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GCSE

Physics

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Type: Mark scheme
Code: 1700

MEG

MIDLAND EXAMINING GROUP

GCSE EXAMINATIONS SUMMER 1994

MARKING SCHEME

for

PHYSICS PAPER 2 (1700/2)

Notes:

1. This Marking Scheme is a working document prepared for use by Examiners, all of whom are required to attend a Standardisation meeting to ensure that the Marking Scheme is consistently interpreted and applied in the marking of candidates' scripts.

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MIDLAND EXAMINING GROUP

General Certificate of Secondary Education

Science: PHYSICS **20 JUNE 1994**

PAPER 2

Question 1

(a) AB - acceleration / increase in velocity / increase in speed / speeding up / getting faster [1]
(Allow decreasing acceleration)

BC - decreasing acceleration / slower acceleration [1]

CD - constant speed / terminal velocity / steady speed / maximum speed / speed of 50 m/s / stopped accelerating [1]

DE - deceleration / slowing down / decrease in speed [1]

(b) weight / gravitational (force) / gravity / pull of Earth [1]

(c) air resistance / air friction / wind resistance [1]
(air resistance) increases / air resistance equals weight / air resistance equals gravity / balanced forces / forces cancel out [1]

(d) At D / after 18 s [1]
because she is slowing down / decelerating / speed decreases [1]
(second mark is dependent on first mark)

Question 2

(a) (the size of) the force [1]
the (perpendicular) **distance** from the pivot (nut) / position (whereabouts) (of force) on spanner / the **direction** of the force [1]

(b) (i) Two arrows drawn through the hands [1]
correct directions shown [1]
(condone curved arrows)

(ii) larger (diameter) wheel [1]

Question 3

(a) (i) *work done* = 250 x 0.4
= 100, J (allow Nm or j) [1],[1]

(ii) power = 33.3 W (accept 33 W) [3]

Award the marks indicated for the following answers:

power = 2000 J/min [3]

power = 1.67 W [2]

power = (100 x 20)/1
= 2000 [2]

power = (100 x 20)/1
= 2000 W or J [2]

power = 2000 (no working) [1]

power = 2000 W or J (no working) [1]

(b) (i) **Between A and B:**

Hooke's law obeyed / extension (directly) **proportional** to load / spring will go back to original length [1]

Between B and C:

spring is beyond its elastic limit (limit of proportionality) / extension is no longer (directly) proportional to load / spring won't go back to original length / Hooke's law not obeyed / permanent deformation / becomes easier to stretch [1]

(ii) 40 (N) [1]

(iii) 200 (N) **OR** 5 x answer to (b) (ii) [1]

Question 4

(a) (i) conduction [1]

(ii) hot water becomes less dense / hot water expands [1]
hot water rises / cold water falls [1]
water circulates / convection occurs / currents set up [1]
(for writing about **air** allow a maximum of 2 marks)

(b) (i) infra-red / (electromagnetic) radiation [1]

(ii) conduction [1]

Question 5

(a) sound (waves) / longitudinal waves [1]

of high frequency / high pitch / short wavelength / above our hearing / above 20 000 Hz [1]

(b) It is reflected (rebounds or bounces off), from the sea bed. [1],[1]

(c) 0.5 (s) [1]

(d) 0.2 (s) [1]

(For (c) as 5 s and (d) as 2 s, allow 1 mark)

(e) *distance* = 1500 x 0.2
= 300, m [1],[1]

(f) 150 (m) **OR** half of answer in (e) [1]

Question 6

(a) (i) voltmeter [1]

(ii) correct symbol used [1]
shown in parallel with wire [1]

(iii) *resistance* = 1.5 / 0.5 [1]
= 3.0, Ω (accept 3, Ω) [1],[1]

(iv) 60 cm length - 6.0 Ω [1]
15 cm length - 1.5 Ω / ¼ of previous answer [1]

(v) resistance doubles as length of wire doubles / resistance is (directly) proportional to length / resistance changes by 1 ohm for each 10 cm [2]

(Allow 1 mark for resistance increases with length)

(b) (resistance) increases [1]

the gradient increases / evidence of an actual calculation of two resistance values/ graph gets steeper / graph curves upwards [1]

Question 7

(a) Earth wire - yellow and green [1]
neutral wire - blue [1]
live wire - brown [1]

(b) so that it connects first when put into a socket / to open the shutters (flaps) (on the live/neutral) [1]

(c) *Allow any two of the following:*

correct wires go to each terminal / wires in correct positions;
a suitable fuse has been fitted;
the screws are tight / the wires are secure;
the cable (grip) is tight;
no bare wires are visible / no wires touch each other / no frayed wires [1],[1]

(d) fuse melts / fuse breaks / fuse blows (up) / fuses [1]
large current flows / current flows to Earth / low resistance to Earth [1]
disconnects live circuit / disconnects supply/ switches (it / current / live / circuit / supply / heater) off [1]

Question 8

(a) cone moves / cone vibrates and then stops [1]

(b) (i) an a.c. changes (reverses) **direction** (continually) / a d.c. flows in one **direction** [1]

(ii) the cone vibrates / the cone moves backwards and forwards [1]

(iii) continuous tone / continuous sound / high pitch / whine whistle / hum [1]

(c) A quiet(er) note / low volume / low amplitude soft(er) note [1]
of low(er) pitch /low frequency / deep(er) pitch
long wavelength / low(er) note. [1]

Question 9

(a) atoms / group of atoms / molecules / particles atoms [1]
which have lost (gained) an electron / charged [1]
(second mark dependent on first mark)

(b) greater ionisation (produced) / shorter range in air / alpha particles cannot escape [1]
(allow converse points about gamma rays)

(c) Positive ions move to Y, negative ions move to X. / [1],[1]
Positive ions move to negative plate, negative ions to positive plate./ Positive ions move up, negative ions move down.

(allow 1 mark for opposite but incorrect directions)

(d) battery going flat / source decaying / dust / steam / sprays / battery runs out of energy (power) [1]

(e) so that the source does not need changing regularly / so that it works for a long time / to prevent the alarm sounding as the source decays / so that it does not stop producing ions [1]

(f) smoke rises / hot air rises [1]

(g) (No) - alpha particles have a short range / particles don't penetrate the case / alpha particles cannot penetrate the skin [1]

Question 10

(a) (i) (logic level) 1 / high / 5 V [1]

(ii) (logic level) 0 / low / 0 V [1]

(b) Q = 1 [1]

door	**LDR**
open	dark
open	light
closed	dark

one pair of the above scores 2
two pairs of the above score 3 [3]

Special cases:

"door is open" but no other answer, scores 1 mark

"LDR is in dark" but no other answer, scores 1 mark

"door is open or LDR is in the dark" scores 3 marks

Q is 0 **and** "door is closed and LDR in the light" scores 2

The Awarding of Marks for Spelling, Punctuation and Grammar

Syllabus		1702/2

Marks are to be awarded for the use of accurate spelling, punctuation and grammar according to the following criteria:

		Marks
Below Threshold Performance		0
Threshold Performance	Candidates spell, punctuate and use the rules of grammar with reasonable accuracy; they use a limited range of specialist terms appropriately.	1
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The marks will be awarded on an impression basis and will reflect the candidate's performance in the paper as a whole.

MEG

MIDLAND EXAMINING GROUP

GCSE EXAMINATIONS SUMMER 1994

MARKING SCHEME

for

PHYSICS PAPER 3 (1700/3)

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Physics 1700/3 Paper 3 Summer 1994

Mark Scheme

(as modified after the Examiners' meeting)

Alternative answers for the same mark are separated by / . Other answers not suggested here may be equally valid and should be given the marks.

The words the candidates use may be quite different from those given here but should convey the same sense. Reward correct physics which answers the question.

Numerical problems

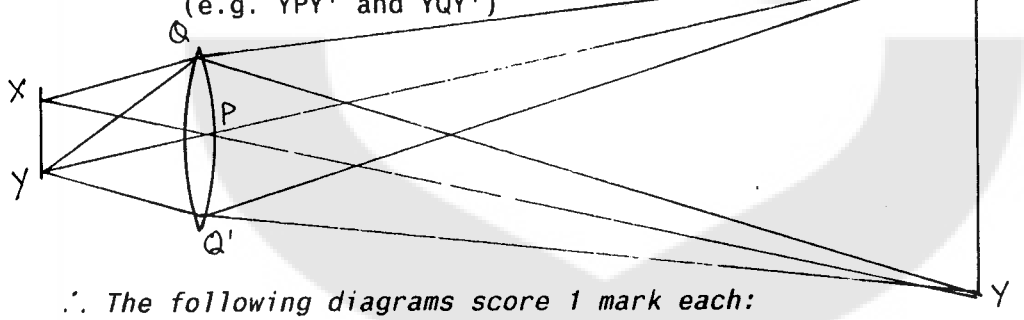
The scheme shows how marks can be scored for partially correct answers. Correct answers with no working shown gain full marks.

In all problems allow 'error carried forward'; a candidate who makes a mistake in the first line does not necessarily score 0 for the whole problem. Credit should be given for correct later working, even if the wrong numbers are used because of the earlier error. Don't penalise the same error twice in the same problem.

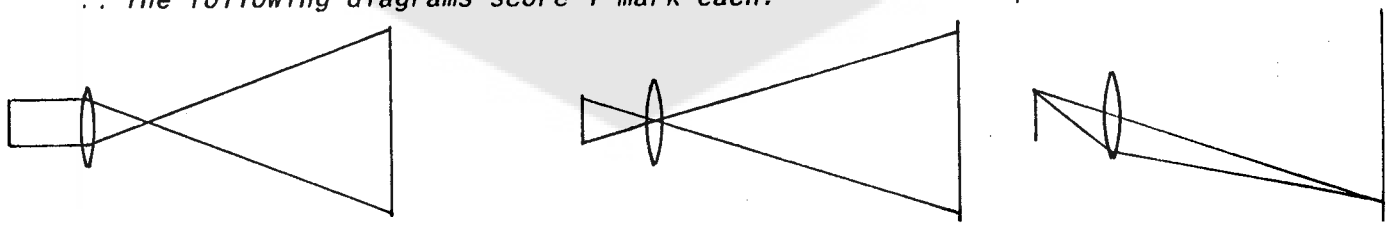
Units: the last mark in numerical problems is for the correct (or error carried forward) number plus unit. Units are not expected in the working except in the final answer. Equivalent answers to those in the scheme are permitted (e.g. 2 MW, 2000 kW, or 2 x 10^6 W)

Significant figures: subtract maximum of 1 mark per paper for final answers given to 4 or more significant figures.

1 (a) rays drawn to show inverted image larger than object (e.g. XPX' and YPY') 1
two rays drawn to illustrate focussing action (e.g. XPX' and XQX') 1
two rays drawn from another point similarly (e.g. YPY' and YQY') 1



∴ *The following diagrams score 1 mark each:*



(b) to get the image the right way up / image is upside-down / image is inverted 1

(c) lens is closer to slide than to screen / sensible reference to geometry of ray diagram 1 [5]

2 (a) force = 3 N 1

(b) pressure causes upwards force on rod / molecules bombarding base of rod 1
force (pressure) increases with depth 1

(c) (i) 5.4 N 1

(ii) $x/5.4 = 15/3$ 1
$x = 27$ cm 1

(If 2.4 N used instead of 3 N then answer of 33.8 cm scores 1)

(iii) pressure (exerted by water) is proportional to depth / pressure increases uniformly with depth 1 [7]

3 (a) force exerted by engine decreases / Y decreases 1
resistive force on train increases / X increases 1

(difference between Y and X decreases *scores* 2)

(b) resultant force on train = (100 - 12) kN = 88 kN 2
(allow ± 1 kN)

$a = F/m$ 1

$a = \frac{88 \times 10^3}{400 \times 10^3}$ 1

$a = 0.22$ m/s^2 1

($a = 0.25$ m/s^2; $a = 0.03$ m/s^2; $a = 0.28$ m/s^2 max. 3 marks)

(c) 50 m/s 1
resultant force is then zero / forces are balanced / forces X and Y are equal 1

(d) force = 40 kN 1
power = force x $\frac{\text{distance moved}}{\text{time taken}}$ (or = force x velocity) 1
power = 40 kN x 50 m/s 1
= 2000 kW 1 [13]

4 (a) *any 4 points*:

at P waves arrive in step / in phase / crest on crest
at P constructive interference occurs / reinforcement
0.8 m = half wavelength / path difference = half wavelength
waves reaching Q are out of step / out of phase / crest on trough
at Q destructive interference occurs / cancellation 4

(*some points may be made diagramatically*)

(b) (i) wavelength halved / 0.8 m 1

(ii) wave of same amplitude as X drawn 1
period on screen halved 1

[7]

5 (a) (i) magnetic field in coil is changing / magnetic field is cutting coil 1
cuurent (or voltage or e.m.f.) induced / electromagnetic induction occurs 1

(ii) shape shows two cycles with constant amplitude (+ve and -ve) and period (+ 2 small squares) 2
(*other details of shape are not being tested*)

(b) (i) larger current (or power or voltage) gives brighter bulb 1

magnetic field changes (cut) more rapidly 1

increased frequency of alternation / increased heat production in the coil 1

(ii) extra work (or energy or power) 1
to light the lamp 1

(OR extra force has to be exerted on pedals 1)
(frictional force between tyre and cycle wheel 1)

(OR current in dynamo causes (electromagnetic) forces 1)
(which oppose the change which causes them / which
(requires extra force on pedals 1) [9]

6 (a) buzzer stays on 1

(b) (i) to reset latch / to stop buzzer sounding / to make B logic 1 1

(ii) resistance of copper too low 1
to prevent a short circuit when P is pressed / logic level would not change when P is pressed / logic would remain 0 1

(c) LDR resistance = 400 ohm 1

$R = \frac{2}{4} \times 400$ or $I = \frac{4}{400}$ and $R = \frac{2}{I}$ 1

R = 200 ohm 1

(d) increase R / replace LDR with one of lower resistance 2 [9]
(change R / change LDR *scores* 1)

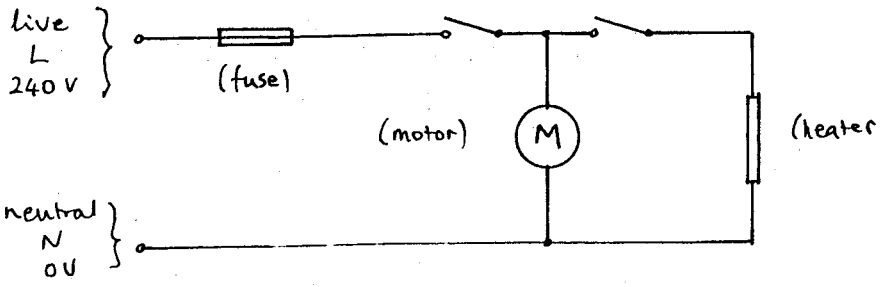
7 (a) power = $\frac{240 \times 240}{36}$ 2

= 1600 W 1

(b) resistance proportional to 1/area 1
area is 4 times smaller 1
144 ohm 1

(72 ohm *or* 9 ohm *scores max. 1 mark*; resistance quadrupled *scores* 2 marks)

(c)



Give 1 mark for each "yes" to the following:

a) Is the motor in parallel with the heater?
b) Can the motor be switched on alone, using 1 or 2 switches?
c) Can the motor and heater be switched on together at full voltage, but not the heater alone?
d) Is there a fuse and one switch on the same side?
e) Is the fuse or one switch on the identified live side?

(If the mains can be short-circuited, then -1 after the above)

5

(d) overheating of hair drier will occur / fire risk 1
unless fan removes the hot air 1

(e) live wire touches neutral / water between live and neutral / wire in the element is made too short or too thick 1
low resistance path gives high current 1 [15]

8 (a) (i) diffusion occurs 1
molecules in liquid in random motion 1
molecules spread in all directions / molecules collide / molecules mix 1

(ii) total mass = 200 g 1
new volume = 186 cm^3 1
density = $\frac{200}{186}$ 1
= 1.08 g/cm^3 1

(*A density calculation involving the wrong mass and/or volume loses either or both the first two marks but can gain later marks by error carried forward*)

(b) (i) *any 5 points*:

molecules moving in all directions / random motion
heating the gas increases the speed (or energy) of molecules
molecules hit the wall harder
molecules hit the wall more often
increased pressure (or force) pushes the piston up
fewer collisions when equilibrium attained 5

(ii) propane liquefies 1
propane becomes solid / propane freezes 1
piston moves down a very long way / atmospheric pressure pushes piston down / pressure inside falls /
piston becomes fixed when propane solid 1 [15]

9 (a) (i) like charges repel / nucleus repels alpha 1
alpha particle and nucleus positively charged 1

(ii) it returns the way it came 1
(*could be shown by a diagram*)

(iii) nucleus very small 1
large distances between nuclei / lots of empty space 1
most alphas too far from nucleus to experience much force 1

(b) (i) *any two*:

nuclear accidents
nuclear reactors
discharges from nuclear power stations or Sellafield
nuclear weapons testing
industrial use
TV tubes (or other cathode ray tubes)
occupational use
physics lessons
(old) luminous watches
smoke alarms 2

(ii) radon breathed in / radon enters lungs 1
alpha particles cause lots on ionisation 1
risk of radiation-induced disease / risk of cancer 1

(iv) after one half life 50 % left 1
after six half lives 1.56 % left / after 7 < 1 % left 1
6.5 half lives (*allow from* 6.3 *to* 7 half lives) 1

time = 6.5 x 56 = 364 s 1
(*allow* 350 s *to* 392 s; *allow* 6 min)

(*Correct answer with no working or reasoning scores 2*)

(OR $\left(\frac{1}{2}\right)^n = 0.01$ 2)
(n = 6.64 1)
(time = 372 s 1) [15]

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