

Work done, power and mechanical energy

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

Model answers and mark schemes follow. Award marks for the equation or method, for correct substitution and for the answer with its unit. Accept equivalent wording and give follow-through marks for consistent errors carried from earlier parts.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS3-1

Question 1 Equations (2 marks)

- a. $P = W \div t$
- b. $GPE = m g h$

Marking: 1 mark each.

Question 2 Pushing a mower (3 marks)

- a. $W = F \times d = 80 \times 25 = \mathbf{2000\ J}$.
- b. $P = W \div t = 2000 \div 40 = \mathbf{50\ W}$.

Marking: (a) 1 mark. (b) 1 mark for substitution, 1 mark for answer with unit.

Question 3 Motorcycle (3 marks)

- a. $KE = \frac{1}{2} \times 220 \times 15^2 = \frac{1}{2} \times 220 \times 225 = \mathbf{24\ 750\ J}$.
- b. Speed doubled, so $KE \times 4 = \mathbf{99\ 000\ J}$.

Marking: (a) 1 mark for substitution, 1 mark for answer. (b) 1 mark.

Question 4 Ball thrown upwards (2 marks)

$$GPE = m g h = 0.20 \times 9.8 \times 6.0 = \mathbf{11.8\ J} \text{ (11.76 J)}.$$

Marking: 1 mark for substitution, 1 mark for the answer with unit.

Question 5 Stretching a spring (3 marks)

- a. The work is the area of the triangle: $\frac{1}{2} \times 0.50 \times 40 = \mathbf{10\ J}$.
- b. The **work done** (energy transferred) in stretching the spring.

Marking: (a) 1 mark for $\frac{1}{2} \times \text{base} \times \text{height}$, 1 mark for answer. (b) 1 mark.

Question 6 Stopping distance (4 marks)

a. $KE = \frac{1}{2} \times 900 \times 10^2 = \mathbf{45\ 000\ J}$.

b. Work by brakes = KE, so $d = 45\ 000 \div 3000 = \mathbf{15\ m}$.

Marking: (a) 1 mark for substitution, 1 mark for answer. (b) 1 mark for using $F \times d = KE$, 1 mark for answer.

Question 7 Carrying a bag (2 marks)

The upward force acts at right angles to the horizontal movement. Work is only done by the part of a force in the direction of movement, so the distance moved in the direction of the force is zero and **the work done by it is zero**.

Marking: 1 mark for right angles / no movement along the force, 1 mark for work = force $\times$ distance in the direction of the force.

Question 8 Unit of power (1 mark)

The watt: **1 W = 1 J/s**.

Marking: 1 mark for joules per second.