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Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CO-ORDINATED SCIENCES **0973/41**

Paper 4 Theory (Extended) **October/November 2022**

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 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **15** printed pages.

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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   <u>'List rule' guidance</u> 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.
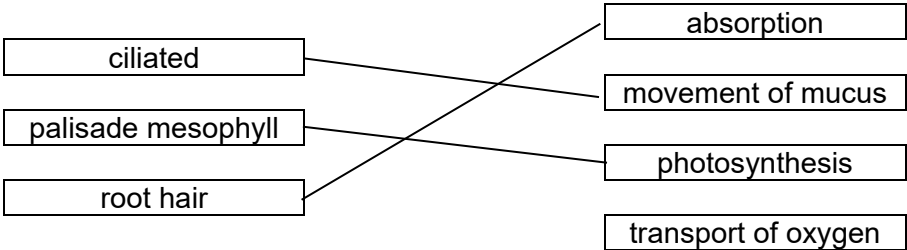
For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.
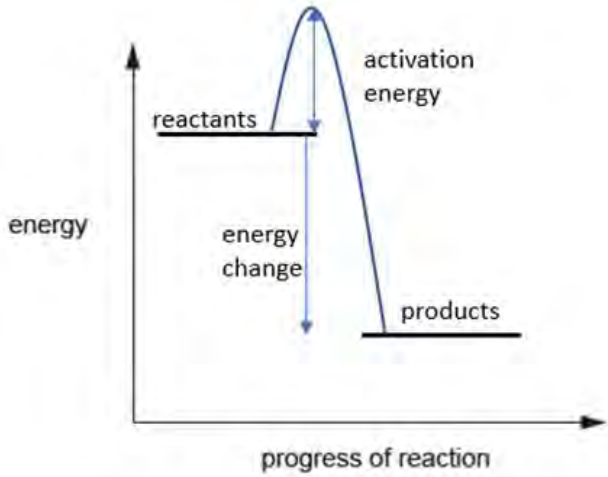
Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

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)	C ; B ; E ; C ;	**4**
1(b)	*any two from:* flagellum labelled ; <u>haploid</u> nucleus labelled ; enzymes labelled ; AVP ;	**2**
1(c)	**1 from:** sperm: unpaired chromosomes **/** single set of chromosomes ; zygote: paired chromosomes / 2 sets of chromosomes ;	**1**
1(d)	 ;;;	**3**
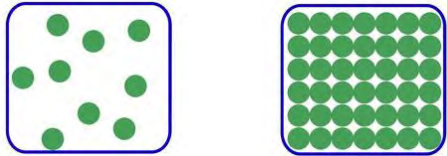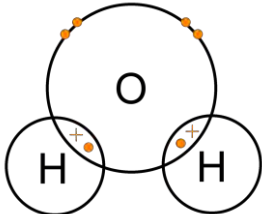
Question	Answer	Marks
2(a)	(compound that contains) carbon and hydrogen ; only / owtte ;	**2**
2(b)(i)	decreases / owtte ;	**1**
2(b)(ii)	$C_{14}H_{30}$;	**1**
2(b)(iii)	idea that if n = 10 then H will be 22, but in decene it is 20 ;	**1**
2(c)	$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$ correct formulae ; correct balancing ;	**2**
2(d)(i)	(reaction in which) energy is given out / heat is given out ;	**1**
2(d)(ii)	 products shown below reactants; energy change or ΔH correctly labelled; activation energy or E_a correctly labelled;	**3**

Question	Answer	Marks
3(a)(i)	(M =) F × d OR 1200 × 5 ; (M =) 6000 (Nm) ;	**2**
3(a)(ii)	6000 ;	**1**
3(b)	(m =) GPE / (gh) or 105000/(42 × 10) or 105000 / 420 ; (m =) 250 (kg) ;	**2**
3(c)(i)	split–ring commutator ;	**1**
3(c)(ii)	arrow drawn N to S ;	**1**
3(c)(iii)	*any two from*: increase the current ; increase magnetic field strength ; increase number of turns on the coil ;	**2**

Question	Answer	Marks
4(a)	*any two from:* oxygen **;** water / moisture **;** warm / suitable temperature **;**	**2**
4(b)(i)	gravitropism **;**	**1**
4(b)(ii)	auxin **;** lower / owtte **;** elongation **;** gravity **;**	**4**
4(c)(i)	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ LHS ; RHS ;	**2**
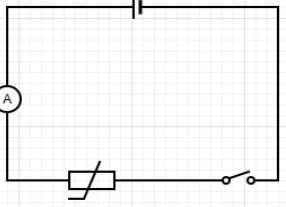
Question	Answer	Marks
4(c)(ii)	transfers light energy to chemical energy **;** for synthesis of, carbohydrates / glucose **;**	**2**

Question	Answer	Marks
5(a)	 gas ; solid ;	**2**
5(b)(i)	move further apart ; continue to move randomly / move more freely / collide with each other less often ;	**2**
5(b)(ii)	bonds (between atoms) are strong / need a lot of energy to break / are covalent ;	**1**
5(b)(iii)	 2 shared pairs ; all else correct ;	**2**
5(c)(i)	particles move faster / have more energy ; more particles possess the minimum energy to react / activation energy ;	**2**
5(c)(ii)	more surface area ; more frequent collisions / more collisions per second / owtte ;	**2**

Question	Answer	Marks
6(a)(i)	friction / drag / air resistance / water resistance ;	1
6(a)(ii)	resultant force = 400 N ; (a =) F / m or 400 / 100 ; (a =) 4 (m / s^2) ;	3
6(b)(i)	0.25 (Hz) ;	1
6(b)(ii)	(v =) fλ / 0.25 × 0.6 ; (v =) 0.15 (m / s) ;	2
6(b)(iii)	circular wavefronts drawn in correct position, spreading out ;	1
6(c)	(nuclear) fusion ;	1

Question	Answer	Marks
7(a)(i)	(vitamin) D **;**	1
7(a)(ii)	exposure to sunlight **;** (named) food high in vitamin D **;**	2
7(b)(i)	(88 / 95) × 100 **;** 93 (%) **;**	2
7(b)(ii)	proteins required for growth **/** children are still growing **;**	1
7(c)	marasmus **;**	1
7(d)	carbon, hydrogen, oxygen **;** nitrogen **;**	2
7(e)	protease **;**	1

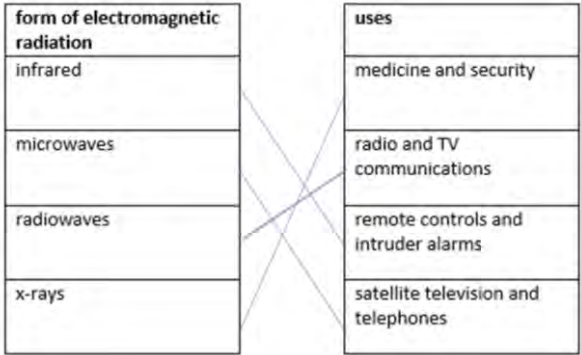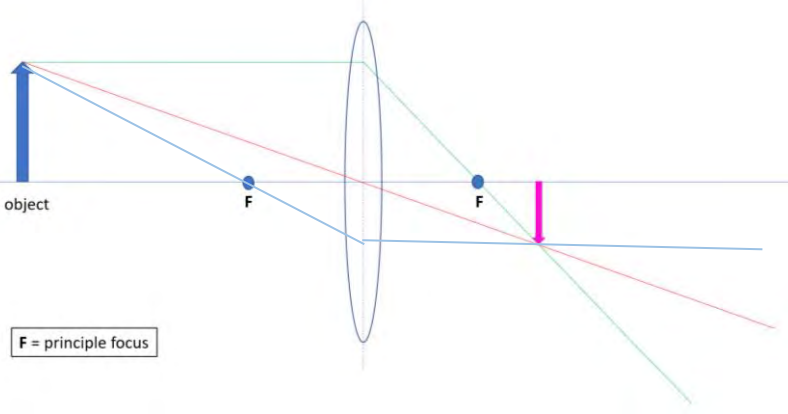| Question	Answer	Marks
8(a)(i)	(car **A** / petrol car because) car **A** / petrol car makes 5×59 OR 295 g (of nitrogen monoxide) but car **B** / diesel car makes 8×29 OR 232 g (of nitrogen monoxide) ;	1
8(a)(ii)	$2NO \rightarrow N_2 + O_2$ correct formulae ; correct balancing ;	2
8(a)(iii)	use of low sulfur fuel / remove sulfur from fuel ;	1
8(b)	M_r of CO = 28 ; (moles of CO =) $236 \div 28$ OR 8.43 ; (volume of CO = 8.43×24 =) 202 dm³ ;	3
8(c)	*any two from*: pressure – 2 atmospheres / 200 kPa ; temperature – 450 °C ; vanadium(V) oxide / V_2O_5 catalyst ;	2

Question	Answer	Marks
9(a)	correct symbols ; correct circuit ;	2
9(b)	(from graph I =) 5 (mA) / 0.005 (A) ; (t =) Q / I or 1 / 0.005 ; (t =) 200 (s) ;	3
9(c)(i)	conduction ; vibrations passed from particle to particle ;	2
9(c)(ii)	kinetic energy / speed of molecules increases ; molecules move further apart ;	2
9(c)(iii)	(m =) $\rho \times V$ OR 0.78×2.0 OR 1.56 (g) ; (ρ =) m / V OR 1.56 / 1.95 ; (ρ =) 0.80 (g / cm^3) ;	3

Question	Answer	Marks
10(a)	<table><tr><td>name of part</td><td>letter in Fig. 10.1</td><td>function</td></tr><tr><td>fatty tissue / fat</td><td>**C**</td><td>provide insulation</td></tr><tr><td>hair erector muscle</td><td>**D**</td><td>(contract to) raise hair</td></tr><tr><td>sweat gland</td><td>**B**</td><td>produce sweat</td></tr></table> ;;;	**3**
10(b)	ref to <u>vasodilation</u> / arterioles widen / dilate **;** increase in blood flow to, skin surface / capillaries **;** (more) heat loss from skin (by radiation) **;**	**3**
10(c)(i)	ref to a, set point / normal level **;** any change results in an opposing action / AW **;**	**2**
10(c)(ii)	control of blood glucose concentration / AVP **;**	**1**

Question	Answer	Marks
11(a)	oxygen is removed/lost (from copper oxide) ;	**1**
11(b)(i)	copper sulfate ;	**1**
11(b)(ii)	(pure) copper ;	**1**
11(c)	$Cu^{2+} + 2e^- \rightarrow Cu$ correct formulae ; correct balancing ;	**2**
11(d)(i)	aluminium ;	**1**

Question	Answer	Marks
11(d)(ii)	oxidation ;	1
11(e)	relative formular mass of Al_2O_3 =102 ; ($\frac{204 \times 1.35}{108}$ OR $\frac{102 \times 1.35}{54}$ =) 2.55 (g) ;	2

Question	Answer	Marks
12(a)	cancer ;	1
12(b)	$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha$$;	2
12(c)(i)	3×10^8 <u>m / s</u> ;	1
12(c)(ii)	 | form of electromagnetic radiation	uses
infrared	medicine and security
microwaves	radio and TV communications
radiowaves	remote controls and intruder alarms
x-rays	satellite television and telephones | ,, *1 correct = 0* *2 or 3 correct = 1* *4 correct = 2*	2

Question	Answer	Marks
12(d)(i)	 any 2 rays ; image ;	**3**
12(d)(i)(i)	*any one from***:** real image can be projected on to a screen / ora ; real image is formed where rays of light actually converge / ora ;	**1**