** of $CuCl_2$ = 135 ; $\frac{4.0 \times 135}{124}$ = 4.4 ;	**2**
5(b)(iii)	M_r of CO_2 = 44 ; moles of CO_2 = mass ÷ M_r or 8.8 ÷ 44 / 0.2 ; volume of CO_2 = moles × 24 or 0.2 × 24 / 4.8 dm^3 ; conversion to cm^3 = 4800 cm^3 ;	**4**
5(c)	has sea of electrons ; which can move (through the metal) ;	**2**

Question	Answer	Marks
6(a)(i)	acceleration = 9/3 = 3 m/s^2 ; force = mass × acceleration ; working or 3 × 450 (= 1350 N) ;	**3**
6(a)(ii)	work done = force × distance / 1350 × 13.5 ; = 18 200 (J) ;	**2**
6(b)	90 × 4 = 360 (cm^2) = 0.036 m^2 ; pressure = force / area or 4500 / 0.036 ; pressure = 125 000 (N/m^2) ;	**3**
6(c)	iron, magnetises / loses magnetism, quicker ; steel, magnetises / loses magnetism, slower ; **max 1**	**1**
6(d)	humans have smaller audible range ;	**1**
6(e)	$^{192}_{77}Ir \rightarrow {}^{192}_{78}Pt + {}^{0}_{-1}\beta$;;	**2**

Question	Answer	Marks
7(a)(i)	340 – 120 or 220 (220 / 120) × 100 = 183(%) ;;	**2**
7(a)(ii)	nitrate ions are needed to make, amino acids / proteins ; amino acids are needed for protein synthesis ; proteins are needed for growth which increases the yield ;	**3**
7(b)	genotype for wrinkly peas — rr ; phenotype of a heterozygous genotype — round ; the type of breeding if two wrinkly pea plants were crossed — pure ;	**3**

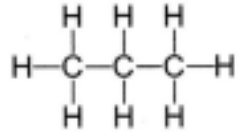
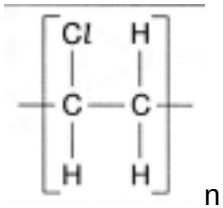
Question	Answer	Marks
7(c)(i)	as a reactant for respiration / energy source ; used to make cellulose for cell walls ; converted to sucrose for transport ; AVP ;; **max 2**	**2**
7(c)(ii)	carbon, hydrogen, oxygen ;	**1**

Question	Answer	Marks
8(a)	A ; fastest reaction / shortest time ;	**2**
8(b)	particles have more kinetic energy / move faster ; more collisions per second / greater collision frequency; more particles have the, minimum / activation energy ;	**3**
8(c)	bond breaking absorbs energy / bond breaking is endothermic ; bond making releases energy / bond making is exothermic ; more energy released than absorbed / ORA ;	**3**

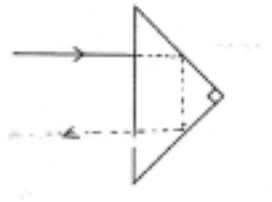
Question	Answer	Marks
9(a)	mass is measured in kg / weight is measured in newtons;	**1**
9(b)(i)	I = P / V or working 6000 / 240; current = 25 (A);	**2**
9(b)(ii)	fuse rating should be higher than working current / fuse will blow ;	**1**
9(c)	two different metals ; joined together / to make junction(s) ;	**2**

Question	Answer	Marks
9(d)	evaporation can occur at any temperature / boiling occurs at the boiling point ; evaporation happens only at the surface / boiling occurs throughout the liquid ; during boiling, all / most, molecules have enough energy to leave / evaporation only lets the molecules with the greatest kinetic energy escape ; evaporation can occur using the internal energy of the system / boiling requires a(n external) source of heat ; evaporation is a slow process / boiling is a rapid process ; evaporation produces cooling / boiling does not produce cooling ; **max 2**	**2**

Question	Answer	Marks
10(a)(i)	ref to vasoconstriction ; arterioles narrow ; blood flow to, surface capillaries / skin surface, reduced ; less heat lost by radiation ; hair stands on end ; AVP ; **max 3**	**3**
10(a)(ii)	part A covers vital organs ; a suitable temperature is required for body / AW to function ; ref to enzymes ; AVP ;	**2**
10(b)	homeostasis ;	**1**
10(c)	ability to detect, stimuli / changes to the environment / surroundings ; and respond ;	**2**

Question	Answer	Marks
11(a)	 ;	**1**
11(b)	bromine water remains orange (with propane) / bromine water is not decolourised (with propane) ; bromine water is decolourised (with propene) / bromine water changes from orange to colourless (with propene) ;	**2**
11(c)	large hydrocarbon molecules are broken down / split up (into smaller molecules) ; to make, alkenes / named alkene other than propene ; *plus any two from:* high temperature / 300 to 600 °C ; catalyst / correctly named catalyst e.g. zeolite or porcelain ; high pressure / 50 to 200 atmospheres ;	**max 4**
11(d)	 n ;	**1**

Question	Answer	Marks
12(a)(i)	gap closes ; road expands in the heat ;	**2**
12(a)(ii)	(the road will) buckle / bend / break / be damaged ;	**1**

Question	Answer	Marks
12(b)	ref to friction / described ; transfer of electrons ; from the fuel (to the pipe) ; **max 2**	**2**
12(c)	 reflection only shown at first reflection ; after second reflection ray emerges parallel to incident ray ;	**2**
12(d)(i)	coil correctly labelled ;	**1**
12(d)(ii)	slip rings correctly labelled ;	**1**
12(d)(iii)	magnetic field ; rotating coil cuts magnetic field or flux / experiences a changing magnetic field ; e.m.f. / current reverses every half turn ;	**3**