

Q1.(2018)

a)

Figure 1 shows a cyclist riding along a flat road.

Figure 1



Complete the sentence.

Choose answers from the box.

[2 marks]

chemical	elastic potential	gravitational potential	kinetic
-----------------	--------------------------	--------------------------------	----------------

As the cyclist accelerates, the _____ energy store in the cyclist's body decreases and the _____ energy of the cyclist increases.

b)

The mass of the cyclist is 80 kg. The speed of the cyclist is 12 m/s.

Calculate the kinetic energy of the cyclist.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

Kinetic energy = _____ J

c)

When the cyclist uses the brakes, the bicycle slows down.

This causes the temperature of the brake pads to increase by $50\text{ }^{\circ}\text{C}$.

The mass of the brake pads is 0.040 kg .

The specific heat capacity of the material of the brake pads is $480\text{ J/kg }^{\circ}\text{C}$.

Calculate the change in thermal energy of the brake pads.

Use the equation:

change in thermal energy = mass $\times$ specific heat capacity $\times$ temperature change
[2 marks]

Change in thermal energy = _____ J

d)

How is the internal energy of the particles in the brake pads affected by the increase in temperature?

Tick **one** box.

[1 mark]

Decreased ☐

Increased ☐

Not affected ☐

Q2.(2018)

a)

Figure 13 shows a lift inside a building.

Figure 13



The motor in the lift does 120 000 J of work in 8.0 seconds.

Calculate the power output of the motor in the lift.

Use the equation:

$$\text{Power output} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

Power output = _____ W

b)

The power input to the motor is greater than the power output.

Tick **two** reasons why.

[2 marks]

Energy is transferred in heating the surroundings.

☐

Friction causes energy to be transferred in non-useful ways.

☐

The motor is connected to the mains electricity supply.

☐

The motor is more than 100% efficient.

☐

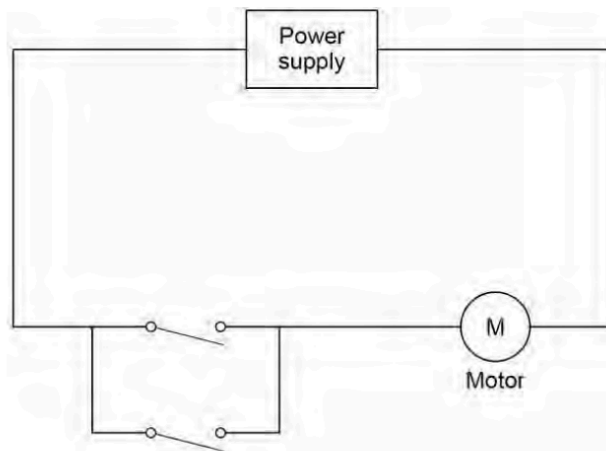
There are only four people in the lift.

☐

c)

Figure 14 shows part of the circuit that operates the lift motor.

Figure 14



The lift can be operated using either of the two switches.

Explain why.

[2 marks]

d)

Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

e)

The lift goes up 14 m. The total mass of the people in the lift is 280 kg.

gravitational field strength = 9.8 N/kg

Calculate the increase in gravitational potential energy of the people in the lift.

Give your answer to 2 significant figures.

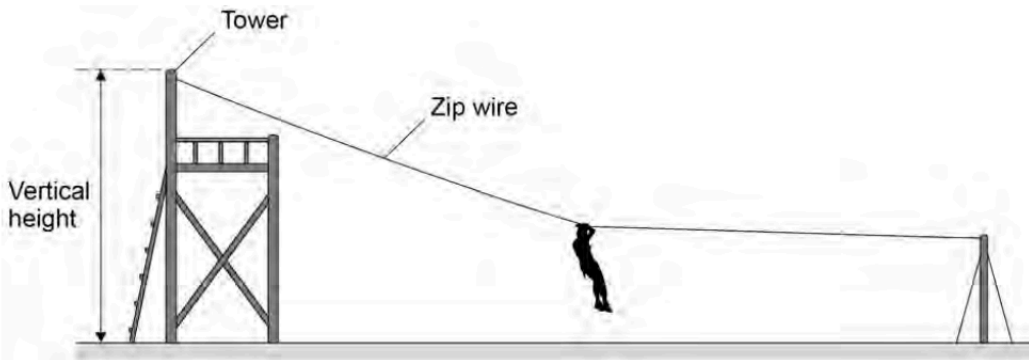
[3 marks]

Increase in gravitational potential energy = _____ J

a)

Figure 4 shows a person sliding down a zip wire.

Figure 4



Describe how the vertical height of the tower could be measured accurately.

[2 marks]

b)

When using the zip wire, the person moved through a vertical height of 2.0 m

The person has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the person.

Use the equation:

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

[2 marks]

Change in gravitational potential energy = _____ J

c)

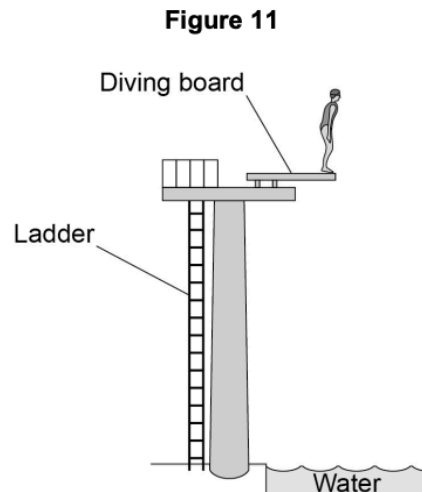
Give **three** factors that affected the kinetic energy of the person as she reached the bottom of the zip wire.

[3 marks]

Q4.(2021)

a)

Figure 11 shows a diver about to dive off a diving board.



Complete the sentences.

Choose answers from the box.

[2 marks]

elastic potential	gravitational potential	kinetic	nuclear
--------------------------	--------------------------------	----------------	----------------

As the diver falls towards the water there is a decrease in her _____ energy.

As the diver falls towards the water there is an increase in her _____ energy.

b)

Write down the equation which links kinetic energy (E_k), mass (m) and speed (v).

[1 mark]

c)

At the instant the diver hits the water, the kinetic energy of the diver is 5040 J.

The speed of the diver is 12 m/s.

Calculate the mass of the diver.

[3 marks]

Mass = _____ kg

d)

Most of the kinetic energy of the diver is transferred to the water.

How does this affect the thermal energy of the water?

[1 mark]

Tick (✓) **one** box.

The thermal energy decreases.

☐

The thermal energy stays the same.

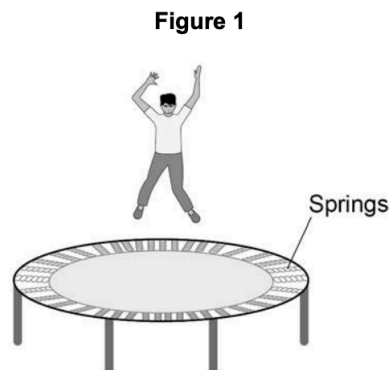
☐

The thermal energy increases.

☐

a)

Figure 1 shows a boy bouncing on a trampoline.



The boy falls from the position in **Figure 1** towards the trampoline.

Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	elastic potential	gravitational potential
kinetic	nuclear	

As the boy falls, there is a decrease in his _____ energy.

As the boy falls, there is an increase in his _____ energy.

b)

As the boy lands on the trampoline, each spring stretches 0.015 m.

spring constant of each spring = 120 000 N/m

Calculate the energy stored by each spring.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

[2 marks]

Elastic potential energy = _____ J

c)

There are 40 springs on the trampoline.

Calculate the total energy stored by the 40 springs when each spring is stretched by 0.015 m.

Use your answer from Question 01.2

[1 mark]

Total energy stored = _____ J

d)

The kinetic energy of the boy as he lands on the trampoline is 600 J.

The maximum kinetic energy of the boy after he bounces is 45% of his kinetic energy as he lands.

Calculate the maximum kinetic energy of the boy after he bounces.

[2 marks]

Maximum kinetic energy = _____ J

e)

Why is the kinetic energy of the boy after he bounces less than his kinetic energy as he lands?

[1 mark]

Tick (✓) **one** box.

Energy is not conserved.

☐

Energy is transferred to the surroundings.

☐

The springs transfer energy to the boy.

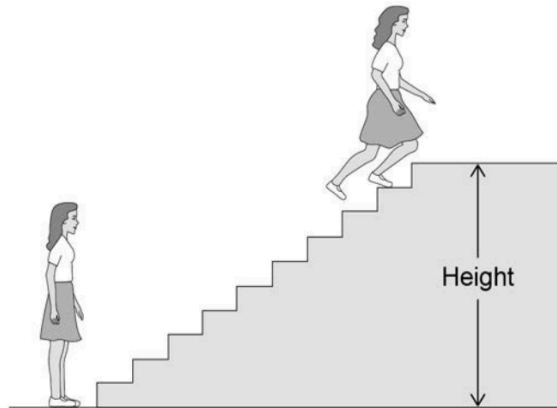
☐

a)

A girl ran to the top of some stairs.

Figure 2 shows the stairs.

Figure 2



The girl measured the height of the stairs.

What measuring instrument should she have used?

[1 mark]

b)

The height of the stairs was 1.7 m.

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

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

[2 marks]

Gravitational potential energy = _____ J

c)

Subtopic: Energy stores and systems

<http://www.pcfgstudy.com>

A boy ran up the same stairs and did 1800 J of work.

The time it took the boy to run up the stairs was 1.44 s.

Calculate the power of the boy.

Use the equation:

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

Power = _____ W

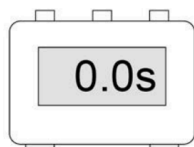
d)

Which stop-clock was used to measure the time the boy took to run up the stairs?

[1 mark]

Tick (✓) **one** box.

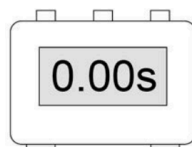
Stop-clock A

☐

Stop-clock B

☐

Stop-clock C

☐

e)

The boy had a speed of 2.0 m/s at the top of the stairs.

The mass of the boy was 70 kg.

Calculate the kinetic energy of the boy at the top of the stairs.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

Kinetic energy = _____ J

Q7.(2022)

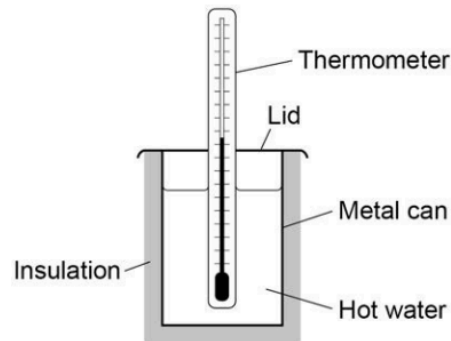
a)

A student investigated the insulating properties of two different materials.

The same thickness of each material was used.

Figure 9 shows some of the equipment used by the student.

Figure 9

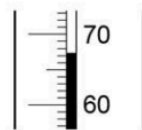


The student used two different types of thermometer to measure the temperature changes.

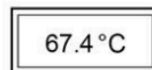
Figure 10 shows a reading on each thermometer.

Figure 10

Thermometer A



Thermometer B



What is the resolution of thermometer **B**?

[1 mark]

Tick (✓) **one** box.

0.1 °C

☐

0.4 °C

☐

67.0 °C

☐

67.4 °C

☐

b)

Complete the sentence.

Choose the answer from the box.

[1 mark]

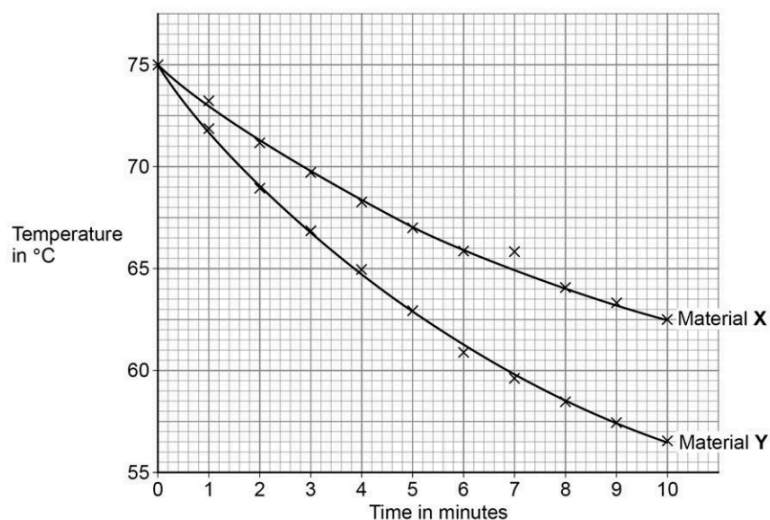
a smaller	the same	a bigger
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Thermometer **A** has _____ chance of being misread than thermometer **B**.

c)

Figure 11 shows the results.

Figure 11



The mass of water used was 0.12 kg.

specific heat capacity of water = 4200 J/kg °C

Determine the total change in thermal energy of the water when Material **X** was used.

Use values from **Figure 11**.

Use the Physics Equations Sheet.

[4 marks]

Total change in thermal energy = _____ J

d)

There is an anomalous result on **Figure 11**.

Draw a ring around the anomalous result.

[1 mark]

e)

Give **two** conclusions that can be made from **Figure 11**.

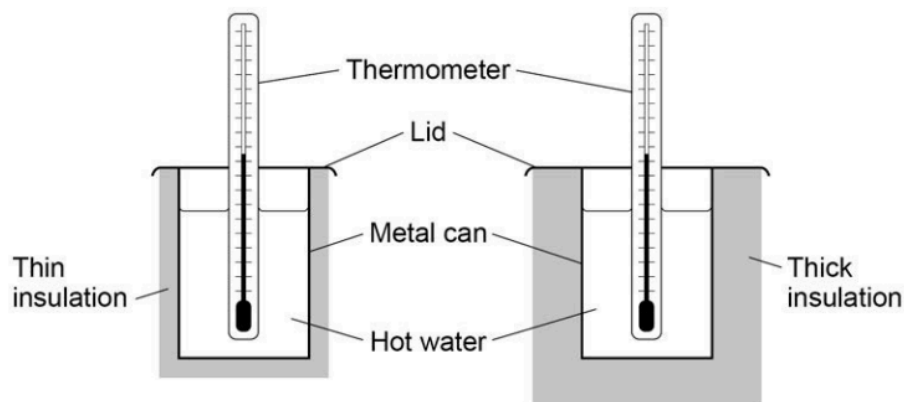
[2 marks]

f)

Another student investigated how the thickness of the insulation affected the rate of cooling of hot water.

Figure 12 shows some of the equipment used.

Figure 12



How would using thick insulation affect the rate of cooling of hot water compared with using thin insulation?

[1 mark]

Tick (✓) **one** box.

The rate of cooling would be higher.

☐

The rate of cooling would be lower.

☐

The rate of cooling would not change.

☐

g)

Subtopic: Energy stores and systems

<http://www.pcfgstudy.com>

Predict how using thick insulation would affect the temperature of the water after 10 minutes compared with using thin insulation.

[1 mark]

Tick (✓) **one** box.

The temperature would be higher.

☐

The temperature would be lower.

☐

The temperature would be the same.

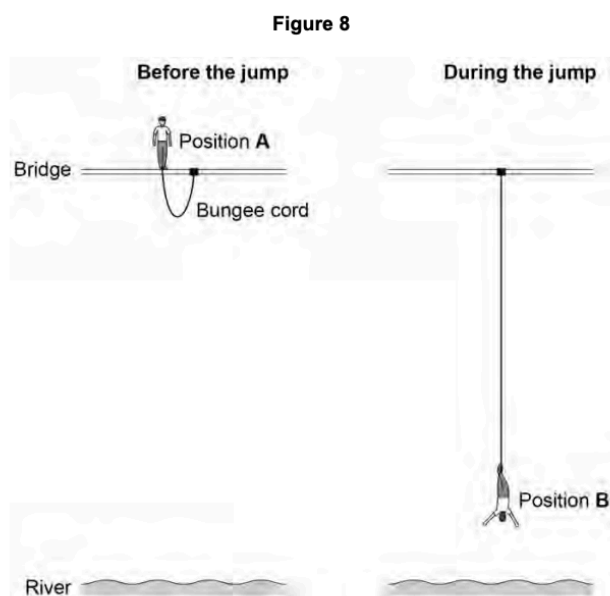
☐

Q8.(2023)

a)

Figure 8 shows a student before and during a bungee jump.

The diagram is not to scale.



In position **B**, the student is moving towards the river and the bungee cord is stretching.

How do the energy stores in position **B** compare with the energy stores in position **A**?

[3 marks]

Tick (✓) **one** box in **each** row.

Energy store	Less than at A	The same as at A	More than at A
The student's gravitational potential energy			
The student's kinetic energy			
The bungee cord's elastic potential energy			

b)

Subtopic: Energy stores and systems

<http://www.pcfgstudy.com>

The bungee cord behaves like a spring with a spring constant of 78.4 N/m.

At one point in the bungee jump, the extension of the bungee cord is 25 m.

Calculate the elastic potential energy stored by the bungee cord.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times \text{extension}^2$$

[2 marks]

Elastic potential energy = _____ J

c)

Table 5 shows information about different bungee cords.

Table 5

Bungee cord	Spring constant in N/m	Maximum extension before snapping in metres
A	78.4	36
B	82.0	24
C	84.5	12

Bungee cord **C** will have a smaller extension than **A** or **B** for any bungee jumper.

Give the reason why.

[1 mark]

Q8.d)(2023)

Which bungee cord would be safest to use for a person with a large weight?

Give a reason for your answer.

[2 marks]

Bungee cord _____

Reason _____

Q9.(2024)

a)

Figure 16 shows a wind turbine.

Figure 16



Wind turbines may generate electricity when the electricity is not needed.

Two methods that can be used to store the energy from the turbine are:

Method A: Heating water to a high temperature.

Method B: Pumping water uphill into a reservoir.

Which energy store increases when water is heated?

[1 mark]

b)

Which energy store increases when water is pumped uphill into a reservoir?

[1 mark]

c)

Table 4 shows information about the two methods of storing energy.

Table 4

Method	Energy stored per 100 kg of water in kJ	Percentage of stored energy wasted	Installation
A: Increasing water temperature by 80 °C	33 600	40%	Anywhere
B: Pumping water uphill to a height of 500 m	490	25%	High mountains

Compare the advantages and disadvantages of the two methods of storing energy.

Include calculations in your answer.

[4 marks]

d)

Decreasing the amount of carbon dioxide released by different activities will help slow down climate change.

Transport and generating electricity are the two activities that released the largest amounts of carbon dioxide in the UK in 2018.

Explain **one** change that would reduce the amount of carbon dioxide released by **each** activity.

[4 marks]

Transport _____

Generating electricity _____

a)

A nuclear power station has a power output of 500 MW.

Calculate the energy output in 3600 s.

Give your answer in J.

[3 marks]

Energy output = _____ J

b)

Radioactive waste produced by nuclear power stations has a long half-life.

Suggest **one** precaution taken to reduce the hazard caused by radioactive waste from power stations.

[1 mark]

c)

Nuclear power stations do **not** generate electricity every day of the year.

One nuclear power station generated electricity for 92% of a year.

one year = 365 days

Calculate the number of days during the year that the nuclear power station generated electricity.

[2 marks]

Number of days = _____