AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.1.1.1 ENERGY STORES AND SYSTEMS (PACK 2)

SCORE	PERCENTAGE
/67	%

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Q1.

The diagram below shows a cyclist riding along a flat road.



(a) Complete the sentence.

Choose answers from the box.

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.

(2)

(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:

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

_____

_____

_____

_____

Kinetic energy = _____ J

(2)

(c) When the cyclist uses the brakes, the bicycle slows down.

This causes the temperature of the brake pads to increase by 50 °C.
The mass of the brake pads is 0.040 kg.
The specific heat capacity of the material of the brake pads is 480 J/kg °C.

Calculate the change in thermal energy of the brake pads.

Use the equation:

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change in thermal energy = mass × specific heat capacity × temperature change

_____

_____

_____

Change in thermal energy = _____ J

(2)

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

Tick **one** box.

Decreased ☐

Increased ☐

Not affected ☐

(1)

(Total 7 marks)

Q2.

Figure 1 shows a cyclist riding along a straight, level road at a constant speed.

Figure 1



(a) Complete the sentences.

As the cyclist rides along the road, the _____ energy store in the cyclist's body decreases.

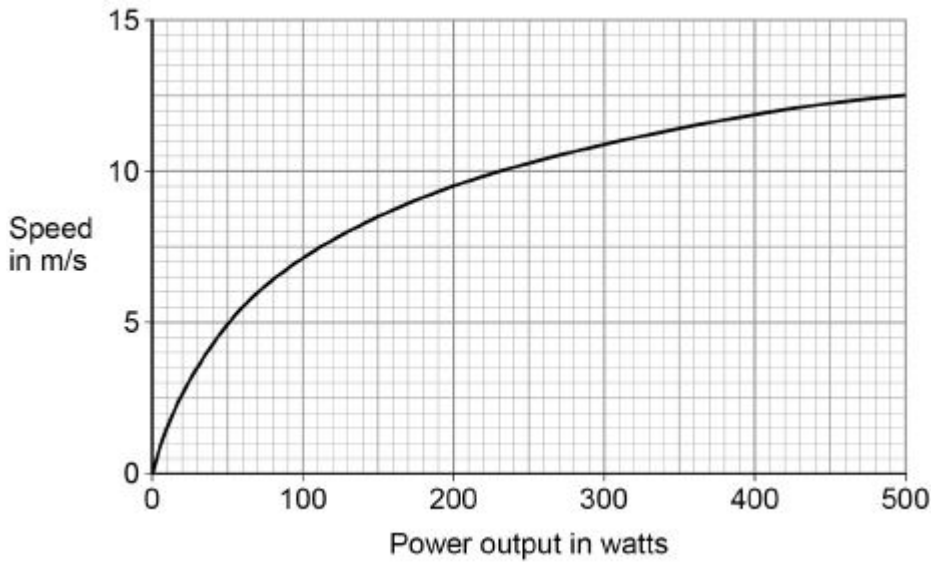
The speed of the cyclist is constant when the work done by the cyclist is _____ the work done against air resistance.

(2)

Figure 2 shows how the speed changes as the power output of the cyclist changes.

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Figure 2



(b) Write down the equation that links power, time and work done.

_____

(1)

(c) Calculate the work done by the cyclist when his power output is 200 W for 1800 seconds.

_____

_____

_____

_____

Work done = _____ J

(3)

(d) Calculate the percentage increase in speed of the cyclist when the power output changes from 200 W to 300 W.

_____

_____

_____

_____

Percentage increase in speed = _____

(2)

(e) The maximum speed this cyclist can travel on a level road is 14 m/s.

How does cycling uphill affect the maximum speed of this cyclist?

Explain your answer.

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_____

_____

_____

_____

_____

_____

(3)

(Total 11 marks)

Q3.

The photograph below shows a coffee machine. The coffee machine uses an electric element to heat water.



(a) The coffee machine has a metal case.

Why would it be dangerous for the live wire of the electric cable to touch the metal case?

_____

_____

(1)

(b) The power output of the coffee machine is 2.53 kW.

The mains potential difference is 230 V.

Calculate the current in the coffee machine.

_____

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_____

_____

_____

Current = _____ A

(3)

(c) The coffee machine heats water from 20 °C to 90 °C.

The power output of the coffee machine is 2.53 kW.

The specific heat capacity of water is 4200 J/kg °C.

Calculate the mass of water that the coffee machine can heat in 14 seconds.

_____

_____

_____

_____

_____

Mass = _____ kg

(5)

(Total 9 marks)

Q4.

The diagram below shows a wind turbine.



(a) At a particular wind speed, a volume of 2.3×10^4 m^3 of air passes the blades each second.

The density of air is 1.2 kg/m^3.

Calculate the mass of air passing the blades per second.

_____

_____

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_____

_____

Mass of air per second = _____ kg

(3)

(b) The power output of the turbine is directly proportional to the kinetic energy of the air passing the blades each second.

Describe the effect on the power output when the wind speed is halved.

_____

_____

_____

_____

_____

_____

(3)

(c) At a different wind speed, the wind turbine has a power output of 388 kW.

The mass of air passing the wind turbine each second is 13 800 kg.

Calculate the speed of the air passing the blades each second.

Assume that the process is 100% efficient.

_____

_____

_____

_____

Speed of air = _____ m/s

(3)

(Total 9 marks)

Q5.

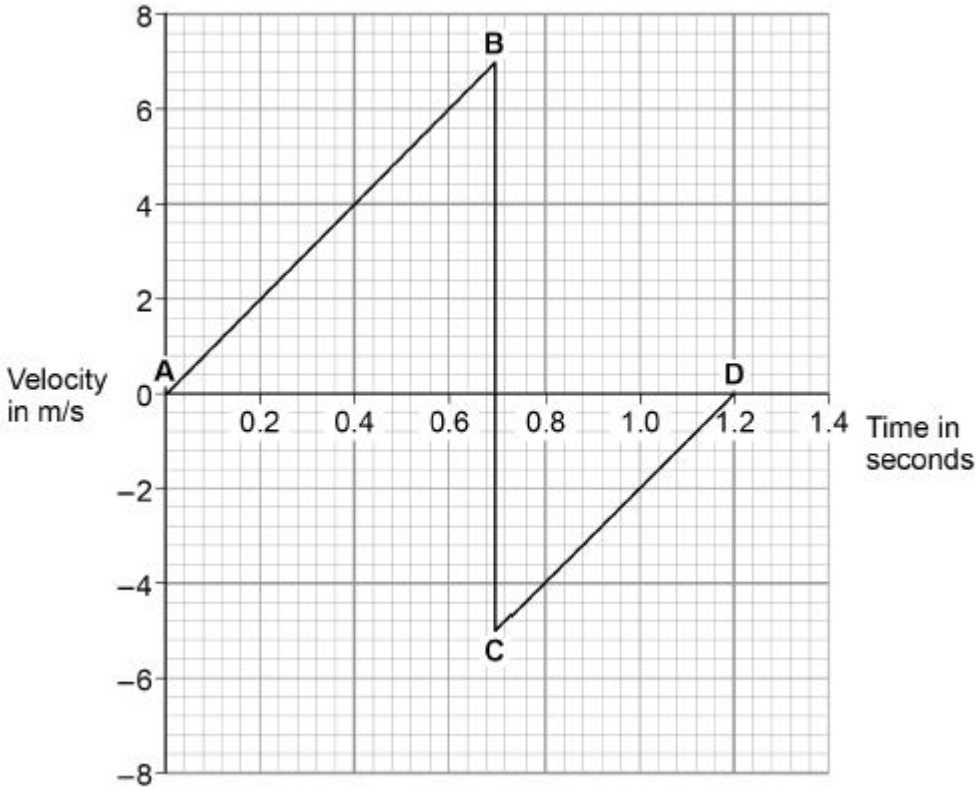
A child drops a ball.

The ball hits the ground and bounces.

The graph below shows the velocity-time graph for the ball from when the ball is dropped until when the ball reaches the top of its first bounce.

Air resistance has been ignored.

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(a) Describe the motion of the ball between points **A** and **B** on the graph above.

_____

_____

_____

_____

(2)

(b) What direction is the ball moving between points **C** and **D** on the graph above?

_____

(1)

(c) The ball and the Earth form a system.

What is meant by 'a system'?

Tick **one** box.

A group of objects that interact. ☐

Objects with big differences in mass. ☐

Objects with gravitational potential energy. ☐

(1)

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(d) When the ball hits the ground, energy is transferred from the ball to the Earth.

Explain how the data in the graph above shows this energy transfer.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q6.

The image shows a battery-powered drone.



(a) Complete the sentences.

Choose the answers from the box.

	chemical	**elastic potential**	
gravitational potential		**kinetic**	**nuclear**

As the drone accelerates upwards

its _____ energy increases

and its _____ energy increases.

The _____ energy store

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of the battery decreases.

(3)

(b) In the USA, drones are not allowed to be flown too high above the ground.

Suggest **one** possible risk of flying a drone too high above the ground.

_____

_____

_____

(2)

(c) Write down the equation that links energy transferred, power and time.

_____

(1)

(d) The drone can fly for 25 minutes before the battery needs recharging.

The power output of the battery is 65.0 W

Calculate the maximum energy stored by the battery.

_____

_____

_____

_____

Maximum energy = _____ joules

(3)

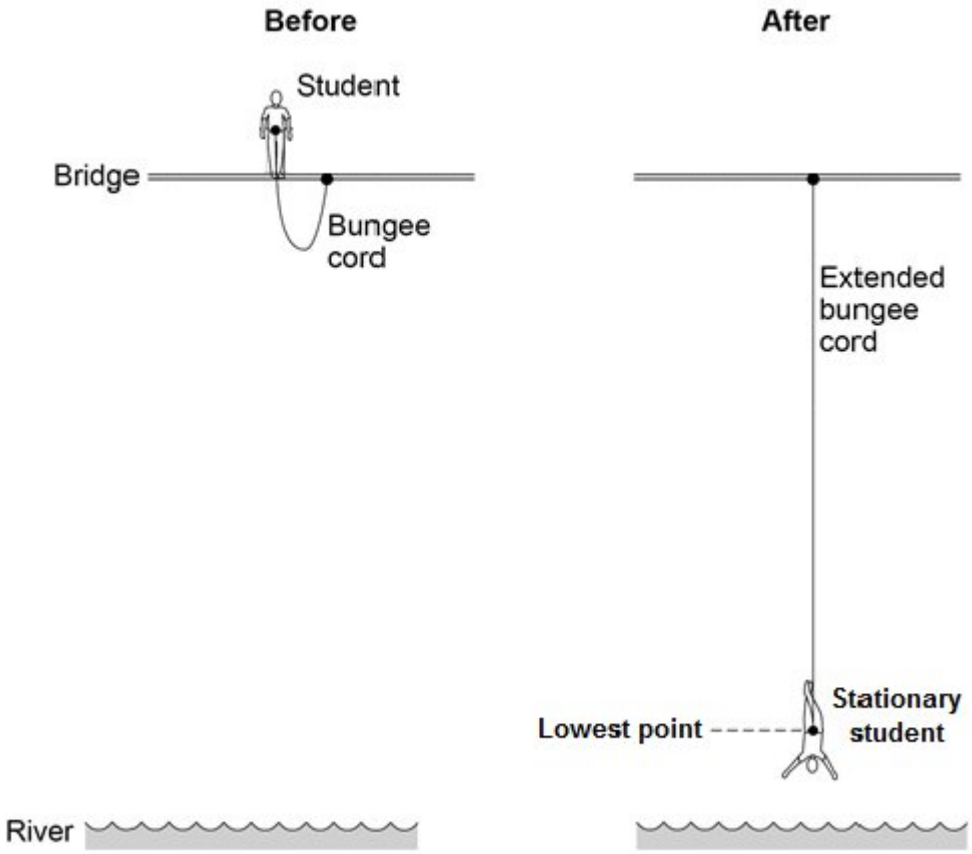
(Total 8 marks)

Q7.

The image below shows a student before and after a bungee jump.

The bungee cord has an unstretched length of 20 m.

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(a) For safety reasons, it is important that the bungee cord used is appropriate for the student's weight.

Give **two** reasons why.

1. _____

_____

2. _____

_____

(2)

(b) The student jumps off the bridge.

Complete the sentences to describe the energy transfers.

Use answers from the box.

elastic potential	**gravitational potential**	**kinetic**	**sound**
	thermal		

Before the student jumps from the bridge he has a store of

_____ energy.

When he is falling, the student's store of _____

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energy increases.

When the bungee cord is stretched, the cord stores energy as

_____ energy.

(3)

(c) At the lowest point in the jump when the student is stationary, the extension of the bungee cord is 35 metres.

The bungee cord behaves like a spring with a spring constant of 40 N / m.

Calculate the energy stored in the stretched bungee cord.

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

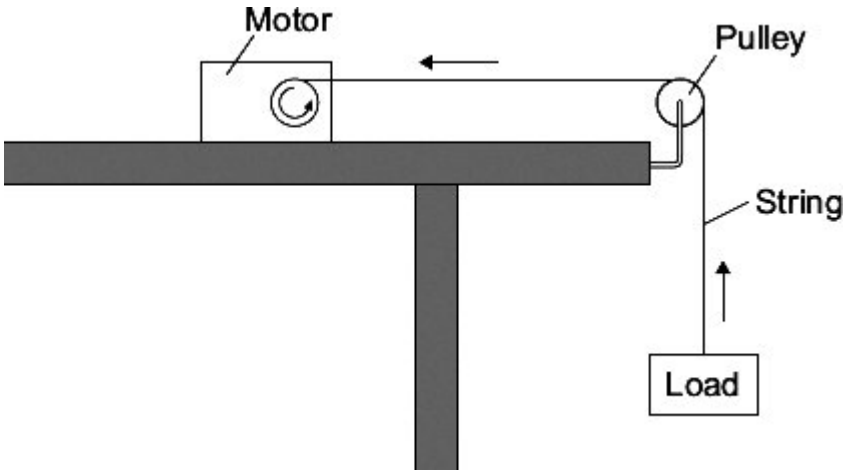
Energy = _____ J

(2)

(Total 7 marks)

Q8.

A student uses an electric motor to lift a load.



In the motor, the electrical energy is transferred into other types of energy. Some of this energy is useful and the rest of the energy is wasted.

(a) (i) Name the useful energy output from the electric motor.

_____

(1)

(ii) What eventually happens to the wasted energy?

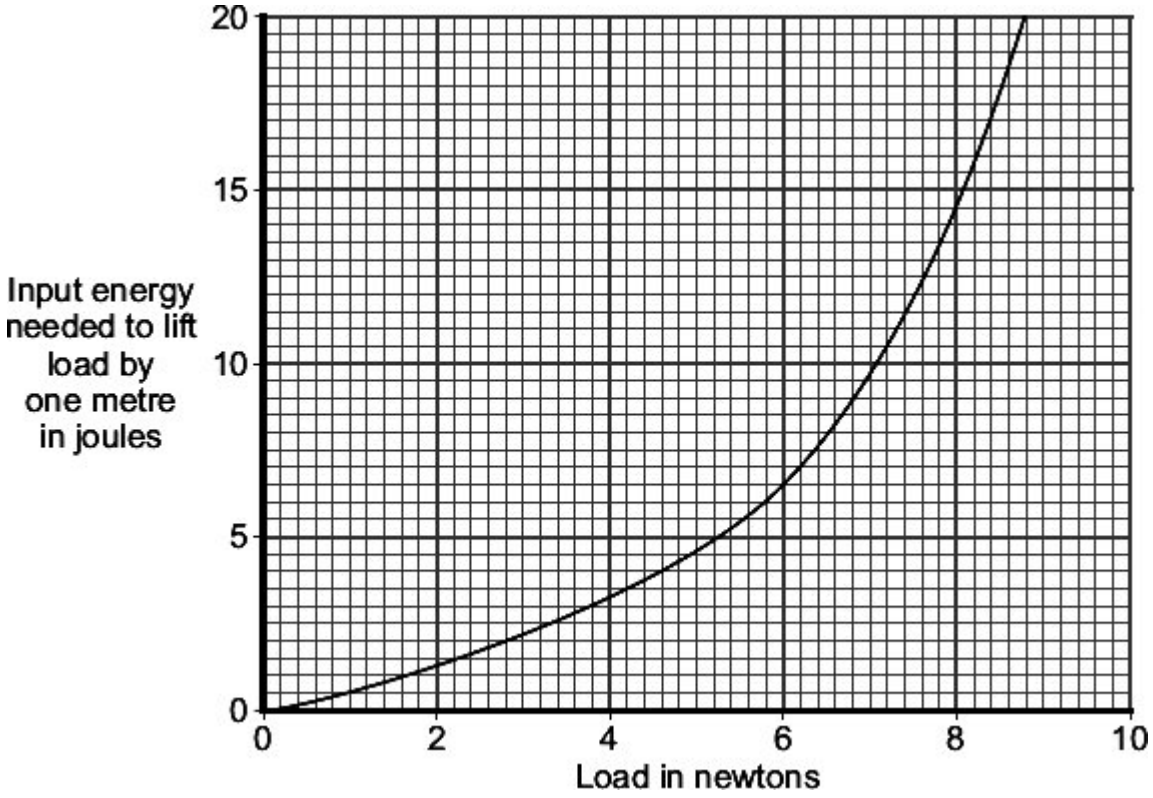
_____

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_____

(1)

(b) The graph shows the input energy the motor needs to lift different loads by one metre.



What can you conclude from the graph about the relationship between the load lifted and the input energy needed?

_____

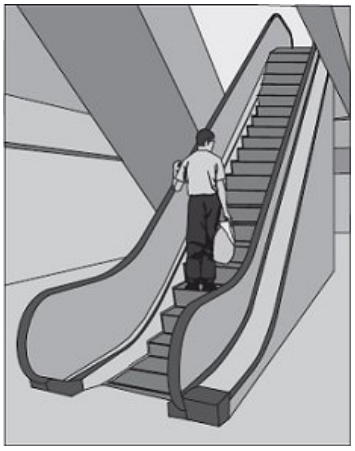
_____

_____

_____

(2)

(c) A shop uses escalators to lift customers to different floor levels. The escalators use electric motors. When the shop is not busy some escalators are turned off. A sign tells the customers that the escalators are turned off to save energy.



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(i) Each escalator has one motor with an average power of 4000 W. The motor is turned on for an average of 8 hours each day, 6 days each week. Electricity costs 15 pence per kilowatt-hour.

Calculate the cost of the electricity used in an average week to run **one** escalator.

Show clearly how you work out your answer.

_____

_____

_____

_____

Cost = _____ pence

(3)

(ii) Give **one** environmental advantage to turning off electrical appliances when they are not being used.

_____

_____

(1)

(Total 8 marks)

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