

Solutions

Each answer shows the steps, then the **result**.

2.1

- weight is mass times the gravitational field strength:

$$F_W = mg = (12 \text{ kg})(9.8 \text{ m s}^{-2})$$

- $F_W = \mathbf{118 \text{ N}}$

2.2

- It falls to one quarter (inverse square)

2.3

- Mass stays the same; weight changes (because g changes)

2.4

- $F_W = mg$, rearranged for g :

$$g = \frac{F_W}{m} = \frac{3.2 \text{ N}}{2 \text{ kg}}$$

- $g_{\text{Moon}} = \mathbf{1.6 \text{ m s}^{-2}}$

3.1 C

- gravity follows an inverse-square law

3.2 C

- mass is the same everywhere

3.3

(a)

- The force on B is one quarter of that on A

(b)

- the force follows an inverse-square law, $F = \frac{GMm}{r^2}$
- with $r_B = 2r_A$:

$$\frac{F_B}{F_A} = \frac{r_A^2}{r_B^2} = \frac{r_A^2}{(2r_A)^2} = \frac{1}{4}$$

3.4

(a)

- $F_W = mg = (3 \text{ kg})(9.8 \text{ m s}^{-2}) = \mathbf{29.4 \text{ N}}$

(b)

- mass does not depend on location: still **3 kg**
- weight uses the new g :

$$F_W = mg = (3 \text{ kg})(20 \text{ m s}^{-2}) = \mathbf{60 \text{ N}}$$