Power

Specification: AQA 7367: MC7 (with MC1–MC3) · Edexcel 9FM0: FM1 2.1 Work, energy and power

HOMEWORK Consolidation

1 A motor lifts a load of mass 60 kg vertically through 4 m at a constant speed in 3 s. Take $g = 9.8$ m s^{-2}. Find the power of the motor.

AQA 7367 MC1, MC7 · Edexcel FM1 2.1

2 A car moves at 90 km h^{-1} on a level road. Its engine produces a driving force of 1600 N. Find the power of the engine.

AQA 7367 MC7 · Edexcel FM1 2.1

3 A van of mass 2200 kg moves on a level road. Its engine works at 33 kW against a constant resistance of 1100 N.

(a) Find the maximum speed of the van.

(b) Find its acceleration when its speed is 11 m s^{-1}.

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4 A car of mass 1300 kg climbs a road inclined at 7° to the horizontal. Its engine works at 28 kW against a constant resistance of 650 N. Take $g = 9.8$ m s^{-2}. Find its maximum speed up the road.

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5 A car of mass 1100 kg travels down a road inclined at 3° to the horizontal. Its engine works at 12 kW against a constant resistance of 1000 N. Take $g = 9.8$ m s^{-2}.

(a) Find the maximum speed of the car down the road.

(b) Find its acceleration when its speed is 15 m s^{-1}.

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6 A train of mass 200 tonnes has an engine of power 1.5 MW. Its maximum speed on a level track is 50 m s^{-1}.

(a) Find the resistance, assumed constant.

(b) Find the acceleration of the train when its speed is 20 m s^{-1}.

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7 A car of mass 1000 kg works at 25.6 kW on a level road. The resistance is $40v$ N at speed v m s^{-1}.

(a) Find its maximum speed.

(b) Find its acceleration when its speed is 16 m s^{-1}.

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8 A van of mass 2000 kg has an engine of power 30 kW. The resistance is a constant 900 N. Its maximum speed up a hill inclined at θ to the horizontal is 12 m s^{-1}. Take $g = 9.8$ m s^{-2}. Find θ.

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9 A car of mass 1200 kg moves on a level road. Its engine works at a constant 25 kW for 10 s. In this time its speed rises from 12 m s^{-1} to 20 m s^{-1} and it travels 165 m.

(a) Find the work done against the resistance.

(b) Find the mean resistance.

AQA 7367 MC1, MC2, MC3, MC7 · Edexcel FM1 2.1

10 A vehicle works at a constant power P on a level road. The resistance is kv at speed v.

(a) Show that its maximum speed is $\sqrt{(P/k)}$.

(b) By what factor must the power be multiplied to double the maximum speed?

(c) A car with $k = 25$ has a maximum speed of 30 m s^{-1}. Find its power.

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11 *AQA-style*. A car of mass 1200 kg moves along a straight horizontal road. Its engine works at a constant rate of 20 kW. A resistance force of magnitude $25v$ N acts on the car when its speed is v m s^{-1}.

(a) Find the maximum speed of the car. [3 marks]

(b) Find the acceleration of the car when its speed is 15 m s^{-1}. [3 marks]

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12 *Edexcel-style*. A cyclist and her bicycle have a total mass of 80 kg. She cycles up a straight road inclined at an angle α to the horizontal, where $\sin\alpha = 1/40$. The resistance to motion from non-gravitational forces is modelled as a constant force of magnitude 20 N. She works at a constant rate of 240 W. Take $g = 9.8$ m s^{-2}.

(a) Find her acceleration when her speed is 4 m s^{-1}. [4 marks]

(b) Find her maximum speed up the road. [2 marks]

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