



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**CO-ORDINATED SCIENCES**

**0654/03**

Paper 3 Theory (Core)

**For examination from 2019**

MARK SCHEME

Maximum Mark: 120

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**Specimen**

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This document consists of **10** printed pages.

## 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:

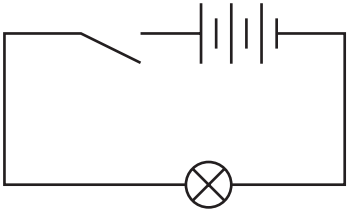
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**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

Question	Answer	Marks	Guidance
1(a)(i)	all symbols correct ; all in series ; 	2	not: if only one cell shown or drawn
1(a)(ii)	(I =) $V/R/4.5 \div 5$ ; 0.9 ; A/ampere ;	3	
1(a)(iii)	10 ( $\Omega$ ) ;	1	
1(b)(i)	reflected ray drawn at the correct angle ;	1	
1(b)(ii)	angle of incidence marked correctly ;	1	
1(b)(iii)	it will double ;	1	

Question	Answer	Marks	Guidance
2(a)(i)	<u>fractional distillation</u> / fractionation ;	1	
2(a)(ii)	heated / boiled ;	1	allow: changes from liquid to gas
2(b)(i)	hydrocarbon / alkane ;	1	
2(b)(ii)	$C_8H_{18}$ ;	1	
2(c)(i)	sulfur dioxide ;	1	
2(c)(ii)	causes acid rain ;	1	allow: descriptions of effects of acid rain e.g. causes corrosion of metals / stonework / may cause breathing difficulties / asthma / irritate respiratory system

Question	Answer	Marks	Guidance
3(a)(i)	transpiration ;	1	

Question	Answer	Marks	Guidance
3(a)(ii)	label line labelled E on the <u>surface</u> of a cell in contact with the air ;	1	
3(a)(iii)	stoma/ stomata ;	1	
3(a)(iv)	Any two from: high temperature ; <u>low</u> humidity /arid/ dry ; high wind speed ; light ;	2	max 2 for high wind speed allow: windy
3(b)	root hair → root cortex cell ; → xylem → cells in the leaf	1	
3(c)	glucose ; oxygen ;	2	
3(d)	petal <b>C</b> ; anther <b>A</b> ; stigma <b>B</b> ; sepal <b>D</b> ;	4	

Question	Answer	Marks	Guidance
4(a)(i)	X at two minutes ;	1	
4(a)(ii)	D written anywhere on section from 1.5 min–2 mins ;	1	
4(a)(iii)	K written anywhere on section from 0 mins–1.5 mins ;	1	
4(b)(i)	radio first box ; visible light fourth box ;	2	
4(b)(ii)	satellite TV/mobile phone communication ;	1	
4(b)(iii)	frequency/wavelength ;	1	
4(b)(iv)	<b>B</b> ; <b>E</b> ;	2	
4(c)	use a magnet – steel will be attracted/steel is magnetic and aluminium will not be attracted/aluminium is not magnetic ;	1	not: just use a magnet

Question	Answer	Marks	Guidance
5(a)	heat/leave in warm place ; evaporation ;	2	
5(b)(i)	atom has equal numbers of protons and electrons ; ion has lost one electron/owtte;	2	
5(b)(ii)	ionic ;	1	
5(c)(i)	electrolysis ;	1	
5(c)(ii)	positive ;	1	
5(c)(iii)	unreactive ;	1	

Question	Answer	Marks	Guidance
6(a)		3	award 1 mark for 1–2 correct links award 2 marks for 3–4 correct links award 3 marks for 5–6 correct links
6(b)(i)	both increasing in mass/both growing ; group 2 increasing in mass faster/growing faster ;	2	
6(b)(ii)	The average mass would be lower than group 1 and group 2 because of no milk/vitamins ;	1	
6(c)(i)	growth/repair ;	1	
6(c)(ii)	energy ;	1	

Question	Answer	Marks	Guidance
6(d)	calcium ; for bones ; <b>or</b> iron ; for blood/haemoglobin ;	<b>2</b>	
6(e)	poor bone growth ;	<b>1</b>	

Question	Answer	Marks	Guidance
7(a)(i)	electrons ;	<b>1</b>	
7(a)(ii)	move apart/repel ; because like charges repel each other ;	<b>2</b>	
7(b)(i)	sound waves are reflected from the wall ;	<b>1</b>	
7b)(ii)	166 m ;	<b>1</b>	
7(b)(iii)	(speed =) distance $\div$ time / 166 $\div$ 0.50 ; 332 (m/s) ;	<b>2</b>	allow: ecf from <b>(b)(ii)</b>
7(c)(i)	350 (N) ;	<b>1</b>	
7(c)(ii)	the resultant force is upwards so the balloon moves upwards ;	<b>1</b>	allow: force up greater than force down
7(c)(iii)	(density =) mass $\div$ volume / 2660 $\div$ 2800 ; 0.95 (kg/m <sup>3</sup> ) ;	<b>2</b>	

Question	Answer	Marks	Guidance
8(a)	number of protons in the nucleus/proton (atomic) number ;	<b>1</b>	
8(b)(i)	(X) number of neutrons in X is 10 – 5 = 5 ;	<b>1</b>	
8(b)(ii)	isotopes/nuclides ;	<b>1</b>	
8(c)(i)	hydrogen ;	<b>1</b>	
8(c)(ii)	increases ; an alkali/sodium hydroxide is produced ;	<b>2</b>	

Question	Answer	Marks	Guidance
8(c)(iii)	slower reaction / slower evolution of gas / takes longer for lithium to react completely ; because lithium is less reactive / higher up Group 1 ;	2	ignore: names of products

Question	Answer	Marks	Guidance
9(a)(i)	2002 ;	1	
9(a)(ii)	not diagnosed / people not seeing a doctor / delay in symptoms manifesting ;	1	
9(b)	Any two from: unprotected sex / exchange of sexual fluids ; needle sharing ; (contaminated) blood transfusions ; mother to baby ; avp ;	2	max 2
9(c)(i)	decreases ; from 5800 to 3100 / by 2700 / to about half ;	2	
9(c)(ii)	Any two from: better education ; screening blood transfusions ; making free condoms available ; free needles for drug addicts ; treating (pregnant women) with antiretrovirals ; avp ;	2	max 2

Question	Answer	Marks	Guidance
10(a)(i)	chemical ;	1	
10(a)(ii)	thermal / heat ;	1	allow: sound
10(a)(iii)	not all energy input changed into electrical energy / useful output energy is less than input ;	1	not: just energy is lost



Question	Answer	Marks	Guidance
10(b)(i)	Any two from: reference to <u>ionising</u> radiation ; (radiation) damages cells/DNA/body tissue ; (causing) cancer/mutation/radiation sickness/damage to offspring ;	2	max 2 allow: description of ionisation allow: high energy radiation
10(b)(ii)	radiation cannot penetrate or little penetration through thick concrete	1	allow: alpha/beta/gamma cannot penetrate
10(c)(i)	nucleon ; nucleus ;	2	
10(c)(ii)	tick in beta ; tick in alpha ; tick in gamma ;	2	award 1 mark for 1 or 2 correct award 2 marks for 3 correct

Question	Answer	Marks	Guidance
11(a)	Any two similarities and any two differences from: similarities: both contain only carbon atoms ; both have covalent bonding ; both are giant structures ;  differences: <i>in diamond:</i> atoms arranged tetrahedrally ; only strong bonds ; each C atom joined to 4 others ; <i>in graphite:</i> atoms arranged in layers ; carbon arranged in hexagons ; weak forces of attraction between layers between layers ; each C atom joined to 3 others ;	4	max 4
11(b)	limewater ; turns milky/white ppt. ;	2	note: 2nd mark dependent on correct reagent
11(c)	<u>thermal</u> decomposition ;	1	

Question	Answer	Marks	Guidance
12(a)(i)	combustion ;	1	
12(a)(ii)	decomposers ;	1	
12(a)(iii)	Any two from: <b>T</b> ; <b>V</b> ; <b>W</b> ;	2	max 2
12(a)(iv)	<b>S</b> ;	1	
12(b)	glucose + oxygen → carbon dioxide + water ;;	2	award 1 mark for reactants award 1 mark for products
12(c)	sun provides (light) <u>energy</u> ; light necessary for <u>photosynthesis</u> ;	2	

Question	Answer	Marks	Guidance
13(a)(i)	(K) oxygen and water present (together) ; test-tube J contains no water / owtte ;	2	
13(a)(ii)	painted / plating / enamelling ;	1	
13(a)(iii)	idea there is a barrier to oxygen and water ;	1	
13(b)(i)	<b>V and W</b> ; the pH of water is 7 ;	2	
13(b)(ii)	(W) transition metals form coloured oxides / the oxide is red ;	1	
13(b)(iii)	(phosphorous oxide) is a non-metal oxide / phosphorus is a non-metal ; is an acidic oxide ;	2	
13(c)(i)	magnesium + oxygen → magnesium oxide ;	1	
13(c)(ii)	(temperature) increases ;	1	