Mark scheme
June 2003

GCSE

Physics (Modular)

3453

Higher

ADDITIONAL 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

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available −1).

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.

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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 speed = time/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 speed = distance/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 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.

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Question 1

	answers		extra information	mark
(a)	work = force x distance (1) = 200 x 3 (1) 600 (1)		allow: energy transferred; w = f x d	3
(b) (i)	weight = mass x gravitational field strength 600		or weight = 60 x 10 (1) allow 588 – 600 (inc)	2
(ii)	<u>friction</u> (between crate & slope) so <u>more work</u> must be done		independent marks accept 50% efficient (1) if no other marks	1 1
total				7

Question 2

	answers	extra information	mark
(a) (i)	electrons		1
(ii)	negatively charged	no e.c.f.	1
(b) (i)	nucleus is positive/ alpha and nucleus have same charge (like) charges repel/push away	**or** alpha and nucleus both have positive charge dependent on 1st mark NOT collisions (nucleus –ve and repels = O)	1 1
(ii)	some…Y …nucleus + charged some rebound……nucleus large mass very few… …nucleus very small	all 3 correct (1 mark deducted for each incorrect to zero) 2 lines from a box X – not acceptable 2 lines to a box – possibly acceptable	2
total			6

Question 3

		answers	extra information	mark
(a) (i)		A		1
	(ii)	B		1
(b)		any **two** from • light waves are transverse/sound waves are longitudinal • light waves can travel through a vacuum/sound waves cannot travel through a vacuum • light waves travel (much) faster/different speeds • light waves are part of the electromagnetic spectrum. • light waves have a (much) higher frequency **or** light waves have a much smaller wavelength	do not accept – uses/sources accept corresponding statements about sound waves	1 1
total				4

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Question 4

		answers	extra information	mark
(a) (i)		moment = force x distance……...	accept turning effect not accept turning force not accept weight/height	1
	(ii)	**either** 80 (Nm) **or** moment = 400 x 0.2 (1)		2
	(b)	the <u>perpendicular</u> distance (from pivot) changes	do not credit just the distance from pivot changes **or** the cyclist is not pushing (straight) down just different angle	1
total				4

Question 5

		answers	extra information	mark
(a)		A: crust/lithosphere B: mantle C: (inner) core		1 1 1
(b)		have shapes which fit (quite) closely have similar patterns of rocks/fossils	accept coastlines similar do not accept reference to plants/animals	1 1
(c) (i)		tectonic plates	accept just plates	1
(ii)		any **two** from • earthquakes • volcanic (eruptions)/volcanoes • subduction • mountain building • Tsunamis/tidal waves	 accept formation of (oceanic) trenches accept folding (of strata)	2
total				8

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Question 6

	answers	extra information	mark
(a) (i)	ON; ON; ON	all correct 1; 1; 1	1
(ii)	OR (gate)		1
(b) (i)	NOT (gate)/invertor		1
(ii)	thermistor	not accept temperature dependent resistor	1
(iii)	L(ight) D(ependent) R(esistor)		1
(c)	when it is cold & dark correct explanation of how (i) OR and (ii) NOT gates work	2nd and 3rd marks any reference to currents - negates correct info	1 1 1
total			8

Question 7

	answers	extra information	mark
10	**Quality of written communication** *The answer to this part of the question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	ONLY APPLIES TO SCRIPTS WHERE FOUR MARKS ARE GAINED	
		maximum 3 if ideas not well expressed	
	any 4 points #		
	1. magnet/electromagnet/magnetised /magnetic 2. (but) not powerful enough to move arm/attracts the arm or iron 3. when current larger than normal magnet <u>more powerful</u> 4. pulls/moves arm <u>downwards</u> 5. breaking the <u>contact</u> 6. any sensible reference to resetting the circuit breaker	ignore 'charge'/magnetically charged do not credit: solenoid spring prevents it moving # this point essential for full credit do not accept 'breaking the circuit'	4
total			4

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Question **8**

		answers	extra information	mark
(a)		**either** 5 **or** acceleration = gradient (1) = 40 / 8 (1) independent mark m/s^2	**or** accn = (change in) speed/time **or** accn = (change in) velocity/time **or** (40 – 0) / 8 **or** m/s/s	3 1
(b)		**either** 80 **or** distance = area under graph (1) = ½ x 4 x 40 (1)	**or** ½ x base x height **or** distance = (average) speed x time **or** ½ (40 – 0) x 4	3
total				7

Question 9

	answers	extra information	mark
(a)	any **two** from • (may have) started with a (huge) explosion • billions of years ago • from one place	not accept star exploding do not credit just started with a big bang accept millions point/spot	2
(b) (i)	light (from galaxies) is moved towards red end of spectrum	**read (b) (i) and (ii) together** not accept stars	1
(ii)	• galaxies (1) • <u>red-shift</u> means galaxies <u>moving away</u> (1) • the further away the bigger the red-shift • the bigger the red-shift the faster it's moving • the farthest galaxies are moving away fastest • Universe is expanding (1)	**read (b) (i) and (ii) together** not accept stars any one from (1)	4
total			7

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Question 10

	answers	extra information	mark
(a)	• P longitudinal/S transverse • P faster than S/S slower than P • S cannot travel through liquids/S only through solids/P through solids and liquids	one longitudinal other transverse (1) or vice versa any one – but an incorrect statement negates	3
(b)(i)	they are refracted	**or** abrupt change in direction do not credit just change in direction	1
(b) (ii)	refraction of P waves so change of state/density X is solid + Y is liquid because S waves cannot travel through liquid	**or** (abrupt) change of direction of P waves so change of state **or** because S waves can only travel through solid **or** because P & S waves can only both travel through solids	1 1 1
total			7

Question 11

		answers	extra information	mark
(a)	(i)	**either** 0.5mm **or** (wave) speed = frequency x wavelength **or** 1500 = 3 000 000 x wavelength wavelength = 1500 / 3 000 000 (1)	**or** 0.0005m **or** v = fλ (1) (1) for correct answer (1) for unit	4
	(ii)	• waves (partly) reflected at boundary • time taken for waves to reach/or distance to boundary measured • info <u>processed</u> to give visual display	accept bounce off womb/fetus/baby	3

(b)		1. • x-rays not reflected
		2. • poor/no image (of fetus)
		3. ┌ • x-rays can ionise atoms
		   │ • some absorbed by cells
		   │ • can cause cancer/harm fetus/kill
		   └ cells/mutations
			accept too penetrating
			
			too much energy/EM waves
				3

total				10

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Question 12

		answers	extra information	mark
(a) (i)		force = (change in) momentum / time		1
	(ii)	**either** 65 (m/s) **or** change in mtm = 130 x 0.03 = 3.9 1 sub (1) 3.9 = mass x change in velocity = 0.06 x V **or** v = 3.9/0.06 1 rrgt (1) 1 answer (1)		3
	(b)	**Quality of written communication** *The answer to this part of the question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*		
			maximum 2 if ideas not well expressed	
		<u>drivers</u> momentum changed airbag makes time of impact longer/gradual loss of drivers momentum **or** momentum changed in longer time reducing the force (of the impact)		1 1 1
	total			7

Question 13

	answers	extra information	mark
(a)(i)	coal gives <u>more</u> CO_2 than oil (for same energy)	do not credit comparisons of sulphur dioxide emissions	1
(ii)	2005		1
(b) (i)	the demand is rising (too rapidly)	mark (i) and (ii) together	1
(ii)	resources insufficient to meet (future) demand	amount needed is greater than amount available (1)	1
(c) (i)	greenhouse (effect)	**or** global warming	1
(ii)	(produces) acid rain	**or** makes rivers/lakes(more) acidic	1
.(d)	any **five** from • no polluting gases released • large energy • so no increase in greenhouse effect/acid rain • when running normally very little radiation escapes • if an accident occurs (large) amounts of radiation may be released • waste radioactive • waste has to be stored (safely) for a longtime/underground • take a long time to start up	There must be at least 2 advantages and 2 disadvantages for full marks √ A √D max 3 of either not accept reference to cost	5
total			11

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