

Category - B

1. (a) strong Nuclear (0.5)
(b) weak Nuclear (0.3)
(c) Gravitation (0.2)

(2) $g = \frac{GM}{r^2} = \frac{\frac{4}{3}\pi R^3 \rho G}{r^2} = \frac{4}{3}\pi \rho G R$
(1 point) g linear in R (1 point)

so, g is halved at $R/2$ (1 point) [Answer]

(3) Total internal reflection [1 mark]
just reflection [0.5 marks]

(4) The acceleration of the skier can be found,
 $400 = \frac{1}{2}at^2 \Rightarrow a = \frac{800}{60 \times 60}$
or, frictional force $= 1.2 \times 50 = 60N$
 $= \frac{2}{9} = 2.2 \text{ ms}^{-2}$ [1 mark]

so, frictional co-efficient = $\frac{\text{frictional force}}{\text{Normal force}}$

(5) $= \frac{1.2}{9.8 \cos 20} \approx 0.12$ or 0.13
 \Rightarrow (1 mark)

(6) $F = k \frac{q_1 q_2}{r^2}$ [1 mark]
[No partial mark]

$= 9 \times 10^9 \times \left(\frac{1.6 \times 10^{-19}}{10^{-10} \times 10^{-2}} \right)^2$
 $= 9 \times 10^9 \times 2.56 \times 10^{-14} N$

$= 2.31 \times 10^{-4} N$ (Ans) [1 mark]

Correct formula (0.5) Correct number (0.5 mark)

7. one cannot determine it as two time period do not depend on mass [1] (No partial mark)

8. Conservation of volume = $VA = V'A'$ (1 mark)

$$\therefore v' = v \left(\frac{A}{A'}\right) = 5 \times \left(\frac{d}{d'}\right)^2 = 5 [6]^2 = 180 \text{ m/s} \quad (0.5 \text{ mark})$$

diameter squared \rightarrow 0.5 mark.

9. $5\Omega = 4\Omega + 1\Omega$ (1 mark)

$$= \underbrace{(8\Omega \parallel 8\Omega)}_{2 \text{ of them}} + \underbrace{(8\Omega \parallel 8\Omega \parallel 8\Omega \parallel 8\Omega \parallel \dots \parallel 8\Omega)}_{8 \text{ of them}}$$

so one needs 10 of them (1 mark)
 ΔC the idea that parallel combination of R and R is present (0.8 marks)