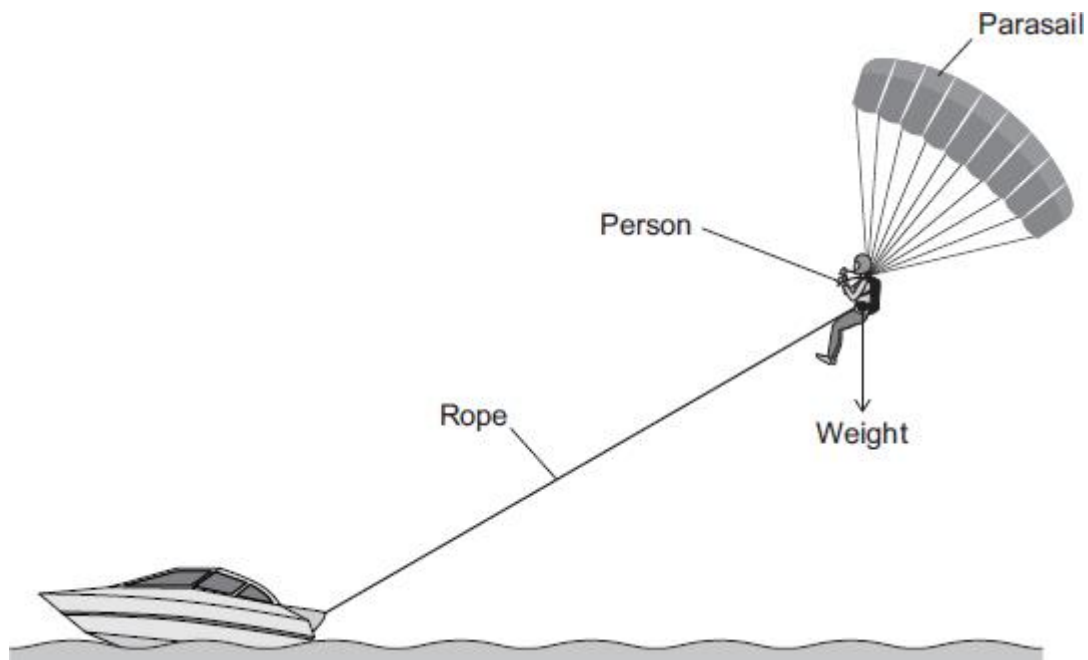


P1 Energy Homework Conservation and dissipation task 2

Q1.

The figure below shows a boat pulling a person parasailing. A rope attaches the person to the boat.



(a) What type of force is the weight?

Tick (✓) **one** box.

Contact force

Magnetic force

Non-contact force

(1)

(b) The mass of the person is 75 kg.

Calculate the weight of the person.

gravitational field strength = 9.8 N/kg

Use the equation:

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

Weight = _____ N (2)

(c) The resultant force acting on the person is zero.

Which of the following describes the motion of the person?

Tick (✓) **one** box.

Velocity decreasing

Moving at constant velocity

Velocity increasing

(1)

(d) The horizontal force on the person is 4300 N.

Calculate the work done by this force in moving the person a horizontal distance of 500 m.

Use the equation:

$$\text{work done} = \text{force} \times \text{distance}$$

Choose the unit from the box.

joules	metres/second	watts
--------	---------------	-------

Work done = _____

Unit _____

(3)

(e) The speed of the boat changes.

The height of the person above the water decreases by 18 m.

Calculate the decrease in gravitational potential energy of the person.

mass of person = 75 kg

gravitational field strength = 9.8 N/kg

Use the equation:

gravitational potential energy = mass \times gravitational field strength \times height

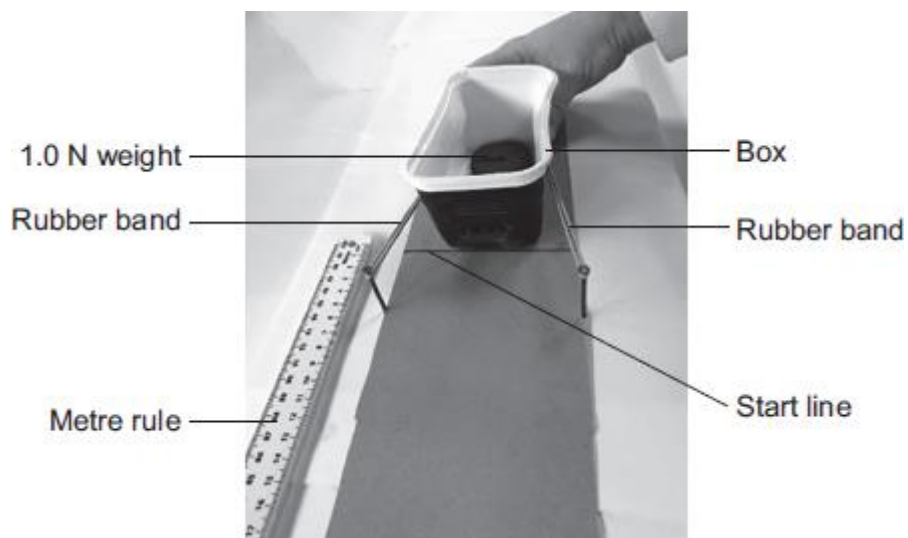
Decrease in gravitational potential energy = _____ J

(2)

(Total 9 marks)

Q2.

The figure below shows the equipment a student used to investigate the effect of weight on the distance a box slides.



This is the method used.

1. Put a 1.0 N weight in the box.
2. Pull the box backwards until it reaches the start line, extending the rubber band by 10 cm.
3. Release the box.
4. When the box stops moving, measure the distance the box has slid using the metre rule.
5. Repeat steps 2 to 4 using a weight of 2.0 N and then 3.0 N.

- (a) Identify the variables in the investigation.

Independent variable _____

Dependent variable _____

(2)

- (b) The extension of the rubber band was a control variable in the investigation.

Suggest **one other** control variable in the investigation.

(1)

- (c) **Table 1** shows the results when the weight inside the box was 1.0 N.

Table 1

Weight inside box in N	Distance the box slides in cm			
	Trial 1	Trial 2	Trial 3	Mean
1.0	12.6	13.1	13.4	13.0

What was the uncertainty in the distance measurements when the weight inside the box was 1.0 N?

Tick (✓) **one** box.

± 0.1 cm ± 0.4 cm ± 0.8 cm ± 1.0 cm

(1)

- (d) The rubber band was extended by 10 cm.

The rubber band behaves like a spring with a spring constant of 36 N/m.

Calculate the elastic potential energy stored by the rubber band.

Use the Physics Equations Sheet.

Elastic potential energy = _____ J

(3)

- (e) What is the maximum possible value for the kinetic energy of the box?

Maximum possible kinetic energy = _____ J

(1)

(f) **Table 2** shows the student's results.

Table 2

Weight inside box in N	Distance the box slides in cm			
	Trial 1	Trial 2	Trial 3	Mean
1.0	12.6	13.1	13.4	13.0
2.0	10.4	9.4	10.0	9.9
3.0	7.9	7.3	6.8	7.3

Describe improvements the student could make to the method.

Use information from:

- The figure in part (a).
- **Table 2.**

(4)

(Total 12 marks)

Higher Tier Questions

Q3.

Heating homes and businesses using natural gas produces a third of the UK's carbon dioxide emissions.

- (a) Give **one** energy resource that produces carbon dioxide when burnt.

Do **not** refer to natural gas.

(2)

- (b) Hydrogen can be burned to power cars.

Hydrogen can be extracted from seawater.

Burning 1 kg of hydrogen releases 142 MJ of energy.

Burning 1 kg of petrol releases 45 MJ of energy.

Give **two** advantages of using hydrogen to power cars compared with using petrol.

1 _____

2 _____

(1)

Scientists are investigating whether appliances that usually only burn natural gas can burn a mixture of hydrogen gas and natural gas.

- (c) Give **three** environmental benefits of burning a mixture of hydrogen gas and natural gas compared to just burning natural gas.

1 _____

2 _____

3 _____

(3)

- (d) All gas appliances in the UK bought since 1996 can burn a mixture of 23% hydrogen gas and 77% natural gas.

Explain a possible problem of changing the UK gas supply to this mixture of hydrogen gas and natural gas.

(2)
(Total 8 marks)

Q4.

Figure 1 below shows a wind turbine.

Figure 1



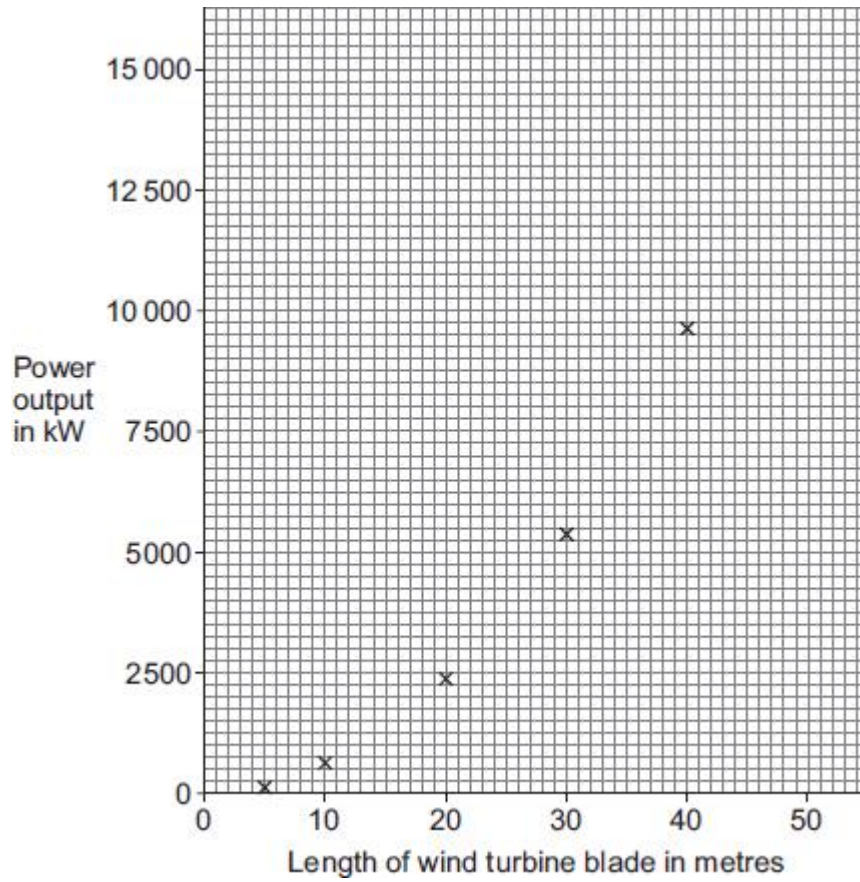
- (a) An alternating potential difference is produced when the wind turbine spins.

What is meant by 'alternating potential difference'?

(1)

Figure 2 shows how the power output of a wind turbine varies with the length of the wind turbine blades when the wind speed is 20 m/s.

Figure 2



- (b) It is more economical to construct and use one wind turbine with 40-metre blades than two wind turbines with 20-metre blades.

Explain why.

Use information from **Figure 2**.

(c) Predict the power output of a wind turbine with a blade length of 50 metres.

Tick (✓) **one** box.

10 000 kW

12 000 kW

14 000 kW

15 000 kW

(1)

(d) The kinetic energy of the air passing the wind turbine blades each second is 73.9 MJ.

The mass of air passing the wind turbine blades each second is 236 000 kg.

Calculate the speed of the air passing the wind turbine.

Speed = _____ m/s

(4)

(Total 8 marks)