2021 ASSESSMENT MATERIALS

GCSE
PHYSICS

Physics Test 1: Energy (Higher)

Total number of marks: 35

1 0 **Figure 19** shows a tennis ball thrown vertically into the air.

Figure 19

At position **C**, the ball has just left the tennis player's hand at a speed of 5.0 m/s

The tennis ball has a mass of 0.058 kg

1 0 . 1 Write down the equation that links kinetic energy, mass and speed.

[1 mark]

$KE = \frac{1}{2}mv^2$

10.2 Calculate the kinetic energy of the tennis ball at position **C**.

[2 marks]

$KE = \frac{1}{2} m v^2$

$= \frac{1}{2} \times 0.058 \times 5^2$

Kinetic energy = 0.725 J

10.3 At position **A** the tennis ball is at maximum height.

What is the gravitational potential energy of the tennis ball at position **A**?

Ignore the effect of air resistance.

[1 mark]

0.725J

At position **B** the tennis ball has 0.38 J of gravitational potential energy.

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

[1 mark]

GPE = mgh

10.5 Calculate the height of the tennis ball above the tennis player's hand when at position **B**.

gravitational field strength = 9.8 N/kg

[3 marks]

$0.38 = 0.058 \times 9.8 \times h$

$= 0.6685$

≈ 0.669

Height = 0.669 m

0 4 **Figure 5** shows a cyclist riding along a straight, level road at a constant speed.

Figure 5

0 4 . 1 Complete the sentences.

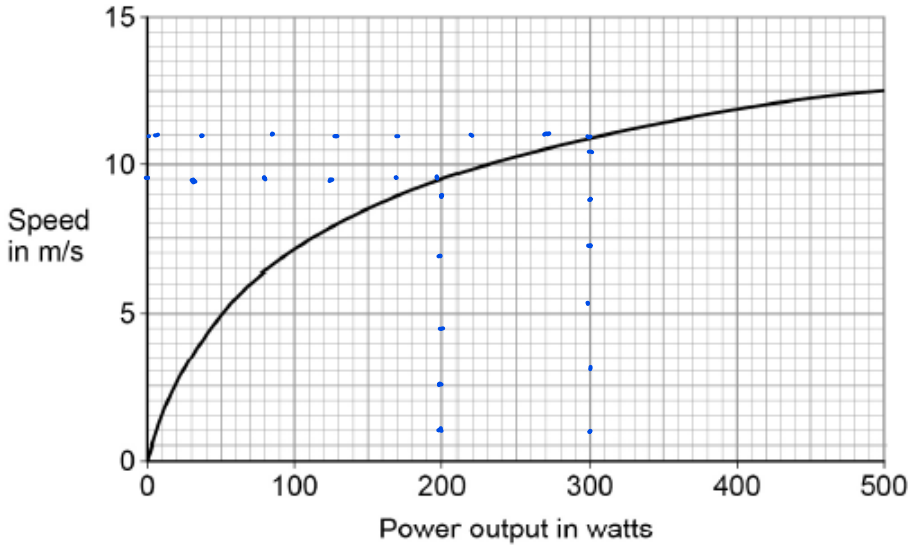
[2 marks]

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

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

Figure 6 shows how the speed changes as the power output of the cyclist changes.

Figure 6



0 4 . 2 Write down the equation that links power, time and work done.

[1 mark]

Power = work done / time

0 4 . 3 Calculate the work done by the cyclist when his power output is 200 W for 1800 seconds.

[3 marks]

200 = W.d. / 1800

Work done = 360000 J

0 4 . 4 Calculate the percentage increase in speed of the cyclist when the power output changes from 200 W to 300 W.

[2 marks]

200 → 9

300 → 12

3/9 x 100%.

Percentage increase in speed = 33%.

0 4 . 5 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?

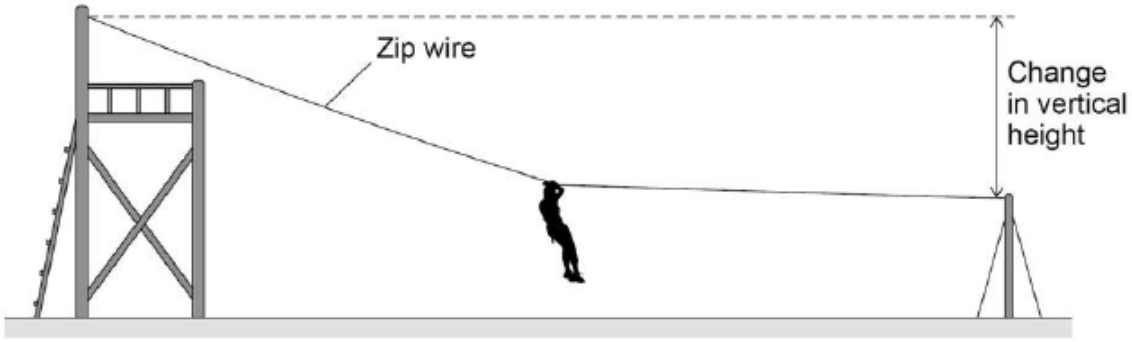
Explain your answer.

[3 marks]

Speed would decrease as a proportion of cyclist's power will be used to increase the gravitational potential energy of the cyclist. Therefore, a less amount of power will be responsible for the KE, which results in a lower speed.

0 7 **Figure 9** shows a person sliding down a zip wire.

Figure 9



0 7 . 1 As the person slides down the zip wire, the change in the gravitational potential energy of the person is 1.47 kJ

The mass of the person is 60 kg

gravitational field strength = 9.8 N/kg

GPE = mgh
1470 = 60 x 9.8 x h

Calculate the change in vertical height of the person.

[3 marks]

Change in vertical height = 2.5 m

0 7 . 2 As the person moves down the zip wire her increase in kinetic energy is less than her decrease in gravitational potential energy.

Explain why.

[2 marks]

The rate at which height decreases close to the end of the zip wire is less compared to the start of the zip wire.

0 7 . 3 Different people have different speeds at the end of the zip wire.

Explain why.

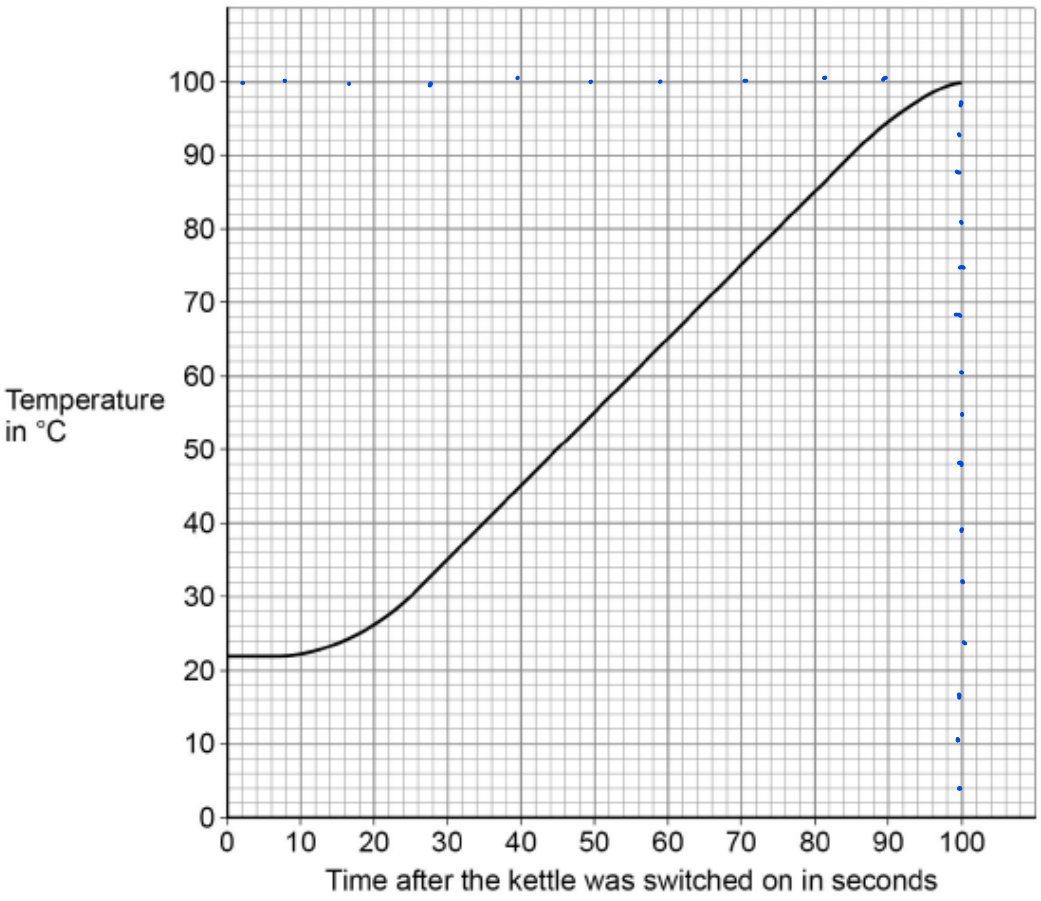
[2 marks]

Final speed at the end depends on the mass of the person, as a higher mass would have a higher GPE at the start and hence a high KE at the end, increasing the speed.

0 7 An electric kettle was switched on.

Figure 10 shows how the temperature of the water inside the kettle changed.

Figure 10



0 7 . 1 When the kettle was switched on the temperature of the water did **not** immediately start to increase.

Suggest **one** reason why.

The coil has to warm up, which takes time. **[1 mark]**

0 7 . 2 The energy transferred to the water in 100 seconds was 155 000 J.

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

Determine the mass of water in the kettle.

Use **Figure 10**.

Give your answer to 2 significant figures.

$E = mc\Delta T$

$155000 = m \times 4200 \times (100 - 22)$

$m = \frac{155000}{327600} = 0.473 \approx 0.47$ **[5 marks]**

Mass of water (2 significant figures) = 0.47 kg

0 7 . 3 The straight section of the line in **Figure 10** can be used to calculate the useful power output of the kettle.

Explain how.

[3 marks]

The gradient of the line gives change in temperature per unit time.

It can be used in the $mc\Delta T$ to find the energy transfered to water per unit time which is the power output of the kettle.