Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/42**

Paper 4 Extended Theory **October/November 2019**

MARK SCHEME

Maximum Mark: 80

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 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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.

Question	Answer	Marks
1(a)	use of v = distance / time OR 100 / 10.5 ; 9.52 / 9.5 ;	**2**
1(b)	use of gradient of graph ; number in range 1.0 to 1.2 ; m/s^2 ;	**3**
1(c)	*any two from:* (velocity) is a vector ; (velocity) has direction ; average velocity is zero ; velocity is (constantly) changing direction ; displacement is zero ;	**2**

Question	Answer	Marks
2(a)	diffusion ;	**1**
2(b)(i)	NH_3 = 17 **and** HCl = 36.5 ;	**1**
2(b)(ii)	reactants and products ; state symbols ; $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$;	**2**
2(c)	hydrochloric acid has, greater or twice molecular mass (of ammonia) ;	**1**

Question	Answer	Marks
3(a)(i)	*any three from:* M1 all the water / tank is heated / heats up faster ; M2 (water is heated by) convection ; M3 hot water less dense (than cold water) / water expands on heating ; M4 hot water or more energetic particles rise / cold water sinks ;	**3**
3(a)(ii)	(tank can be) lagged / insulated ;	**1**
3(b)	(copper / metals have) free / delocalised / sea of, electrons ; these electrons carry the energy (through the solid) ;	**2**

Question	Answer	Marks
4(a)	the temperature range is broad ;	**1**
4(b)	**B** and **C**, are different compounds / are a mixture of substances ; contain impurities / not a pure substance ;	**2**
4(c)	used to separate a mixture of liquids / compounds (**A**–**C)** are solids / solids might not be soluble / do not dissolve ;	**1**

Question	Answer	Marks
5(a)(i)	(families of compounds with the) same general formula ; similar chemical properties ;	2
5(a)(ii)	alkane ;	1
5(a)(iii)	all carbons have single bonds / contain C-C (only) ;	1
5(b)(i)	high temperature ; high pressure ;	2
5(b)(ii)	H_2 ;	1

Question	Answer	Marks
6(a)	arrow pointing downwards between PS **AND** downwards between QR ;	1
6(b)	M1 voltmeter with correct symbol drawn in parallel with a component ; M2 across the lamp ;	2
6(c)(i)	power = VI OR (I =) 2.5 / 1.5 ; 1.7 / 1.67 / 1.6 ;	2
6(c)(ii)	2.5 ;	1
6(c)(iii)	M1 $R = V / I$ OR **(ii)** / **(i)** ; 1.5 ;	2
6(d)	idea resistance α 1 / area ; 18 ;	2

Question	Answer	Marks
7(a)	M1 Mr determination: Mr ZnS = 97 **AND** Mr ZnO = 81 ; M2 ratio: 1:1 mole ratio / 97 g of ZnS gives 81 g of ZnO ; M3 mass of ZnO: (97 g produces 7 × 81 / 97 ecf on mole ratio gives) 5.8(45) ;	**3**
7(b)(i)	carbon / C ;	**1**
7(b)(ii)	*any one of:* toxic ; prevents the uptake of oxygen ;	**1**
7(b)(iii)	*any two of:* catalytic convertor ; CO is oxidation reaction / reaction of CO with oxygen / CO forms CO_2 / equation ; reaction of NO into nitrogen / equation ;	**2**
7(c)	*any three of:* M1 (thin layer of) zinc coated onto the steel ; M2 stops oxygen **AND** water reaching steel ; M3 zinc acts as sacrificial metal ; M4 zinc more reactive than, iron / steel ; M5 zinc oxidised (in preference to, iron / steel) ;	**3**
7(d)	changes the properties (of iron or pure metal) ;	**1**

Question	Answer	Marks
8(a)	refracted ray straight and refracted towards the normal ; emergent ray parallel to the incident ray ;	**2**
8(b)	(*n* =) sin i / sin r ; (sin r =) sin 64 / 1.48 or 0.899 / 1.48 or 0.624 ; 37.4 ;	**3**
8(c)	*(n =)* speed of light in air / speed of light in glass or 3.0×10^8 / 1.48 ; 2.02×10^8 ;	**2**

Question	Answer	Marks
9(a)	*any three from:* M1 the wire or coil or current is in a magnetic field ; M2 this causes a force (on wire / coil / current) / coil or current has a magnetic field ; M3 forces right angles to current AND magnetic field ; M4 forces on opposite sides of coil are in opposite direction ; M5 forces dependent on direction of the current ; M6 (forces) produce couple / moment / torque ;	**3**
9(b)(i)	commutator ;	**1**
9(b)(ii)	*any two from:* every half turn (the split ring comes into contact with a different brush) ; **X** reverses the current (in the coil) ; couple is always in the same direction (which is clockwise / anticlockwise / rotational) ;	**2**

Question	Answer	Marks
10(a)(i)	to enable the ions to move / ions fixed in position when solid ;	1
10(a)(ii)	anode: chlorine (gas) / Cl_2 ; cathode: magnesium / Mg ;	2
10(a)(iii)	chloride with 8 electrons AND magnesium with no electrons or 8 electrons ; 2+ charge on magnesium AND 1– charge on chloride ; 1 magnesium and 2 chlorides ;	3
10(b)(i)	beryllium chloride AND hydrogen ;	1
10(b)(ii)	less reactive AND *any one from:* reactivity increases down the group ; Ba produces more bubbles (than Mg) ; Ba reacts more vigorously (than Mg) ;	1

Question	Answer	Marks
11(a)	radiation from (radioactive isotopes in) the environment ;	1
11(b)	M1 subtraction of background count rate from figures in the table ; M2 understanding that half-life is time elapsed when count rate drops to half initial rate ; M3 2 (hours) ;	3

Question	Answer	Marks
12(a)	7 ;	1
12(b)	proton donor / or acid lose / donate a proton or H^+ ;	1
12(c)	M1 labelled reactants on left and products on right ; M2 correct shape / reactants higher than products ; M3 energy released or downward arrow ;	3