Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/04**

Paper 4 Theory (Extended) **For examination from 2019**

MARK SCHEME

Maximum mark: 80

Specimen

This document consists of **8** printed pages.

CAMBRIDGE International Examinations

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.

mark scheme abbreviations

;	separates marking points
/	alternative responses for the same marking point
not	do not allow
allow	accept the response
ignore	mark as if this material was not present
ecf	error carried forward
avp	any valid point
ora	or reverse argument
owtte	or words to that effect
underline	actual word given must be used by candidate (grammatical variants excepted)
( )	the word/phrase in brackets is not required but sets the context
max	indicates the maximum number of marks
any [number] from:	accept the [number] of valid responses
note:	additional marking guidance

[Turn over

Question	Answer	Marks	Guidance
1(a)	measure <u>volume</u> of gas or carbon dioxide ; measure time ;	**2**	allow: measure concentration of ethanol
1(b)	increase in temperature / more yeast present / yeast multiplies ;	**1**	

Question	Answer	Marks	Guidance
2	Award 1 mark for any three valid features without explanation. Award 1 mark each for any three valid features explained. **Feature** — **Explanation** Trapped air — Good insulator / reduces convection ; Copper — Good thermal conductor ; Black (paint) — Good absorber ; Insulating material — Reduces heat loss ; Narrow pipes/large surface area — Absorbs more heat ; Glass — transmits Sun's radiation but stops re-radiation ;	**4**	allow: **Feature** — **Explanation** Slow flow of water — Exposed to heat longer ; Maximise length of pipes — Exposed to heat longer ; ignore: electrical conductor ignore: stops heat loss

Question	Answer	Marks	Guidance
3(a)(i)	exothermic ;	**1**	
3(a)(ii)	energy is taken in when bonds are broken / bond breaking is endothermic ; energy is given out when bonds are made / bond forming is exothermic ; energy from making bonds is more than energy from breaking bonds ;	**3**	
3(b)	natural gas ;	**1**	

Question	Answer	Marks	Guidance
4(a)(i)	8 electrons in second shell ; 8 electrons in third shell ;	**2**	
4(a)(ii)	Na_2S ;	**1**	

Question	Answer	Marks	Guidance
4(b)	carbon with 3 shared electron pairs, one pair with each hydrogen ; carbon with 1 shared electron pair with oxygen ; oxygen with one shared electron pair with hydrogen ;	**3**	

Question	Answer	Marks	Guidance
5(a)	speed × time (in any form) / any area under the graph used or stated 13 m / s or 24 s or (42 – 18) s seen ; 13 × 24 ; 312 m (2 or 3 sig. figs.) ;	**3**	
5(b)	rate of change of speed / gradient of graph ; correct pair of values, e.g. 18 (m / s) **and** 12 (s) seen ; 1.5 m / s^2 ;	**3**	
5(c)	same gradient / slope / equal speed changes in equal times ;	**1**	

Question	Answer	Marks	Guidance
6(a)(i)	5.45 (N) ±0.05 ;	**1**	
6(a)(ii)	mass = weight / g / 5.4 ÷ 10 / 9.8 / 9.81 ; = 0.54 / 0.55 kg ;	**2**	ecf from **(a)(i)** not: just 0.55, 0.54, kg must be seen
6(b)	immerse **P** in a liquid / put <u>fully</u> in a liquid ; in a <u>measuring cylinder</u> ; volume = difference in readings ; **or** <u>fill</u> a eureka can (displacement can) with liquid ; immerse **P** ; (measure) volume displaced in <u>measuring cylinder</u> ;	**3**	not: beaker
6(c)	density = mass / volume / 0.54 (× 103) ÷ 180 ; 3.0 (g / cm^3) ;	**2**	ecf from **(a)(ii)** [3.1]

Question	Answer	Marks	Guidance
7(a)	the number of (complete) waves / wavefronts (passing a point) per unit time ;	**1**	

Question	Answer	Marks	Guidance
7(b)(i)	wavefronts spread from the gap getting wider ; symmetrical semicircles / circular arcs good and centred on the gap (centre) ; wavelength constant and equal to that before going through the gap ;	**3**	
7(b)(ii)	diffraction ;	**1**	
7(c)	similarity: wavelength / frequency / speed ; difference: amplitude / front flattened at centre ;	**2**	

Question	Answer	Marks	Guidance
8(a)(i)	3 ;	**1**	
8(a)(ii)	number of electrons (outer shell) = group number / same / both are three ;	**1**	ora allow: valence electrons for outer electrons
8(b)	boiling point <u>decreases</u> down the group ; density <u>increases</u> down the group ;	**2**	
8(c)(i)	Any two from: lattice / regular arrangement ; positive ions / cations ; in a sea of electrons ;	**2**	max 2 not: atoms or protons
8(c)(ii)	electrons are free / delocalised / mobile ; (electrons) carry the charge / move in response to a p.d. ;	**2**	

Question	Answer	Marks	Guidance
9(a)	(resistance) increases when the current increases ; comment regarding evidence from graph e.g. current rises too slowly / the ratio V/I increases ;	**2**	ignore: comments regarding change in temperature of the lamp / filament
9(b)(i)	3.1 (A) ;	**1**	
9(b)(ii)	(I) = P ÷ V / = 12 ÷ 3 ; 4 (A) ;	**2**	
9(b)(iii)	7.1 (A) ;	**1**	ecf from **(b)(i)** and / or **(b)(ii)**

Question	Answer	Marks	Guidance
9(b)(iv)	(Q) = I t / 7.1 × 300 ; = 2130 (C) ;	**2**	ecf from **(b)(iii)**

Question	Answer	Marks	Guidance
10(a)	supply and demand are different ; reference to data e.g. petrol / gases / short chains, demand is greater than supply, for longer chains / fuel oil / paraffin / naptha more made than required ;	**2**	
10(b)(i)	Any two from: large molecular size / named hydrocarbons / alkanes broken down ; to make alkenes / smaller or more useful hydrocarbons / alkenes / named / hydrogen ; using high temperature (400–800 °C) / catalyst* / high pressure (40–100 atm) ;	**2**	max 2 (*zeolite / aluminium, alumino silicate / aluminium oxide / claypot)
10(b)(ii)	supply of larger fractions goes down (or named fraction) ; supply of smaller fractions goes up (or named fraction) ;	**2**	
10(c)(i)	family of compounds with similar properties ; due to presence of same function group / same general formula / differing by CH_2 ;	**2**	
10(c)(ii)	has (carbon to carbon) double bond / unsaturated ;	**1**	

Question	Answer	Marks	Guidance
11(a)(i)	α values correct, nucleon number 4 and proton number 2 ; X values correct, nucleon number 227 and proton number 89 ;	**2**	ecf from their α values
11(a)(ii)	actinium / Ac ;	**1**	ecf from **(a)(i)**
11(b)(i)	the time taken for the number of atoms / nuclei in a sample of that isotope to halve ;	**1**	owtte allow: time taken for radioactivity / activity / count rate from that isotope to halve not: time taken for half the sample / isotope to decay

[Turn over

Question	Answer	Marks	Guidance
11(b)(ii)	time for activity to fall to $\frac{1}{8}$ = 3 half-lives ; 3 × 3400 = 10200 (years) ;	**2**	

Question	Answer	Marks	Guidance
12(a)	0.89 ; 64 ;	**2**	note: minimum of two significant figures allow: 63.5 to 64.5
12(b)	mole ratio = 1 : 1/248 (g) of ore gives 128 (g) of Cu ; 5 tonnes produces 5 × 128 ÷ 248 or 5 × 0.52 ; 2.6/2.58 (tonnes) of copper ;	**3**	 note: minimum 2 significant figures
12(c)	Award 1 mark for all the correct formulae. Award 1 mark for balancing. $2Cu_2O + C \rightarrow 4Cu + CO_2$ / $Cu_2O + C \rightarrow 2Cu + CO$ / $Cu_2O + CO \rightarrow 2Cu + CO_2$	**2**	
12(d)(i)	hematite ;	**1**	
12(d)(ii)	Fe_2O_3/iron oxide ;	**1**	