Work, Energy and Power

Mechanics · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

USEFUL EQUATIONS

$W = Fs\cos\theta$ $E_k = \tfrac{1}{2}mv^2$ $\Delta E_p = mg\Delta h$ $P = W/t = Fv$

Questions

Show your working in the space under each question.

1. A 0.50 kg ball is dropped from 12 m and lands at 14 m s^{-1}. How much energy was transferred to the air?

2. A car travels at a steady 25 m s^{-1} against resistive forces of 800 N. Find the useful power of the engine. If the engine is 25% efficient, at what rate is fuel energy supplied?

3. A pump raises 600 kg of water through 8.0 m each minute and is 60% efficient. Find the input power.

4. A 900 kg car travelling at 20 m s^{-1} is brought to rest in 40 m. Find the average braking force.

Step-by-step answers

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1. mgh = 58.9 J; ½mv² = 49.0 J; so **9.9 J** was transferred by air resistance.

2. 1. Steady speed, so driving force = 800 N.
2. P = Fv = 800 × 25 = **20 kW**.
3. Input power = 20/0.25 = **80 kW**.
Answer: 20 kW useful; 80 kW input

3. Useful power = 600 × 9.81 × 8.0/60 = 785 W; input = 785/0.60 = **1.3 kW**.

4. Work done = KE: F × 40 = ½ × 900 × 400, so F = **4500 N**.