

GCSE 2004

June Series



Mark Scheme

Science: Double Award

Specification B (Co-ordinated)

3462/3F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
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Dr Michael Cresswell Director General

SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

- 2.1** In a list of acceptable answers where more than one mark is available ‘any **two** from’ is used, with the number of marks emboldened. Each of the following lines is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.

On the script, the QoWC tick should be identified by a ‘q’ written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown. However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

- (a) A candidate who calculates average speed using $\text{speed} = \text{time}/\text{distance}$ **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.
- (b) A candidate who incorrectly calculates average speed using $\text{speed} = \text{distance}/\text{time}$ and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(.....) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.



**Double Award
Foundation Tier 3462/3F**

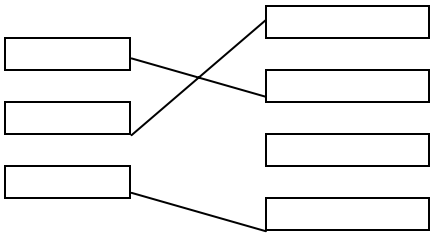
3462/3F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow 2 marks for two letters in the correct place allow 1 mark for one letter in the correct place	3
(ii)	A		1
total			8

3462/3F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any two from: <ul style="list-style-type: none"> • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air 	<p>accept detector is on ceiling or high up the wall</p> <p>accept radiation cannot pass through the body / skin</p> <p>accept cannot pass through the plastic casing</p> <p>do not accept because it is alpha radiation – unless qualified</p> <p>do not accept does not give off harmful substance</p> <p>do not accept cannot pass through building materials etc.</p>	2
(d)	less (than)		1
total			5

3462/3F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise 1 mark allow 1 mark for the correct use of 600 or 0.3% or 30	2
(c)	1 mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do not accept answers referring to cost only	1
total			10

3462/3F Q4

question	answers	extra information	mark
(a)	B E A D	allow 1 mark for each letter in the correct place, to a maximum of 3 marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain or earth the tanker	accept ground for earth	1
(c)	Quality of written communication	for a logical sequence	1
	any two from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do not accept 'if there is too much current' do not accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

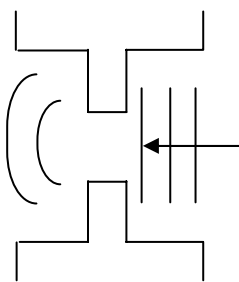
3462/3F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do not accept just rock inner core is denser / hotter than outer core gets 2 marks accept one is solid and one is liquid for 1 mark accept they are different densities for 1 mark wrong way round = 0 marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement of plates (1) dependent mark or difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

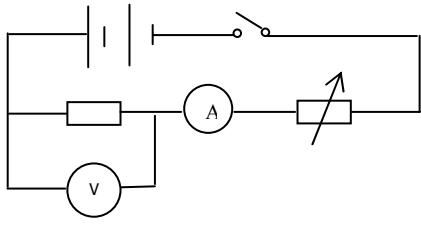

3462/3F Q6

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D and E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

3462/3F Q7

question	answers	extra information	mark
(a)(i)	any one from: <ul style="list-style-type: none"> • (doctors) to see inside a patients body or endoscope • telephone <u>cables</u> • optical fibre / fibre optic lamps or (artificial) Christmas trees • data transfer or internet connection 	<p>accept keyhole surgery</p> <p>do not accept flex or wires for cable</p> <p>accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do not accept lighting unqualified do not accept lamp unqualified</p> <p>do not accept communications unless clarified</p>	1
(ii)	(incident) ray angle greater than critical angle <u>total internal reflection</u> occurs	<p>either order accept (incident) ray greater than 42°</p> <p>accept TIR do not accept just description of TIR</p>	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

3462/3F Q8

question	answers	extra information	mark
(a)	all symbols correct	 <p>accept push switch symbol switch may be open or closed any lines through symbols = 0 marks</p>	1
	correct circuit drawn voltmeter must be across resistor only	<p>polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit</p> <p>omission of any component = 0 marks</p>	1
(b)(i)	potential difference = current × resistance	<p>accept voltage or p.d. for potential difference</p> <p>accept $V = I \times R$</p> <p>accept  provided</p> <p>subsequent use correct</p> <p>do not accept C for current</p>	1
(ii)	2	<p>allow 1 mark for correct substitution wrong working loses both marks</p>	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4$, $V = \text{their (b)(ii)} / 2$ and 0.0	<p>judge by eye</p> <p>this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores 0 marks</p>	1 1 dep
(c)	temperature <u>increases</u>	<p>accept filament lamp / it gets <u>hotter</u> allow heat for temperature</p>	1
total			8

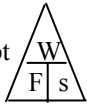
3462/3F Q9

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	accept glows / luminous accept for both marks the ink is fluorescent do not accept answers in terms of uv being reflected	1 1
(c)	any two from: <ul style="list-style-type: none"> • UV can damage / kill / ionise / alter (normal) cells • change DNA structure or mutate • (normal) cells may become cancerous 	do not accept attacks cells or burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves and infra red	both answers needed in either order do not accept heat for IR	1
(ii)	0.9	allow 1 mark for the <u>correct</u> use of 1.8 (kW) ($1.8 \times \frac{1}{2}$ or 1.8×30) i.e. adding the correct 2 power values	2
total			9

3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do not accept velocity / speed increases	1
(b)(i)	acceleration = $\frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ or $a = \frac{v_1 - v_2}{t}$ do not accept velocity for change in velocity do not accept change in speed do not accept $a = \frac{v}{t}$	1
(ii)	15	allow 1 mark for an answer of 900 or for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion or constant speed for orbital speed accept it is travelling fast enough accept for 2 marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation or to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do not accept black absorbs heat on its own do not accept tiles are heat proof	1
total			9

3462/3F Q11

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept $W = F \times s$ or $W = F \times d$ accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow 1 mark for correct substitution or correct use of 1200 (N) accept J do not accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for 2 marks allow 1 mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for 1 mark	2
(c)(i)	any one from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	allow lifting more than 2 people implication of a heavier weight accept loss for transfer do not accept motor inefficient do not accept motor gets hot do not accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric both answers required for the mark	1
total			8

3462/3F Q12

question	answers	extra information	mark
(a)	Y and Z they have the same number of protons or same atomic number	accept they have the same number of electrons or same number of protons and electrons allow only different in number of neutrons N.B. independent marks	1 1
(b)	Quality of written communication A – alpha particle passes straight through the empty space of the atom or it is a long way from the nucleus B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u> C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	for correct use of terms underlined in B or C Q ✓ Q X describes 3 tracks correctly for 2 marks describes 2 or 1 track correctly for 1 mark do not accept hits the nucleus do not accept answers referring to refraction do not accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	1 max 2
total			5