Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CO-ORDINATED SCIENCES (9–1) **0973/42**

Paper 4 Theory (Extended) **May/June 2021**

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.

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This document consists of **13** printed pages.

PUBLISHED

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.

Examples of how to apply the list rule
State **three** reasons…. [3]

A

1. Correct	✓	**2**
2. Correct	✓	
3. Wrong	×	

B **(4 responses)**

1. Correct, Correct	✓, ✓	**3**
2. Correct	✓	
3. Wrong	ignore	

C **(4 responses)**

1. Correct	✓	**2**
2. Correct, Wrong	✓, ×	
3. Correct	ignore	

D **(4 responses)**

1. Correct	✓	**2**
2. Correct, CON (of 2.)	×, (discount 2)	
3. Correct	✓	

E **(4 responses)**

1. Correct	✓	**3**
2. Correct	✓	
3. Correct, Wrong	✓	

F **(4 responses)**

1. Correct	✓	**2**
2. Correct	✓	
3. Correct CON (of 3.)	× (discount 3)	

G **(5 responses)**

1. Correct	✓	**3**
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

H **(4 responses)**

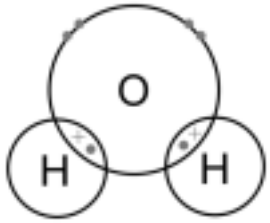
1. Correct	✓	**2**
2. Correct	×	
3. CON (of 2.) Correct	(discount 2) ✓	

I **(4 responses)**

1. Correct	✓	**2**
2. Correct	×	
3. Correct CON (of 2.)	✓ (discount 2)	

Question	Answer	Marks
1(a)	a lower ; osmosis ; turgor ; plasmolysis ;	**4**
1(b)(i)	chloroplast ;	**1**
1(b)(ii)	*any two from:* root hair cells absorb, water / mineral ions ; root hair cells, are underground / do not receive light ; correct reference to photosynthesis ;	**2**
1(b)(iii)	vacuole ; cell wall ;	**2**
1(c)(i)	red blood cells ;	**1**
1(c)(ii)	*any two from:* contain haemoglobin ; no nucleus ; biconcave shape / large surface area ; **AVP** ;	**2**

Question	Answer	Marks
2(a)	 liquid  solid  gas ;;	**2**
2(b)	melting ;	**1**

Question	Answer	Marks
2(c)	*movement:* *idea that* particles change, from moving around each other to vibrating about fixed positions ; *arrangement:* *idea that* arrangement of particles changes from random to regular ;	2
2(d)	 ;;	2

Question	Answer	Marks
3(a)(i)	(d=) v × t / 340 × 3.50 ; 1190 (m) ;	2
3(a)(ii)	stopwatch ;	1
3(a)(iii)	time taken would be too short to measure / speed of light is much greater ;	1
3(b)	(n =) sin i / sin r ; sin42 / sin29 **or** 1.380192509 ; 1.4 ;	3
3(c)(i)	angle of incidence is zero / ray perpendicular to boundary / along normal ;	1
3(c)(ii)	total internal reflection ;	1
3(c)(iii)	communication / medicine ;	1

Question	Answer	Marks
4(a)(i)	*any two from:* glucose produces the **most** carbon dioxide **;** fructose produces the **least** carbon dioxide **;** sucrose / lactose, produce **more** carbon dioxide than fructose **or** sucrose / lactose, produce **less** carbon dioxide than glucose **;** **plus** comparative data quote with correct units / comparative data manipulation **;**	**3**
4(a)(ii)	alcohol **;**	**1**
4(a)(iii)	glucose → lactic acid **;;**	**2**
4(b)	enzymes denatured **;** shape of the active site being changed / enzyme and substrate are no longer complementary / substrate can no longer fit into active site **;**	**2**

Question	Answer	Marks
5(a)	*source of nitrogen* – air **;** *source of hydrogen* – natural gas / cracking **;** 200 atmospheres pressure / 450°C / iron catalyst **;** ammonia is used for making fertilisers **;**	**4**
5(b)(i)	relative molecular mass of H_2 = 2 **and** of NH_3 = 17 **or** relative molecular mass of $3H_2$ = 6 **and** of $2NH_3$ = 34 **;** (6 × 680 / 34 =) 120 (kg) **;**	**2**
5(b)(ii)	**test** – lighted splint / ignite gas **;** **result** – (squeaky) pop **;**	**2**
5(b)(iii)	M_r of N_2 = 28 **;** moles of N_2 = 560 000 ÷ 28 = 20 000 **;** volume of N_2 = 20 000 × 24 = 480 000 (dm^3) **;**	**3**

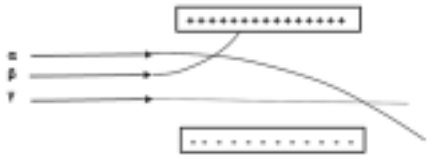
Question	Answer	Marks
6(a)	vibration of particles / atoms / ions ; transfer by electrons ;	**2**
6(b)(i)	20(°C) ;	**1**
6(b)(ii)	P, takes less time to cool to room temp / cools quicker ; black emits, radiation / heat energy / energy, more quickly than white ;	**2**
6(c)(i)	1500 / 1.5×10^3 ; (E =) Pxt / 1500×120 ; 180 000 (J) ;	**3**
6(c)(ii)	180 000 (J) ;	**1**
6(d)	*any two from:* increase temperature ; increase surface area ; draught over surface ; AVP ;	**2**

Question	Answer	Marks
7(a)	nucleus ;	**1**
7(b)	(female) XX (male) XY ;	**1**
7(c)	46 / 23 pairs ;	**1**
7(d)(i)	94 ;	**1**
7(d)(ii)	4 ;	**1**
7(e)	(named) ionising radiation / chemicals ;	**1**

Question	Answer	Marks
7(f)	*any two from:* asexual reproduction ; growth ; repair of damaged tissues ; replacement of cells ;	2
7(g)	meiosis produces sperm in humans ticked ; meiosis is a type of cell division ;	2

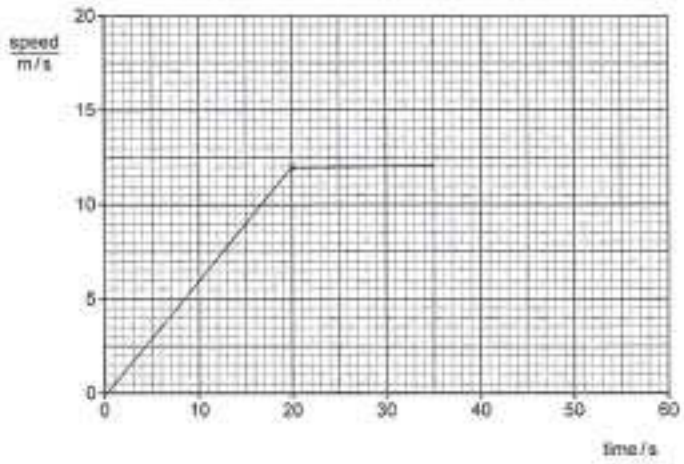
Question	Answer	Marks
8(a)	50 (seconds) ;	1
8(b)	line is same shape as original and is always underneath it ;	1
8(c)	more particles per unit volume / more particles per cm^3 ; more frequent collisions / more collisions per second ;	2
8(d)	$CaCO_3$ + **2** $HCl \rightarrow CaCl_2 + CO_2 + H_2O$;	1
8(e)	endothermic ;	1
8(f)	(acid is a) proton donor / donates protons / owtte ;	1

Question	Answer	Marks
9(a)	(nuclear) fission ;	1
9(b)	$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha$;;	2
9(c)	25 ; days ;	2
9(d)(i)	a region in which an electric charge experience a force ;	1

Question	Answer	Marks
9(d)(ii)	 ;;;	3

Question	Answer	Marks
10(a)(i)	phototropism ;	1
10(a)(ii)	*any three from:* auxin, made in the tip (moves down stem) ; auxin collects on shaded side ; auxin promotes cell elongation ; reference to unequal growth on side of, stem / plant ;	3
10(b)(i)	liver ;	1
10(b)(ii)	*any two from:* increase in pulse rate ; widened pupils ; increase in breathing rate ; avp ;;	2
10(b)(iii)	glucagon ;	1
10(c)	*any two from:* takes longer time ; via chemical substances ; transmission is via the blood ;	2

Question	Answer	Marks
11(a)	<table><tr><td>particle</td><td>relative mass</td><td>relative charge</td></tr><tr><td>electron</td><td>$\frac{1}{1840}$</td><td>**–1 / – / negative**</td></tr><tr><td>neutron</td><td>**1**</td><td>0</td></tr><tr><td>proton</td><td>1</td><td>**+1 / + / positive**</td></tr></table> ;;;	**3**
11(b)(i)	C ;	**1**
11(b)(ii)	C ;	**1**
11(b)(iii)	D **and** E ;	**1**

Question	Answer	Marks
12(a)(i)	 ;;	**2**

Question	Answer	Marks
12(a)(ii)	(a =) Δv / t / 12 / 20 ; 0.6 ; m / s^2 ;	**3**
12(a)(iii)	area under the graph ;	**1**
12(b)	velocity has a direction ORA ; both measure, rate of change of distance or displacement / same units ;	**2**
12(c)(i)	460 (N) ;	**1**
12(c)(ii)	air resistance / friction / drag ;	**1**

Question	Answer	Marks
13(a)	Na^+, Cl^-, H^+, OH^- ;;	**2**
13(b)	anode – chlorine ; cathode – hydrogen ;	**2**
13(c)	sodium hydroxide ; hydroxide ions or OH^- remain in solution ;	**2**
13(d)	reduced because (two) electrons are gained ;	**1**
13(e)	$Al^{3+} + 3e^- \rightarrow Al$;;	**2**