Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/43**

Paper 4 Theory (Extended) **October/November 2018**

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 2018 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:

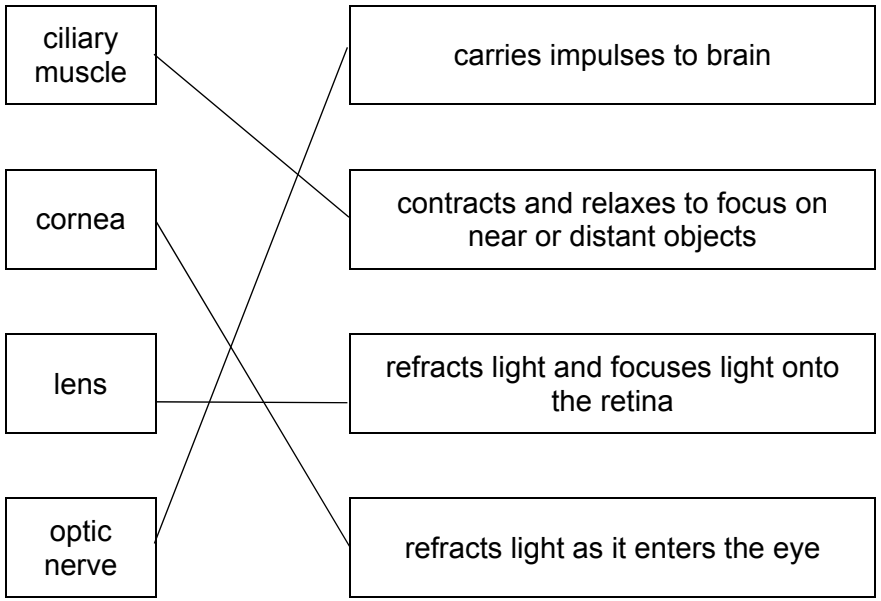
Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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>X drawn on testis ;</td><td>1</td></tr>
<tr><td>1(a)(ii)</td><td>meiosis ;</td><td>1</td></tr>
<tr><td>1(a)(iii)</td><td>any two from
sperm duct ;
urethra ;
penis ;</td><td>max 2</td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><th>feature</th><th>sperm cells</th><th>egg cells</th></tr>
<tr><td>size compared to the other sex cell</td><td>small</td><td>large</td></tr>
<tr><td>number produced during lifetime compared to the other sex cell</td><td>many</td><td>few</td></tr>
<tr><td>ability to move themselves</td><td>able to move themselves</td><td>unable to move themselves</td></tr>
</table>
1 correct row ;
2 correct rows ;
3 correct rows ;</td><td>3</td></tr>
<tr><td>1(c)</td><td>(nuclei) contains, single set / unpaired chromosomes ;</td><td>1</td></tr>
<tr><td>1(d)</td><td>oviduct ;</td><td>1</td></tr>
</table>

Question	Answer	Marks
2(a)(i)	gas gas ; liquid ; solid solid solid ;	**3**
2(a)(ii)	bromine – m.pt. below 20 °C b.pt. above 20 °C ; tennessine – the idea that the trend will continue ;	**2**
2(b)(i)	7 ; number of outer electrons same as group number ;	**2**
2(b)(ii)	117 ;	**1**
2(b)(iii)	117 AND (number of electrons is) the same as number of protons / atomic number ;	**1**
2(c)	−1 / negative ; the idea that number of electrons exceeds number of protons by one ;	**2**

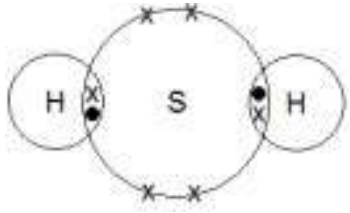
Question	Answer	Marks
3(a)(i)	acceleration = change in speed / time ; 15 / 60 (= 0.25 (m / s^2)) ;	**2**
3(a)(ii)	force = mass × acceleration or 7.5 × 10^5 × 0.25 ; = 1.9 × 10^5 (N) ;	**2**
3(b)	current iron voltage primary secondary 1 or 2 correct ; 3 or 4 correct ; 5 correct ;	**3**

Question	Answer	Marks
4(a)(i)	increase in light intensity ;	**1**
4(a)(ii)	circular muscles contract ; pupil constricts / gets smaller, OR iris expands / gets bigger ;	**2**
4(b)	prevents damage (to retina) in bright conditions **OR** allows enough light to enter the eye in dull conditions ;	**1**
4(c)	 1 correct ; 2 or 3 correct ; 4 correct ;	**3**

Question	Answer	Marks
5(a)	iron aluminium gold / copper 1 or 2 correct ; 3 correct ;	**2**
5(b)(i)	exothermic ;	**1**
5(b)(ii)	chemical (potential) to thermal ;	**1**
5(b)(iii)	6 ;	**1**
5(c)	zinc atoms lose electrons ;	**1**
5(d)	rate is higher ; higher concentration means more copper ions per volume / more ions near the zinc at any one time ; increased **frequency** of collision (of copper ions and zinc atoms surface) / increased chance of collisions ;	**3**

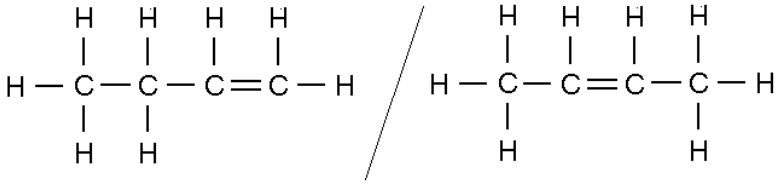
Question	Answer	Marks
6(a)(i)	reference to an effect of ionising radiation on body ;	**1**
6(a)(ii)	lead absorbs X-rays / stops X-rays passing through ;	**1**
6(b)(i)	number of oscillations per second ;	**1**
6(b)(ii)	frequency = speed / wavelength or $3 \times 10^{8} / 5 \times 10^{-9}$; 6×10^{16} (Hz) ;	**2**
6(c)(i)	collide with walls / cylinder ; (collisions exert a) force on the walls / cylinder ;	**2**
6(c)(ii)	$P_1 = P_2 V_2 / V_1$ or $101\,000 \times 350 / 3.0$; = 12 000 000 (Pa) ;	**2**
6(d)(i)	(alpha radiation is) ionising OR kills cells OR low penetration ;	**1**
6(d)(ii)	half life is short / will not radiate for long (in the body) ;	**1**
6(d)(iii)	$^{223}_{88}Ra \rightarrow {}^{219}_{86}Rn + {}^{4}_{2}He$ radon correct ; helium correct ;	**2**

Question	Answer	Marks
7(a)(i)	20–34 year olds ;	**1**
7(a)(ii)	20 (%) ;	**1**
7(a)(iii)	(percentage of smokers) increase then decrease ; maximum is in 18–19 year old age group / at 34% ;	**2**
7(a)(iv)	(increased,) legislation / education / medical intervention / less advertising (of cigarettes) ;	**1**
7(b)	mucus traps smoke particles / particulates ; cilia move mucus (containing smoke particles) (out of airway) ;	**2**

Question	Answer	Marks
8(a)	S_8 ;	**1**
8(b)(i)	 two shared pairs ; four lone electrons on sulfur only ;	**2**
8(b)(ii)	avoids formation of sulfur dioxide / SO_2 ; reference to acid rain ;	**2**
8(c)(i)	high / moderate temperature / (400–450 °C) ; pressure between 1 and 2 atmospheres ; catalyst (of vanadium pentoxide) ;	**max 2**
8(c)(ii)	sulfur trioxide ;	**1**
8(c)(iii)	$2SO_2 + O_2 \rightarrow 2SO_3$ formulae ; balancing ;	**2**

Question	Answer	Marks
9(a)(i)	thermistor ;	**1**
9(a)(ii)	10 (Ω) ;	**1**
9(a)(iii)	current = voltage / resistance or 6 / 10 ; = 0.6 (A) ;	**2**
9(b)	C = $\frac{\Delta E}{m \times \Delta T}$ or $\frac{1087}{4.0 \times 65}$; = 4.2 (kJ / (kg ^{o}C)) ;	**2**
9(c)	compression region of high pressure / where the particles are close together ;	**1**

Question	Answer	Marks
10(a)(i)	water moves in to plant cell ; correct ref to <u>osmosis</u> ; solution is less concentrated / more dilute than plant cell / ; (water moves) from high to low water potential / dilute to concentrated ; causing is to swell / become turgid / AW ;	**max 4**
10(a)(ii)	(animal cell) bursts ; lack of cell wall ;	**2**
10(b)(i)	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ left-hand side correct ; right-hand side correct ;	**2**
10(b)(ii)	presence of chlorophyll / chloroplasts ;	**1**

Question	Answer	Marks
11(a)(i)	propene ;	**1**
11(a)(ii)	 / C=C double bond ; all else correct ;	**2**
11(b)(i)	addition ;	**1**
11(b)(ii)	colourless ; bromine forms colourless compounds with unsaturated hydrocarbons / alkenes ;	**2**
11(c)	step 1 $(12 \times 2) + (1 \times 6) + 16$ (= 46) ; step 2 $1.15 \div 46 = 0.025$; step 3 $0.025 \times 3 = 0.075$; step 4 $0.075 \times 24 = 1.8$ (dm^3) ;	**4**

Question	Answer	Marks
12(a)	use a magnet (no mark) steel is magnetic / attracted to a magnet ;	**1**
12(b)	to switch high current circuits using a small current circuit / so a high current circuit can be switched safely / so that a switch with a low current rating can be used to switch a high current ;	**1**
12(c)(i)	normal drawn and labelled ;	**1**
12(c)(ii)	reflected ray drawn with approx. correct angle of reflection ;	**1**
12(c)(iii)	correctly labelled angle of reflection ;	**1**
12(d)	black surfaces are better absorbers of thermal radiation (than white surfaces) / white surfaces are better reflectors of thermal radiation (than black surfaces) ;	**1**
12(e)	kinetic ; gravitational (potential) ;	**2**
12(f)(i)	work = force × distance or 14 000 × 1500 ; = 21 000 000 (J) ;	**2**
12(f)(ii)	power = $\frac{\text{energy}}{\text{time}}$ or $\frac{\text{work}}{\text{time}}$ or $\frac{21000000}{90}$; = 230 000 ; W ;	**3**

Question	Answer	Marks
13(a)(i)	0.6 (°C) ;	**1**
13(a)(ii)	greenhouse gases ;	**1**
13(a)(iii)	absorbs (infrared) radiation (from Earth's surface) ; energy is trapped / radiation is re-radiated (to Earth's surface) / prevented from leaving atmosphere ;	**2**
13(b)	decay / decomposition ; respiration ;	**2**
13(c)	oxygen (concentration) is reduced / less oxygen is produced ; less photosynthesis ;	**2**