

Easter HW 1 Combined science - Physics (Higher and Foundation)

Physics Paper 1

Topic P1 Energy

6.1.1 Energy changes in a system, and the ways energy is stored before and after such changes

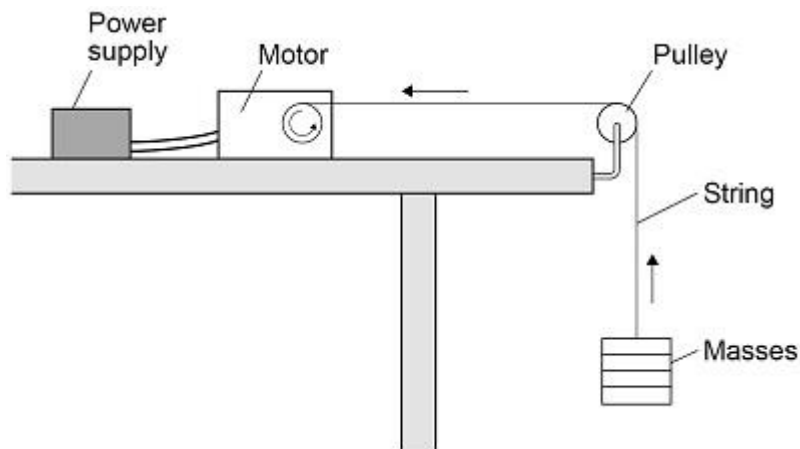
You must complete this homework on Lined/ plain A4 paper and bring it in to school on 19/04/22

Q1.

A student used an electric motor to lift a mass.

He investigated how the efficiency of the motor varied with the mass lifted.

The diagram below shows the apparatus used.



- (a) Energy is transferred to the electric motor by the power supply.

Why is the energy transferred to the motor greater than the gravitational potential energy gained by the mass?

Tick (✓) **two** boxes.

Energy is not conserved

Friction in the motor causes energy transfer to the surroundings

The temperature of the motor increases

Thermal energy from the surroundings is transferred to the mass

Wasted energy is destroyed

(2)

- (b) The student calculated the gravitational potential energy gained by different masses as they were lifted.

The student used the equation:

$$\text{gravitational potential energy} = \text{mass} \times 9.8 \times \text{height}$$

Describe how the student could make accurate measurements to use in the calculations.

(4)

(c) Write the equation which links efficiency, total input energy transfer and useful output energy transfer.

(1)

(d) The efficiency of the motor was 15%.

The student calculated that the useful output energy transfer was 1.20 J

Calculate the total input energy transfer.

Total input energy transfer = _____ J

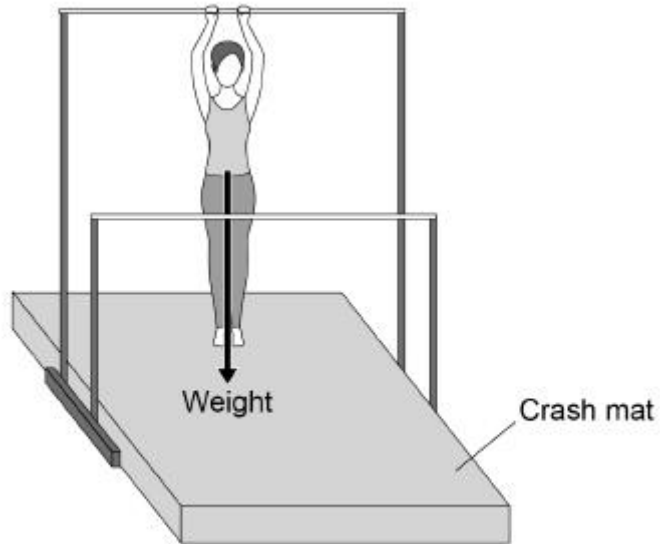
(4)

(Total 11 marks)

Q2.

The diagram shows a gymnast on a piece of gymnastic equipment.

The equipment consists of two bars at different heights.



- (a) The gymnast exerts a downward force on the bar.
 What is the size of the upward force acting on the gymnast from the bar?

Tick (✓) **one** box.

It is greater than the downward force.

It is less than the downward force.

It is the same size as the downward force.

(1)

- (b) Why is the weight of the gymnast represented by an arrow?

Tick (✓) **one** box.

Weight is a constant.

Weight is a scalar.

Weight is a unit.

Weight is a vector.

(1)

- (c) The diagram above shows the weight of the gymnast acting from a point.

What name is given to this point?

Tick (✓) **one** box.

Centre of force

Centre of mass

Centre of tension

Centre of weight

(1)

- (d) The gymnast has a mass of 45 kg
gravitational field strength = 9.8 N/kg

Calculate the weight of the gymnast.

Use the equation:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{Weight} = \text{_____} \text{ N}$$

(2)

- (e) The gymnast swings from one bar to the other bar several times.

Describe how the gravitational potential energy store and the kinetic energy store of the gymnast change as she moves between the bars.

(4)

- (f) Falling on the crash mat reduces the average deceleration of the gymnast compared

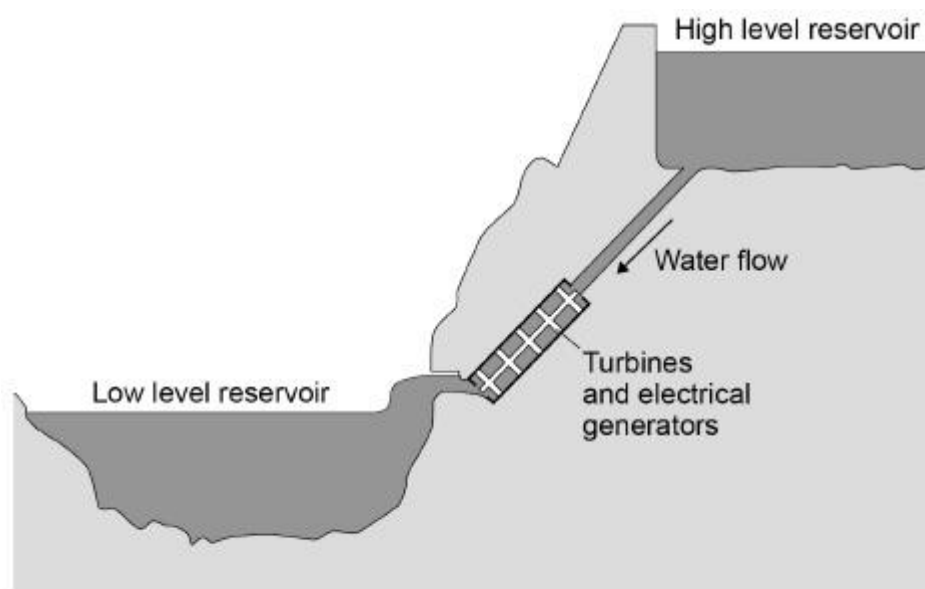
with falling on a hard surface.

Explain why reducing the deceleration is important to the gymnast.

(2)
(Total 11 marks)

Q3.

The diagram shows the flow of water through a hydroelectric power station.



The falling water turns the turbines.

The movement of the turbines causes the electrical generators to generate electricity.

(a) Write the equation which links kinetic energy, mass and speed.

(1)

(b) In 1 minute, a mass of 9 000 kg of water flows through the turbines.

The speed of the water is 30 m/s

Calculate the total kinetic energy of the water passing through the turbines in 1 minute.

Give your answer in kilojoules (kJ).

Kinetic energy = _____ kJ

(3)

(c) Write the equation which links efficiency, total input energy transfer and useful output energy transfer.

(1)

(d) The efficiency of the turbines and generators is 80%

Calculate the useful output energy transfer from the hydroelectric power station in 1 minute.

Use your answer to part (b).

Useful output energy transfer = _____ kJ

(3)

(e) A small group of people live in an area in the mountains.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

- The wind turbine costs £50 000 to buy and install.
- The hydroelectric generator costs £20 000 to buy and install.
- The average power output from the wind turbine is 10 kW
- The hydroelectric generator will produce a constant power output of 8 kW

Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy resources and information given.

(4)
(Total 12 marks)