

Exercise walk-through

4.2

Work power and resources

Pearson Edexcel · International GCSE · Physics

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The method

Method — Four equations, one idea

$$W = Fd \quad GPE = mgh \quad KE = \frac{1}{2}mv^2 \quad P = W/t$$

Worked check. A 60 kg runner sprints at 8 m/s: $KE = \frac{1}{2} \times 60 \times 64 = 1920$ J.
Climbing 4 m of stairs at $g = 10$ N/kg gains $GPE = 60 \times 10 \times 4 = 2400$ J; doing it in 5 s, power = $2400/5 = 480$ W.

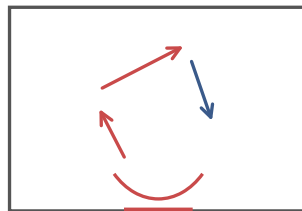
Method — Four equations, one idea

[$W = Fd$ $GPE = mgh$ $KE = \frac{1}{2}mv^2$ $P = W/t$] Worked check.

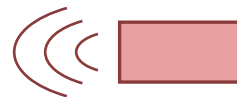
conduction: heat passes along a solid; particles vibrate and pass energy to neighbours



metals conduct best



convection: hot fluid rises, cooler fluid sinks — a circulating current



radiation: infrared waves need no medium; dark, dull surfaces emit and absorb best

Conduction, convection and radiation transfer methods.

Exercises 2.1·2.3

2.1 Calculate the work done by a 25 N force over 8 m. [2]

2.2 Calculate the GPE gained by a 3 kg parcel lifted 2 m ($g = 10 \text{ N/kg}$). [2]

2.3 Calculate the KE of a 0.5 kg ball at 6 m/s. [2]

Exercises 2.1·2.3

2.1 Calculate the work done by a 25 N force over 8 m. [2]

2.1 $W = 25 \times 8 = 200 \text{ J}.$

2.2 Calculate the GPE gained by a 3 kg parcel lifted 2 m ($g = 10 \text{ N/kg}$). [2]

2.2 $GPE = 3 \times 10 \times 2 = 60 \text{ J}.$

2.3 Calculate the KE of a 0.5 kg ball at 6 m/s. [2]

2.3 $KE = \frac{1}{2} \times 0.5 \times 36 = 9 \text{ J}.$

Exercises 2.4·3.1

2.4 A machine does 900 J of work in 6 s. Calculate its power. [2]

2.5 (P) Name one renewable and one non-renewable resource. [2]

3.1 A 50 kg cyclist freewheels from rest down a 5 m drop. Calculate the GPE lost and, ignoring friction, the speed at the bottom ($g = 10 \text{ N/kg}$). [4]

Exercises 2.4·3.1

2.4 A machine does 900 J of work in 6 s. Calculate its power. [2]

2.4 $P = 900/6 = 150 \text{ W}.$

2.5 (P) Name one renewable and one non-renewable resource. [2]

2.5 (P) Renewable – wind (or hydro, solar, geothermal); non-renewable – coal/oil/gas (or nuclear fuel).

3.1 A 50 kg cyclist freewheels from rest down a 5 m drop. Calculate the GPE lost and, ignoring friction, the speed at the bottom ($g = 10 \text{ N/kg}$). [4]

3.1 $GPE = 50 \times 10 \times 5 = 2500 \text{ J}$; all to KE: $\frac{1}{2} \times 50 \times v^2 = 2500$; $v^2 = 100$, $v = 10 \text{ m/s}.$

Exercises 3.2·3.3

3.2 A crane lifts a 200 kg beam 12 m in 20 s at steady speed. Calculate the work done and the crane's useful power ($g = 10 \text{ N/kg}$). [4]

3.3 (P) Compare fossil-fuel and wind generation, giving one advantage and one disadvantage of each. [4]

Exercises 3.2·3.3

3.2 A crane lifts a 200 kg beam 12 m in 20 s at steady speed. Calculate the work done and the crane's useful power ($g = 10 \text{ N/kg}$). [4]

3.2 $\text{Weight} = 200 \times 10 = 2000 \text{ N}$; $W = 2000 \times 12 = 24\,000 \text{ J}$; $P = 24\,000/20 = 1200 \text{ W}$.

3.3 (P) Compare fossil-fuel and wind generation, giving one advantage and one disadvantage of each. [4]

3.3 (P) Fossil fuel: advantage – reliable, concentrated energy available on demand; disadvantage – CO_2 emissions and non-renewable supply. Wind: advantage – renewable, no fuel or emissions; disadvantage – intermittent output, depends on weather, large visual footprint.