

## 4.5 Energy, work and power

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 14 marks

KEY WORDS power 功率 • work done 功 • kinetic 动能 • potential energy 势能 • mass 质量

### Objective

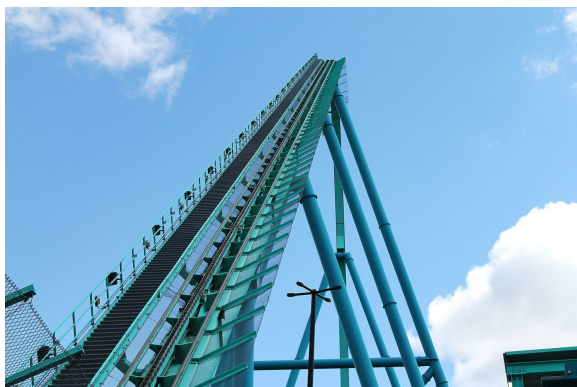
Build the skills to answer exam questions on **energy**, **work** and **power** 能量、功与功率 — **work done** 功, **kinetic** 动能 and **potential energy** 势能, the **work-energy** principle, and **power** 功率  $P = Fv$ . Take  $g = 10 \text{ m s}^{-2}$ .

You must be able to:

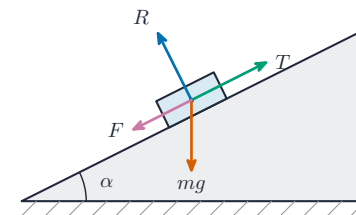
- calculate work  $W = Fd \cos \theta$ ,  $\text{KE} = \frac{1}{2}mv^2$ ,  $\text{PE} = mgh$
- use the work-energy principle (work done = change in energy)
- use  $P = Fv$  for power

### 1 Worked examples

#### ■ Energy & power



A roller coaster trades potential energy for kinetic energy as it rises and falls



Work and energy on an inclined plane

Engine 12 kW, speed  $20 \text{ m s}^{-1}$  on the level:  $P = Fv \Rightarrow F = \frac{12000}{20} = 600 \text{ N}$ .

**Work-energy:** (driving force work) – (resistance work) = change in KE.

### 2 Practice

2.1 Find the kinetic energy of a 2 kg body moving at  $6 \text{ m s}^{-1}$ . [2]

2.2 A force of 50 N moves a body 4 m in its own direction. Find the work done. [1]

### 3 Exam-style questions

3.1 A 1500 W motor raises a load at constant speed. In 10 s it does work of: [1]

|   |   |
|---|---|
| A | B |
| C | D |

- A 150 J
- B 1500 J
- C 15000 J
- D 150000 J

**3.2** A car of mass 1200 kg accelerates from  $10 \text{ m s}^{-1}$  to  $20 \text{ m s}^{-1}$  on a level road.

(a) Find the increase in kinetic energy. [3]

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(b) If a constant resistance of 400 N acts over the 150 m taken, find the total work done by the engine. [3]

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**3.3** A cyclist and bicycle of total mass 90 kg freewheel from rest down a slope, dropping a vertical height of 20 m. Resistances do 9000 J of work.

(a) Using energy, find the speed at the bottom. [4]

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