1)

What is the expression used to **define** power?

A $\frac{\text{energy output}}{\text{energy input}}$

B energy x time taken

C force x velocity

D $\frac{\text{work done}}{\text{time taken}}$

2)

Which of the following is an expression for power?

A energy x time

B force x displacement

C force x velocity

D mass x velocity

3)

A cyclist is capable of generating an average power of 3.0 kW during a 4.0 km speed trial. His aerodynamic suit and position on the cycle reduce resistive forces to 180 N.

What is the approximate time achieved in the speed trial?

A 140 s **B** 240 s **C** 1300 s **D** 2200 s

4)

To travel at a constant speed, a car engine provides 24 kW of useful power. The driving force on the car is 600 N.

At what speed does it travel?

A $2.5\,m\,s^{-1}$

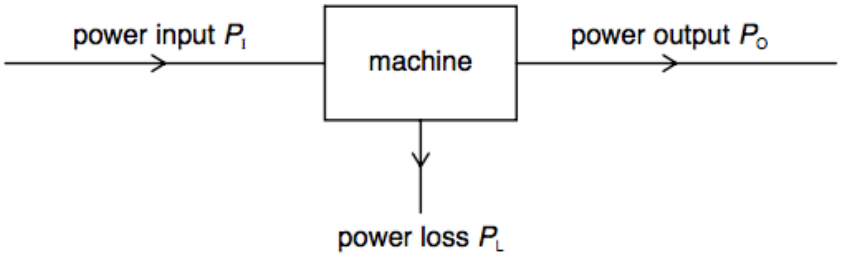
B $4.0\,m\,s^{-1}$

C $25\,m\,s^{-1}$

D $40\,m\,s^{-1}$

5)

Power is transferred through a machine as shown.



What is the efficiency of the machine?

A $\frac{P_I}{P_O + P_L}$ **B** $\frac{P_L}{P_I}$ **C** $\frac{P_L}{P_O}$ **D** $\frac{P_O}{P_I}$

6)

An area of land is an average of 2.0 m below sea level. To prevent flooding, pumps are used to lift rainwater up to sea level.

What is the minimum pump output power required to deal with 1.3×10^9 kg of rain per day?

A 15 kW **B** 30 kW **C** 150 kW **D** 300 kW

7)

A mass is raised vertically. In time t, the increase in its gravitational potential energy is E_p and the increase in its kinetic energy is E_k.

What is the average power input to the mass?

A $(E_p - E_k)t$

B $(E_p + E_k)t$

C $\frac{E_p - E_k}{t}$

D $\frac{E_p + E_k}{t}$

8)

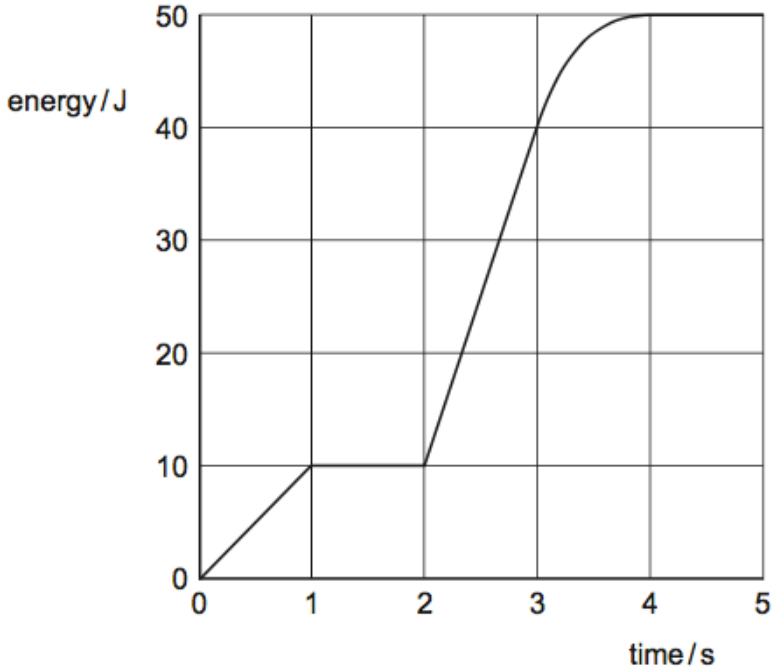
A boat moving at constant speed v through still water experiences a total frictional drag F.

What is the power developed by the boat?

A $\frac{1}{2}Fv$ **B** Fv **C** $\frac{1}{2}Fv^2$ **D** Fv^2

9)

An electrical generator is started at time zero. The total electrical energy generated during the first 5 seconds is shown in the graph.



What is the maximum electrical power generated at any instant during these first 5 seconds?

A 10 W **B** 13 W **C** 30 W **D** 50 W

10)

A shopping trolley and its contents have a total mass of 42 kg. The trolley is being pushed along a horizontal surface at a speed of $1.2\,m\,s^{-1}$. When the trolley is released, it travels a distance of 1.9 m before coming to rest.

(a) Assuming that the total force opposing the motion of the trolley is constant,

(i) calculate the deceleration of the trolley,

deceleration = ... $m\,s^{-2}$ [2]

(ii) show that the total force opposing the motion of the trolley is 16 N.

[1]

(b) Using the answer in **(a)(ii)**, calculate the power required to overcome the total force opposing the motion of the trolley at a speed of $1.2\,m\,s^{-1}$.

power = ... W [2]

11)

(a) **(i)** Define potential energy.

.....

..... [1]

(ii) Distinguish between *gravitational* potential energy and *elastic* potential energy.

gravitational potential energy .....

.....

elastic potential energy .....

..... [2]

(b) A small sphere of mass 51 g is suspended by a light inextensible string from a fixed point P.
The centre of the sphere is 61 cm vertically below point P, as shown in Fig. 3.1.

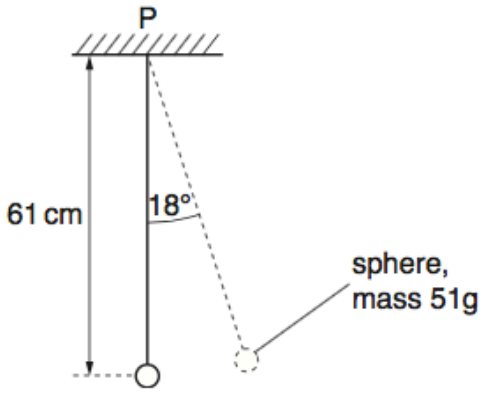


Fig. 3.1

The sphere is moved to one side, keeping the string taut, so that the string makes an angle of 18° with the vertical. Calculate

(i) the gain in gravitational potential energy of the sphere,

gain = ... J [2]

12)

(a) Define what is meant by

(i) *work done*,

.....

.....

..... [2]

(ii) *power*.

.....

..... [1]

(b) A force F is acting on a body that is moving with velocity v in the direction of the force.

Derive an expression relating the power P dissipated by the force to F and v.

[2]

(c) A car of mass 1900 kg accelerates from rest to a speed of 27 m s^{-1} in 8.1 s.

(i) Calculate the average rate at which kinetic energy is supplied to the car during the acceleration.

rate = ... W [2]

(ii) The car engine provides power at a constant rate. Suggest and explain why the acceleration of the car is **not** constant.

.....

.....

..... [2]