Rewarding Learning

General Certificate of Secondary Education
2012

Science: Physics

Paper 1
Foundation Tier

[G7602]

FRIDAY 15 JUNE, AFTERNOON

MARK
SCHEME

Subject-specific instructions

1   In numerical problems, the marks for intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the correct final answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply to formal proofs and derivations, which must be valid in all the stages shown in the mark scheme to obtain full credit.

2   Do not reward wrong physics. No credit is given for substitution of numerical data, or subsequent arithmetic, in a physically incorrect equation.

However, answers to later parts of questions that are consistent with an earlier incorrect numerical answer, and are based on a physically correct equation, must gain full credit. Annotate this by writing **ECF** (Error Carried Forward) by your text marks.

3   The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer mark, but 10^n errors (e.g. writing $550 \, \text{nm}$ as $550 \times 10^{-6} \, \text{m}$) count only as arithmetical slips and lose the answer/unit mark.

1 **(a)** **(i)** 6000 joules every second [1]

(ii) Efficiency = useful output energy/total input energy [1]
0.2 = output/6000 **or** output = 0.2 × 6000 [1]
Output electrical energy = 1200 (J) [1] [3]

(b) **(i)** Black is the best absorber of heat [1]

(ii) It contains trapped air [1]

(iii) Arrow up [1]

(iv) Infrared [1]

(c) **(i)** Work = force × distance moved [1]
= 200 × 1.5 [1]
= 300 (J) [1] [3]

(ii) Total work in 10 seconds = 300 × 10 = 3000 [1]
Power = work/time
= 3000/30 **or** = 300/3 [1]
= 100 = 100 [1]
W **or** J/s W **or** J/s [1] [4]

(d) **(i)** Moment = force × distance from pivot ⎫ [1]
= 1250 × 0.8 ⎬
= 1000 (Nm) [1] ⎭ [2]

(ii) To the left or away from him [1]
500 N has a smaller moment [2] worth 2 marks
its distance from pivot is less [1]
or
He can exert a smaller force
to give same moment since its distance from pivot is greater [3]

20

7136.01 **3**

2 (a) (i) Poor brakes, worn tyres, wet road
              Any **two**   [2]

       (ii) 80 km = 80 000 m   Give [1] if no further credit possible
             1 hr = 60 × 60 = 3600 s   Give [1] if no further credit possible
             80 km/hr = 80 000/3600 = (22.2 m/s) This line is worth [3]   [3]

       (iii) From the graph 0.67 to 0.69
             Evidence of a horizontal line at 15 m award [1]   [2]

       (iv) Straight line of greater slope through origin   [1]

       (v) 30 m   [1]

       (vi) 21/4 or 5.25   [2]
            round up to 6 car lengths   [1]   [3]

   (b) (i) P = F/A   [1]
             = 2000/80   [3]
             = 25 (N/cm^2)   [1]   [5]

       (ii) Kinetic (energy) to heat and sound [1] each   [3]   20

3 (a)

Wave	Direction of vibrations	Type of wave
Light wave	Perpendicular to the direction of energy transfer	Transverse
Sound wave	Parallel to the direction of energy transfer or same direction	Longitudinal
Water wave	Perpendicular to the direction of energy transfer	Transverse

[4]

(b) (i) 4   [1]

(ii) 8   [1]

(iii) The time between one wave and the next (**or** the period) is constant   [1]

(iv) 50 waves/wavelengths/vibrations pass in 1 second   [1]

(c) (i) 14 (mm) (Allow 13–15 mm)   [1]

(ii) Energy   [1]

(iii) Arrow from P at 45° to horizontal   [1]
With 3 wavefronts crossing arrow   [1]
Perpendicular to arrow   [1]
Wavefronts parallel   [1]
Wavefront spacing = wavelength of incident waves   [1]   [5]

(iv) Equal to   [1]

(d) (i) 60°   [1]

(ii) 60°   [1]

(iii) Reflected ray parallel to incident ray (by eye)   [1]

(iv) 30°   [1]   20

AVAILABLE MARKS

4 **(a)** **(i)** Battery $|\mathsf{H}|\mathsf{H}|\mathsf{I}$, Ⓐ, ▭▭▭ , ⟋⟋ , all in series
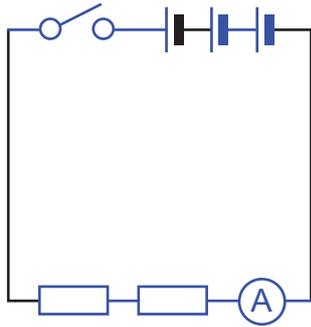
[5]

(ii) Arrow consistent with their diagram from – to + to [1]

(iii) Current same everywhere [1]

(iv) Contacts and link are conductors [1]
base is insulator [1] [2]

(v) In the resistor(s) [1]

(vi) Voltmeter in parallel with one resistor [1]

(vii) Correct location of + sign even if Ⓤ in series [1]

(b) **(i)** R = V/I [1]
R = 12/2 [1]
R = 6 [1]
ohms [1] [4]

(ii) R = 6 + 6 [1] = 12 ohms [1]   ecf from **(i)** [2]
R = R$_1$ + R$_2$ [1] if no further

(iii) R$_{comb}$ = R/2 [1] = 3 ohms [1]   allow ecf from **(b)(i)**

or

$$\frac{1}{R_{comb}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{6} + \frac{1}{6}$$

$$= \frac{2}{6}$$

R$_{comb}$ = 3 ohms [2]   20

7136.01   **6**

				AVAILABLE MARKS

5 **(a)** alpha, particle
beta, particle
gamma, em radiation [6]

(b) **(i)** Background (radiation) or natural [1]

(ii) rocks/ground/air/plants/people/cosmic ray [1]

(iii) Switch on detector/record the count [1] **or** use rate meter
For a specified period of time [1] take reading
Divide count by time (to get count rate) [1]
Any **two** Maximum [2] [2]

Quality of written communication [1]

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar the main points shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	[1]
Response not worthy of credit	[0]

(c) True
False
False

False
False
True
$[\frac{1}{2}]$ each, round down [3]

(d) Protons 6 [1]
Neutrons 8 [1]
Name of particle [1]
Numbers correct [1] each [4]

(e) **(i)** X and Z both needed [1]

(ii) Both have same number of protons/atomic number [1] 20

				Total	**100**