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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Energy, Work & Power

Paper 1 — Multiple-Choice Questions (topical compilation)

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WORK, ENERGY, AND POWER

PAPER 1 QUESTIONS

Energy forms and Major sources of energy

QUESTION # 1: M/J 16 P11

12 What uses non-renewable energy?

- A a geothermal heating system
- B a nuclear power station
- C a solar panel
- D a wind turbine

QUESTION # 2: M/J 16 P11

13 Which process in the Sun produces energy?

- A burning
- B nuclear fission
- C nuclear fusion
- D radiation

QUESTION # 3: M/J 17 P12

16 Which energy source is non-renewable?

- A nuclear energy
- B solar energy
- C tidal energy
- D wind energy

QUESTION # 4: M/J 17 P12

17 In a coal-fired power station, the coal is burnt and thermal energy (heat) is produced. The thermal energy is used to produce electrical energy.

In which order does the energy pass through parts of the power station?

- A boiler → generator → turbine
- B boiler → turbine → generator
- C turbine → boiler → generator
- D turbine → generator → boiler

QUESTION # 5: M/J 18 P11

13 How does an oil-fired power station differ from a nuclear power station?

- A** Gases emitted by hot fuel are emitted into the atmosphere.
- B** Steam is produced in a boiler using hot fuel.
- C** The hot steam is used to turn a turbine.
- D** Turbines are used to drive an electric generator.

QUESTION # 6: M/J 18 P12

14 Which power station produces carbon dioxide when operating?

- A** gas-fired power station
- B** geothermal power station
- C** nuclear power station
- D** wind power station

QUESTION # 7: M/J 19 P12

18 Which method of producing electricity does **not** use an a.c. generator?

- A** geothermal power station
- B** solar panels
- C** wave-energy generators
- D** wind turbine

QUESTION # 8: M/J 20 P11

18 In which situation is energy being released by the fusion of hydrogen nuclei to form helium?

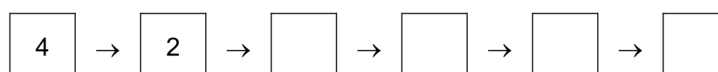
- A** in the decay of ^{14}C used to date an object
- B** in a radioactive isotope emitting alpha-particles
- C** in the centre of the Earth
- D** in the centre of the Sun

QUESTION # 9: M/J 20 P12

19 The main stages in the operation of a coal-fired power station are listed. They are **not** in the correct order.

- 1 The turbine turns a generator.
- 2 Water in the boiler becomes hot.
- 3 Steam turns a turbine.
- 4 Burning coal produces thermal energy.
- 5 Electromagnetic induction produces electrical energy.
- 6 Steam is produced.

The flow chart shows the first two stages.



What is the correct order for the remaining stages?

- A** 6 → 3 → 1 → 5
B 6 → 1 → 3 → 5
C 1 → 6 → 3 → 5
D 6 → 3 → 5 → 1

QUESTION # 10: M/J 20 P12

20 In which situation is there **no** transfer of energy?

- A** a car battery turning the starter motor
B a car moving along a horizontal road at constant speed
C a solar panel warming water
D a spacecraft orbiting the earth at constant height

QUESTION # 11: O/N 16 P12

12 Which power stations all rely on renewable sources of energy?

- A** hydroelectric, oil-fired, solar power stations
B hydroelectric, solar, wind power stations
C hydroelectric, oil-fired, wind power stations
D oil-fired, wind, solar power stations

QUESTION # 12: O/N 18 P12

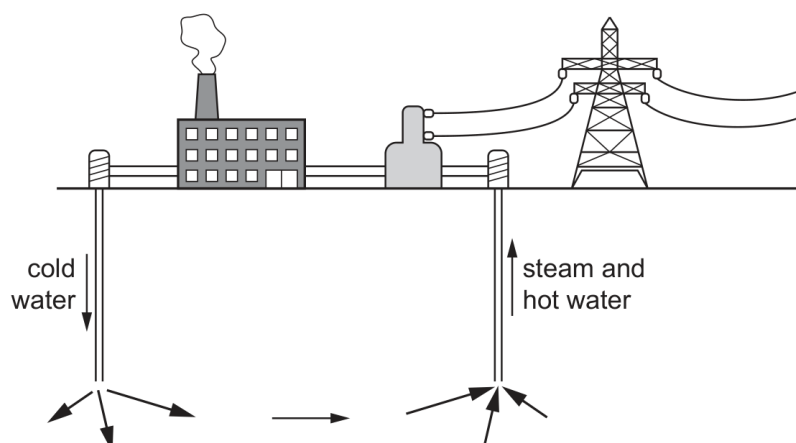
- 8 A tennis ball is compressed. Work is done and energy is transferred to the molecules of air inside the ball, and also to the rubber from which the ball is made.

Which row is correct?

	kinetic energy of air molecules inside the ball	temperature of ball
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

QUESTION # 13: O/N 18 P12

- 11 The diagram represents a geothermal power station.



Which useful energy transformation is taking place?

- A electrical energy $\rightarrow$ potential energy
- B electrical energy $\rightarrow$ thermal energy
- C potential energy $\rightarrow$ electrical energy
- D thermal energy $\rightarrow$ electrical energy

QUESTION # 14: O/N 19 P11

- 18 Where is energy released by the fusion of hydrogen nuclei to form helium?

- A in a nuclear power station
- B in a radioactive isotope emitting alpha-particles
- C in the core of the Earth
- D in the core of the Sun

QUESTION # 15: O/N 20 P11

14 There is a current in a resistor.

Which energy transfer takes place?

- A** electrical → chemical
- B** electrical → internal
- C** kinetic → electrical
- D** potential → electrical

QUESTION # 16: O/N 20 P11

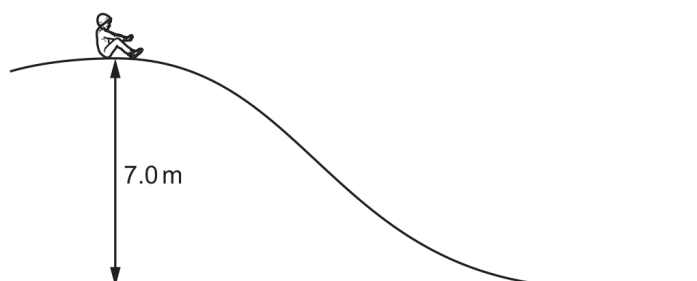
16 Which source of electrical energy is **not** renewable?

- A** solar cells
- B** hydroelectric generators
- C** wind turbines
- D** nuclear reactors

Work, K.E, P.E, Conservation of energy

QUESTION # 1: M/J 16 P11

11 A child slides down a slide.



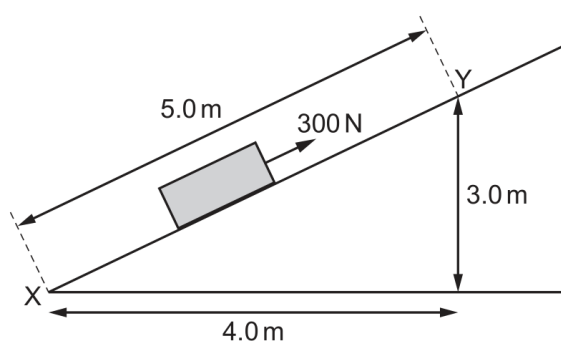
The weight of the child is 250 N. The height of the slide is 7.0 m. The work done against friction as the child travels down the slide is 1300 J.

What is the change in gravitational potential energy and what is the final kinetic energy of the child?

	change in gravitational potential energy	final kinetic energy
A	1750	450
B	1750	1750
C	17500	16200
D	17500	17500

QUESTION # 2: M/J 16 P11

14 A 300 N force is applied to a box to move it up a ramp, as shown.

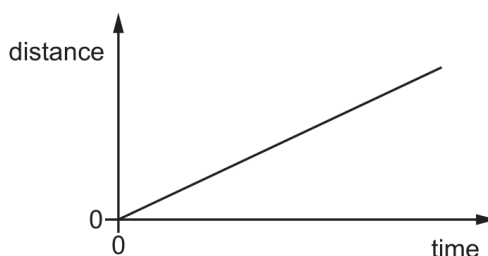


How much work is done by the force when moving the box from X to Y?

- A 900 J B 1200 J C 1500 J D 3000 J

QUESTION # 3: M/J 17 P11

- 4 The diagram shows the distance-time graph of a car.



The car is travelling along a straight road up a hill.

Which quantity for the car is constant and greater than zero?

- A acceleration
- B gravitational potential energy
- C kinetic energy
- D resultant force

QUESTION # 4: M/J 17 P11

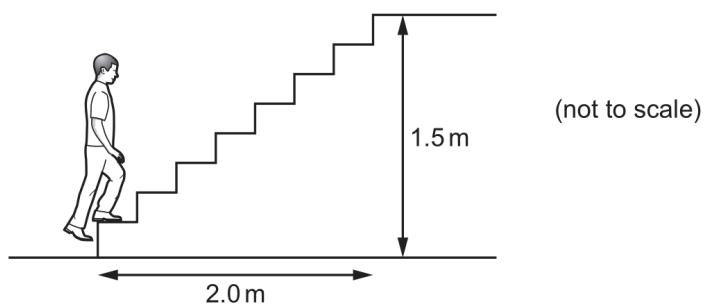
- 13 The work done by a force on a body is calculated by multiplying the force by a quantity.

Which quantity?

- A the distance travelled in the direction of the force
- B the distance travelled perpendicular to the direction of the force
- C the speed in the direction perpendicular to the force
- D the velocity in the direction of the force

QUESTION # 5: M/J 17 P12

- 15 A student of mass 60 kg climbs some steps. He travels a horizontal distance of 2.0 m and a vertical distance of 1.5 m. The gravitational field strength g is 10 N/kg.

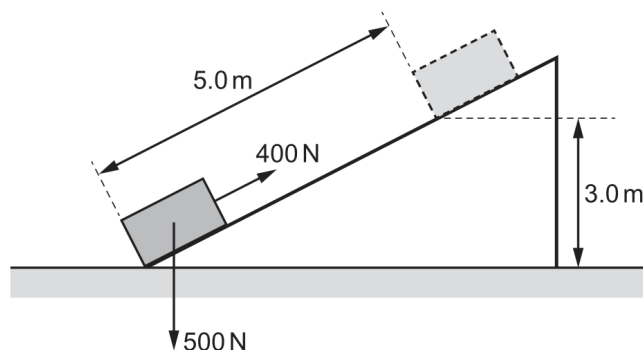


What is the work done against the force of gravity?

- A 90 J
- B 120 J
- C 900 J
- D 1200 J

QUESTION # 6: M/J 18 P12

- 15** Work is done when a force of 400 N pulls a crate of weight 500 N at a constant speed along a ramp, as shown.



Part of the work done increases the gravitational potential energy E of the crate and the rest is work done W against friction.

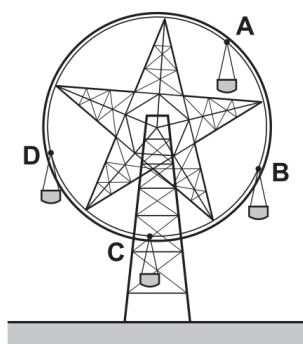
What are the values of E and W ?

	E/J	W/J
A	1500	500
B	1500	2000
C	2000	2500
D	3500	500

QUESTION # 7: M/J 19 P11

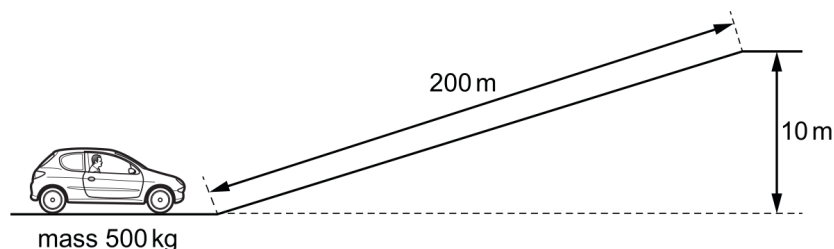
- 14** The diagram shows a stationary fairground ride with four chairs of equal mass.

Which chair has the most gravitational potential energy?



QUESTION # 8: M/J 19 P11

- 15** The diagram shows a small car of mass 500 kg approaching a hill. It moves up the hill with constant speed.



The gravitational field strength g is 10 N/kg .

Ignoring friction, how much work is done in moving the car up the hill?

- A** $5.0 \times 10^3 \text{ J}$ **B** $5.0 \times 10^4 \text{ J}$ **C** $1.0 \times 10^5 \text{ J}$ **D** $1.0 \times 10^6 \text{ J}$

QUESTION # 9: M/J 19 P12

- 16** An object is lifted.

Which expression gives the increase in gravitational potential energy of the object?

- A** mass multiplied by its velocity
B mass multiplied by its acceleration
C the rate at which work is done
D weight multiplied by the increase in height

QUESTION # 10: M/J 20 P11

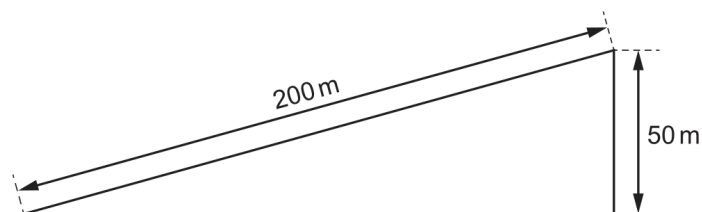
- 12** A rocket of mass M when empty carries a mass M of fuel. The rocket and fuel travel at speed v . The engine of the rocket is fired and all of the fuel is expelled. The speed of the rocket increases to $2v$.

What happens to the kinetic energy of the rocket?

- A** It doubles.
B It halves.
C It increases by a factor of four.
D It stays the same.

QUESTION # 11: M/J 20 P11

13 A car of mass 1000 kg is driven 200 m up an incline so that it rises 50 m vertically.



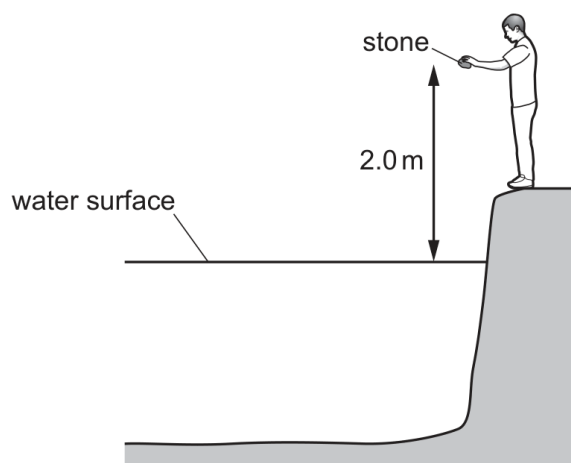
The acceleration of free fall g is 10 m/s^2 .

What is the gain in gravitational potential energy?

- A** 5000 J **B** 200 000 J **C** 500 000 J **D** 2 000 000 J

QUESTION # 12: M/J 20 P11

17 A boy is standing by the side of a lake.



The boy drops a heavy stone from a height of 2.0 m above the water surface.

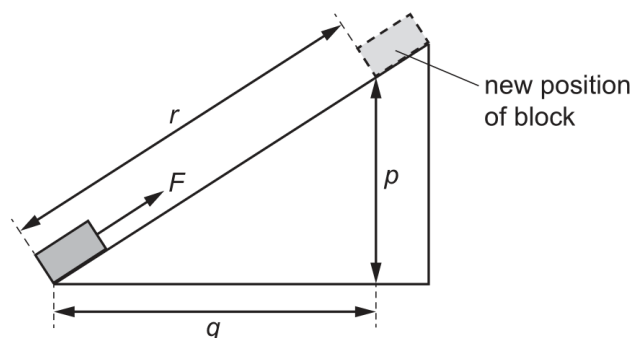
The acceleration due to gravity is 10 m/s^2 .

What is the speed of the stone when it hits the surface of the water?

- A** 4.5 m/s **B** 6.3 m/s **C** 20 m/s **D** 40 m/s

QUESTION # 13: M/J 20 P11

- 19 The diagram shows a block being pulled up a slope by a force F .



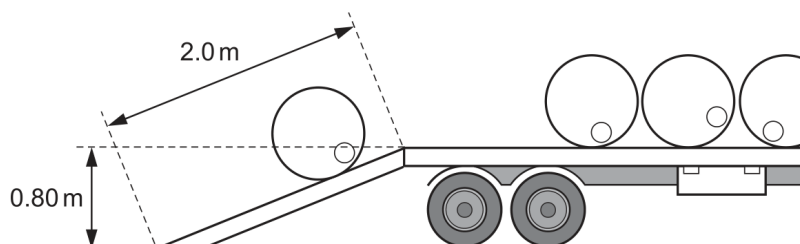
The block reaches the new position at the top of the slope.

What is the work done by force F in moving the block to its new position?

- A $F \times r$ B $F \times p$ C $F(q + p)$ D $F(r + p)$

QUESTION # 14: O/N 16 P11

- 8 A workman rolls a barrel of weight 2000 N up a plank of length 2.0 m and onto a lorry. The back of the lorry is 0.80 m above the horizontal surface of the road.



What is the work done on the barrel against gravity?

- A 1000 J B 1600 J C 2500 J D 4000 J

QUESTION # 15: O/N 16 P11

- 9 Three objects P, Q and R have different masses and different speeds, as shown in the table.

	<u>mass</u> kg	<u>speed</u> m/s
P	1.0	3.0
Q	2.0	2.0
R	5.0	1.0

What is the order of increasing kinetic energy (smallest first) of the objects?

- A P → Q → R
- B P → R → Q
- C R → P → Q
- D R → Q → P

QUESTION # 16: O/N 16 P11

- 10 A weightlifter lifts some masses through a height of 1.8 m.



The gravitational field strength g is 10 N/kg .

During the lift, the gravitational potential energy of the masses increases by 4500 J .

What is the total mass lifted?

- A 25 kg
- B 250 kg
- C 450 kg
- D 810 kg

QUESTION # 17: O/N 16 P12

13 Which force does no work?

- A the force from a car's engine that causes the car to accelerate
- B the force that causes a box to slide over a rough horizontal surface
- C the force that causes a satellite to move in a circular orbit
- D the force that causes a spring to stretch

QUESTION # 18: O/N 17 P11

9 An astronaut on the Moon drops a tool box of mass 3.0 kg. It falls from rest and its kinetic energy as it hits the surface is 0.96 J.

At which speed does the tool box hit the surface of the Moon?

- A 0.46 m/s B 0.57 m/s C 0.64 m/s D 0.80 m/s

QUESTION # 19: O/N 17 P12

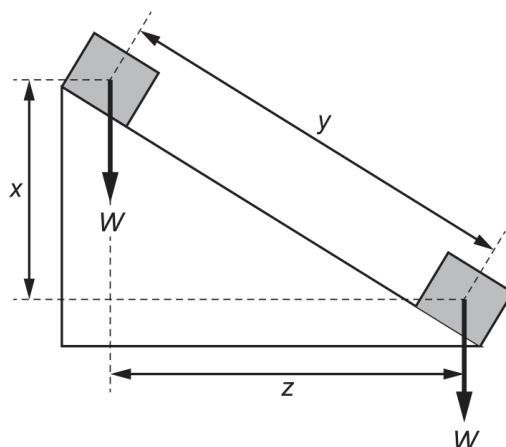
8 A tennis ball of mass 56 g is travelling at 1500 metres/minute.

Which expression is equal to the kinetic energy, in joules, of the tennis ball?

- A $\frac{1}{2} \times 0.056 \times (25)^2$
- B $\frac{1}{2} \times 0.056 \times (1500)^2$
- C $\frac{1}{2} \times 56 \times (25)^2$
- D $\frac{1}{2} \times 56 \times (1500)^2$

QUESTION # 20: O/N 19 P11

17 A heavy box of weight W slides down a frictionless slope.



What is the work done by the weight W in moving from top to bottom?

- A** Wx **B** Wy **C** $W(y - z)$ **D** $W(x + z)$

QUESTION # 21: O/N 19 P12

14 An object X has mass m and velocity v .

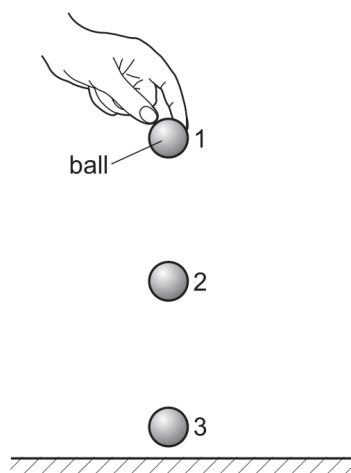
A second object Y has mass $2m$ and velocity $2v$.

What is the value of the ratio $\frac{\text{kinetic energy of Y}}{\text{kinetic energy of X}}$?

- A** 1 **B** 2 **C** 4 **D** 8

QUESTION # 22: O/N 20 P11

15 A ball is dropped from a height as shown.



Ignoring the effects of air resistance, which statement about the total energy of the ball is correct?

- A It is the same at all points.
- B It is greatest at point 1.
- C It is greatest at point 2.
- D It is greatest at point 3.

QUESTION # 23: O/N 20 P11

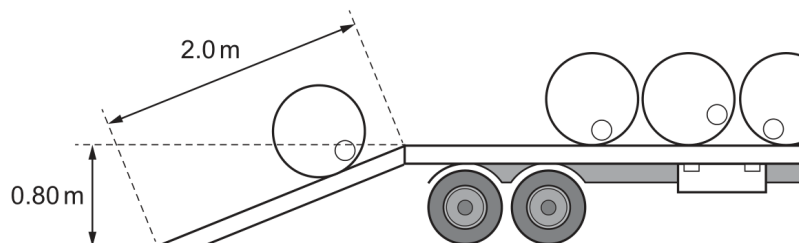
17 The table shows some data from a high-jump competition.

Which athlete jumps the highest?

	weight / N	increase in gravitational potential energy / J
A	600	1320
B	700	1610
C	800	1760
D	900	1800

QUESTION # 24: O/N 20 P11

- 18 A workman rolls a barrel of weight 2000 N up a plank of length 2.0 m and onto a lorry. The back of the lorry is 0.80 m above the horizontal surface of the road.



What is the work done on the barrel against gravity?

- A 1000 J B 1600 J C 2500 J D 4000 J

QUESTION # 25: O/N 20 P12

- 14 A student uses an average force of F to push a box a distance of d across a horizontal table. The mass of the box is m and the gravitational field strength is g .

How is the work done by the student pushing the box calculated?

- A $F \times d$ B $\frac{F \times d}{g}$ C $m \times d$ D $m \times g \times d$

Efficiency and Power

QUESTION # 1: M/J 17 P11

- 14 A small motor has an input power rating of 10 W and is run for 5.0 minutes.

What is the electrical energy input to the motor in this time?

- A 2.0 J B 50 J C 300 J D 3000 J

QUESTION # 2: M/J 17 P11

- 15 A small hydroelectric power station diverts water from a river. Every second, 20 kg of water flows through a pipe and falls through a vertical drop of 15 m. The efficiency of the power station is 0.60 (60%).

The gravitational field strength g is 10 N/kg.

What is the power output?

- A 0.18 kW B 1.8 kW C 3.0 kW D 180 kW

QUESTION # 3: M/J 18 P11

- 12 A student calculates his power in running up a flight of stairs. He measures the vertical height of the stairs, the time taken to run up the stairs and his weight.

How does he calculate his power?

- A height $\times$ time $\times$ weight
B $\frac{\text{height} \times \text{weight}}{\text{time}}$
C $\frac{\text{time} \times \text{weight}}{\text{height}}$
D $\frac{\text{weight}}{\text{height} \times \text{time}}$

QUESTION # 4: M/J 19 P12

- 19 Three solar panels have a total area of 7.2 m². Together, they produce 1.0 kW of power.

An area of 1.0 m² of each panel receives 0.80 kJ of energy from the Sun in 1.0 s.

What is the efficiency of the solar panels?

- A 11% B 17% C 52% D 80%

QUESTION # 5: M/J 19 P12

20 A student suggests three different definitions for power.

- 1 energy transferred per second
- 2 force $\times$ distance moved
- 3 rate of doing work

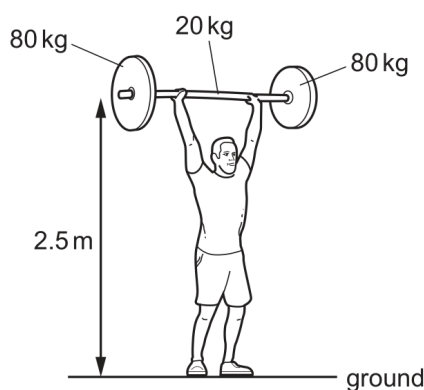
Which definitions are correct?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 3 only

QUESTION # 6: M/J 20 P11

16 In a weightlifting contest, an athlete lifts a metal bar of mass 20 kg fitted with a mass of 80 kg on each end.

The lift from ground to a height of 2.5 m takes 0.50 s.



The gravitational field strength g is 10 N/kg.

What average power does the weightlifter exert in providing the gravitational potential energy during this lift?

- A** 0.90 kW **B** 5.0 kW **C** 8.0 kW **D** 9.0 kW

QUESTION # 7: M/J 20 P12

21 The 200 V battery of an electric car is charged with a current of 33 A for 4.0 hours. The efficiency of the charging process is 90%.

How much useable energy is transferred to the battery?

- A** 21 MJ **B** 86 MJ **C** 95 MJ **D** 106 MJ

QUESTION # 8: M/J 20 P12

- 22 In an experiment to measure the power output of a small steam engine, a known load is lifted by the engine.

Which two measuring instruments are also required?

- A measuring cylinder and thermometer
- B measuring cylinder and metre rule
- C metre rule and stop-watch
- D stop-watch and thermometer

QUESTION # 9: O/N 16 P11

- 11 Which expression is used to calculate power?

- A $\frac{\text{distance}}{\text{work done}}$
- B work done $\times$ distance
- C $\frac{\text{work done}}{\text{time taken}}$
- D work done $\times$ time taken

QUESTION # 10: O/N 16 P12

- 15 An electric motor is used to operate a lift (elevator). The motor does 140 000 J of work in 70 s.

What is the output power of the motor?

- A 0.50 milliwatts
- B 2.0 watts
- C 2.0 kilowatts
- D 9.8 megawatts

QUESTION # 11: O/N 16 P12

- 16 Which expression gives the efficiency of an a.c. generator?

- A $\frac{\text{electrical energy output}}{\text{total energy input}}$
- B $\frac{\text{electrical energy output}}{\text{thermal energy output}}$
- C $\frac{\text{total energy output}}{\text{electrical energy input}}$
- D $\frac{\text{thermal energy output}}{\text{total energy input}}$

QUESTION # 12: O/N 17 P11

- 10 A car travels a distance of 200 m in 20 s. The engine of the car provides a driving force of 1000 N.

What is the power output of the engine?

- A** 0.25 W **B** 4.0 W **C** 100 W **D** 10 000 W

QUESTION # 13: O/N 17 P12

- 9 In a hydroelectric power station, 4.2×10^5 kg of water passes through the turbines every second. The turbines are at a height of 50 m below the surface of the reservoir. The gravitational field strength g is 10 N/kg.

Assuming there are no energy losses, what is the power output of the power station?

- A** 8.4×10^3 W **B** 8.4×10^4 W **C** 2.1×10^7 W **D** 2.1×10^8 W

QUESTION # 14: O/N 18 P11

- 9 An electric motor, connected to the mains, is used to lift bricks to the top of a building.

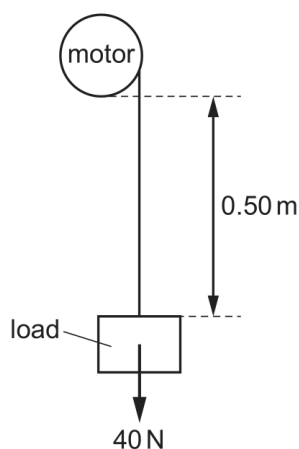
There is a fuse in the plug.

How can the efficiency of the motor be increased?

- A** Increase the friction in the motor.
B Reduce the energy losses in the motor.
C Use a fuse with a higher current rating.
D Use a fuse with a lower current rating.

QUESTION # 15: O/N 18 P12

12 A motor is used to lift a load 0.50 m vertically, as shown.



The load weighs 40 N. The power of the motor is 20 W and the system is 25% efficient.

How long does it take to raise the load?

- A** 0.040 s **B** 0.25 s **C** 4.0 s **D** 40 s

QUESTION # 16: O/N 19 P12

16 A student uses a newton meter to pull an object a distance d horizontally along a flat surface in a time of t . The newton meter reading is F .

What is given by the expression $(F \times d)/t$?

- A** efficiency
B energy
C power
D work

QUESTION # 17: O/N 20 P11

19 Data for three types of electricity generator are shown.

	input energy /MJ	wasted energy /MJ
oil	500	300
nuclear	200	160
hydroelectric	10	1.0

Which is the least efficient generator and which is the most efficient?

	least efficient	most efficient
A	hydroelectric	nuclear
B	hydroelectric	oil
C	nuclear	hydroelectric
D	oil	hydroelectric

QUESTION # 18: O/N 20 P12

16 What is *power*?

- A** force per second
- B** the maximum force an object exerts
- C** the total energy of an object
- D** work done per second