**Q9** A is correct.

$\boldsymbol{a} = (6\text{ m}, -1\text{ m})$ and $\boldsymbol{b} = (1\text{ m}, -2\text{ m})$

so $\boldsymbol{a} - 2\boldsymbol{b} = (6\text{ m}, -1\text{ m}) - 2(1\text{ m}, -2\text{ m}) = (6\text{ m}, -1\text{ m}) - (2\text{ m}, -4\text{ m})$

$= (4\text{ m}, 3\text{ m})$.

The magnitude of this displacement vector is found by squaring the components, adding them and then taking the square root. This gives $\sqrt{(4\text{ m})^2 + (3\text{ m})^2} = 5\text{ m}$.

**Q10** G is correct

The velocity of the particle is equal to the derivative $\mathrm{d}x/\mathrm{d}t$. This is given by

$$\frac{\mathrm{d}x}{\mathrm{d}t} = \frac{\mathrm{d}(At^2)}{\mathrm{d}t} = 2At$$

At $t = 10$ s, the velocity is $2 \times 4.0\text{ m s}^{-2} \times 10\text{ s} = 80\text{ m s}^{-1}$.

**Q11** E is correct.

This question can be answered using the constant acceleration equations. With the $x$-axis pointing vertically upwards and the vase starting from rest, we have

$$s_x = u_x t - \frac{1}{2}g t^2 = -\frac{1}{2}g t^2$$

The displacement of the vase is $-1.8$ m (the minus sign showing that the vase lands *below* the shelf, while the $x$-axis has been chosen to point *upwards*.) Hence,

$$-1.8\text{ m} = -\frac{1}{2} \times 9.8\text{ m s}^{-2} \times t^2$$

so $$t = \sqrt{1.8\text{ m} / 4.9\text{ m s}^{-2}} = 0.6\text{ s}.$$

**Q12** B is correct.

The relevant constant acceleration equation for this question is

$$v_x = u_x + a_x t$$

We choose the $x$-axis to point vertically upwards from the Moon's surface. Then the final velocity of the fuel tank is $v_x = -50\text{ m s}^{-1}$ and the acceleration of the fuel tank is $-1.6\text{ m s}^{-2}$. The time taken for the fuel tank to reach the Moon's surface is 50 s, so

$$-50\text{ m s}^{-1} = u_x - 1.6\text{ m s}^{-2} \times 50\text{ s}$$

and $$u_x = (1.6\text{ m s}^{-2} \times 50\text{ s}) - 50\text{ m s}^{-1} = 30\text{ m s}^{-1}.$$