Energy types and transfers practise questions and answers

Name: _____

Class: _____

Date: _____

Time: **50 minutes**

Marks: **50 marks**

Your score:
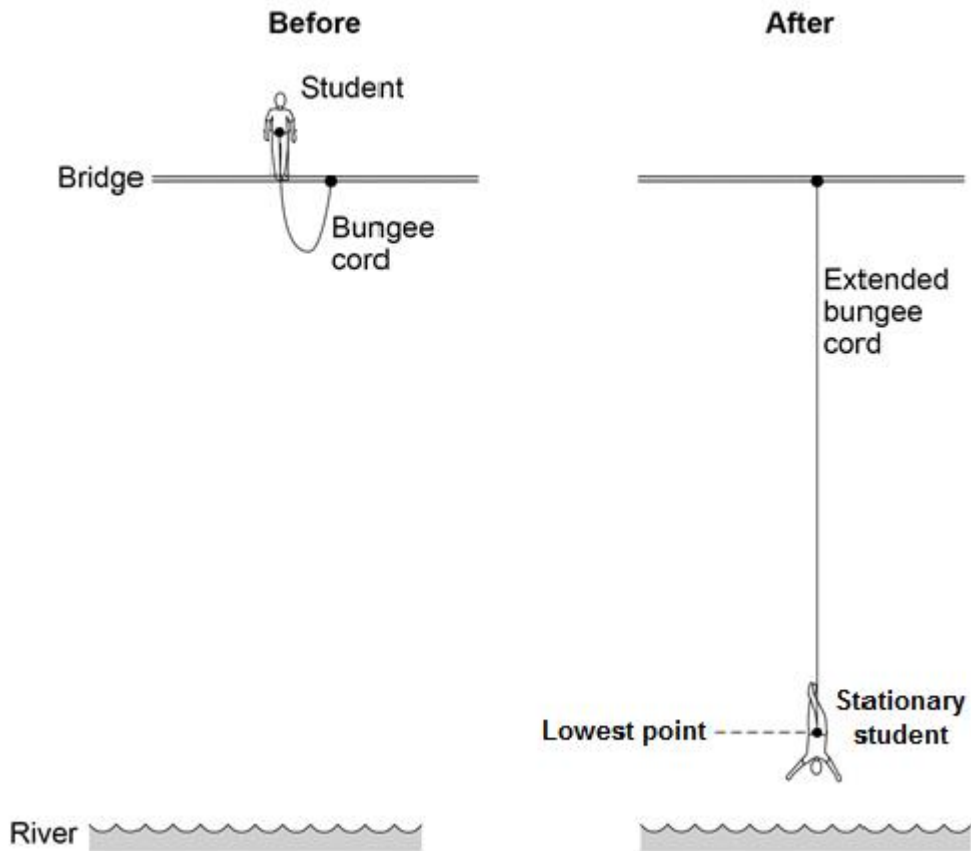
What went well:

How to improve:

Q1.

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

The bungee cord has an unstretched length of 20 m.

(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 _____

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.

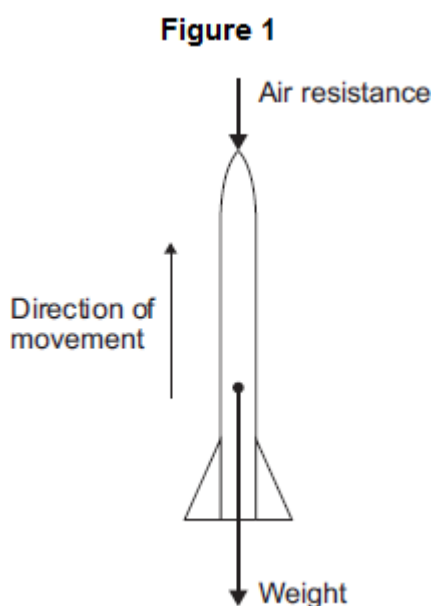Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

Energy = _____ J

(2)

(Total 7 marks)

Q2.
   Figure 1 shows the forces acting on a model air-powered rocket just after it has been launched vertically upwards. The rocket will continue travelling vertically upwards to a maximum height where it slows to a speed of 0 m / s and falls back to Earth

Figure 1

(a)   The speed of the rocket just after being launched is 12 m / s.
The mass of the rocket is 0.05 kg.

   (i)   Calculate the kinetic energy of the rocket just after being launched.

   _____

   _____

   _____

   Kinetic energy = _____ J

(2)

   (ii)   As the rocket moves upwards, it gains gravitational potential energy.

   State the maximum gravitational potential energy gained by the rocket.

   Ignore the effect of air resistance.

   Maximum gravitational potential energy = _____ J

(1)

   (iii)   Calculate the maximum height the rocket will reach.

   Ignore the effect of air resistance.

   Gravitational field strength = 10 N/kg.

   _____

   _____

   _____

   Maximum height = _____ m

(2)

(Total 5 marks)

Q3.

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

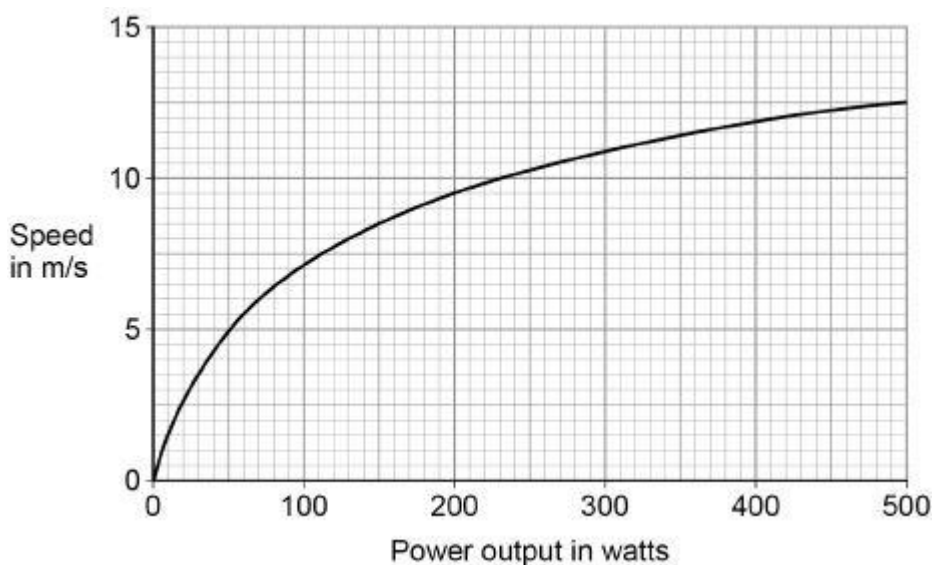**Figure 1**

(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.

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.

_____

_____

_____

_____

_____

_____

(3)
(Total 11 marks)

Q4.

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

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

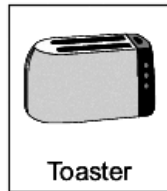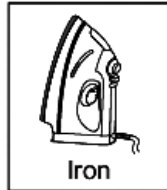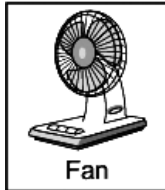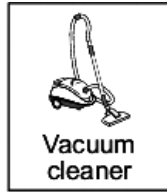Calculate the maximum energy stored by the battery.

_____

_____

Maximum energy = _____ joules

(3)

(Total 8 marks)

Q5.

The appliances shown below transfer electrical energy to other types of energy.

Vacuum cleaner

Fan

Iron

Drill

Washing machine

Toaster

Television

(a)   The vacuum cleaner is designed to transfer electrical energy to kinetic energy.

Three more of the appliances are also designed to transfer electrical energy to kinetic energy. Which **three**?

Draw a ring around each correct appliance.

3

(b)   Which **two** of the following statements are true?

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully. ☐

The energy transferred by appliances will be destroyed. ☐

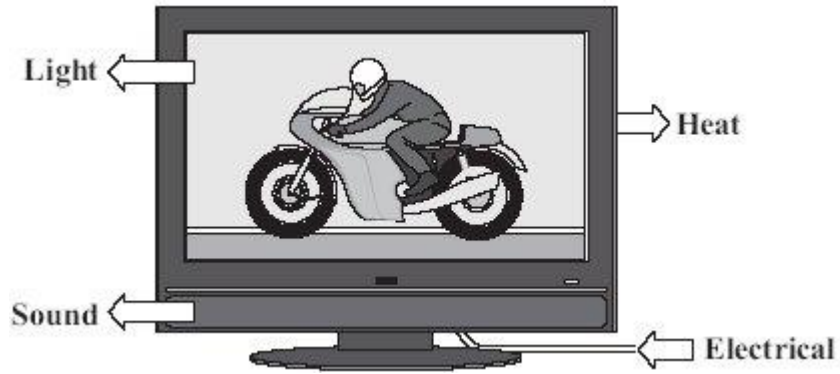The energy transferred by appliances makes the surroundings warmer. ☐

The energy output from an appliance is bigger than the energy input. ☐

(2)
(Total 5 marks)

Q6.

The diagram shows the energy transformations produced by a TV.

(a) Use words from the diagram to complete the following sentence.

The TV is designed to transform _____ energy into

light and _____ energy.

(2)

(b) Which **one** of the following statements is **false**?

Put a tick (✔) in the box next to the **false** statement.

The energy transformed by the TV makes the surroundings warmer. ☐

The energy transformed by the TV becomes spread out. ☐

The energy transformed by the TV will be destroyed. ☐

(1)

(c) Two different makes of television, **A** and **B**, transform energy at the same rate. Television **A** wastes less energy than television **B**.

Complete the following sentence by drawing a ring around the correct line in the box.

Television **A** has

| a higher efficiency than |
| the same efficiency as |
| a lower efficiency than |

television **B**.

(1)
(Total 4 marks)

Q7.

Complete the following sentences.

A TV set is designed to transfer electrical energy into _____

energy and _____ energy.

A hair dryer is designed to transfer electrical energy into _____

energy and _____ energy.

(Total 4 marks)

Q8.

A gas burner is used to heat some water in a pan.

Of the energy released by the burning gas by the time the water starts to boil:
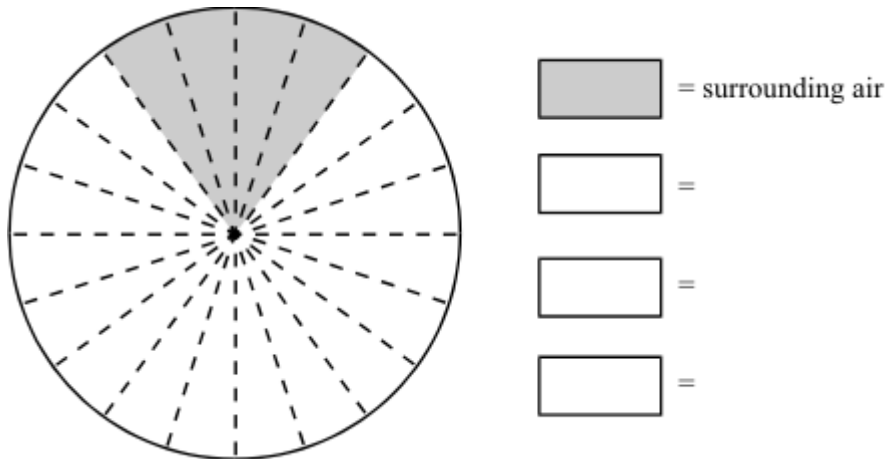
60% has been transferred to the **water**.

20% has been transferred to the **surrounding air**.

13% has been transferred to the **pan**.

7% has been transferred to the **gas burner** itself.

(a)   Use the above information to complete the pie-chart.

[ ] = surrounding air

[ ] =

[ ] =

[ ] =

(3)

(b)   Some of the energy released by the burning gas is wasted.

   (i)   What happens to this wasted energy?

   _____

   _____

(2)

   (ii)   What percentage (%) of the energy from the gas is wasted? Answer: _____ %

(1)
(Total 6 marks)

Mark schemes

Q1.

(a) any **two** from:

- bungee rope may snap
- rope may extend too much
- student may land in the river

2

(b) gravitational potential
correct order only

1

kinetic

1

elastic potential

1

(c) ½ × 40 × 35²

1

24 500 (J)
accept 25 000 (J) (2 significant figures)

1

allow 24 500 (J) with no working shown for 2 marks

[7]

Q2.

(a) (i) 3.6
allow 1 mark for correct substitution i.e.
½ × 0.05 × 12² provided no subsequent step

2

(ii) 3.6 **or** their (i)

1

(iii) 7.2
or
their (ii) ÷ 0.5 correctly calculated
*allow **1** mark for correct substitution i.e.*
3.6 or their (ii) = 0.05 × 10 × h

2

(iv) **B**

[5]

Q3.
(a) chemical

1

equal to

1

(b) $power = \dfrac{work\ done}{time}$

allow $P = \dfrac{W}{t}$

1

(c) $200 = \dfrac{W}{1800}$

1

W = 200 × 1800

1

W = 360 000 (J)

1

*an answer of 360 000 (J) scores **3** marks*

(d) 11 − 9.5 = 1.5 (m/s)

allow a change in speed between 1.2 and 1.5 (m/s)

1

$\left(\dfrac{1.5}{9.5}\right) \times 100 = 15.8\,(\%)$

allow an answer consistent with their change in speed
*an answer of 16 (%) scores **2** marks*

1

*an answer that rounds to 15.8 (%) scores **2** marks*

(e) maximum speed is lower

1

because maximum power output of cyclist is constant
allow maximum force on pedals is constant

1

(but) additional work is done (against gravity)
*do **not** accept additional work done against friction or air resistance*

or
gravitational potential energy (of cyclist) is increased

1

[11]

Q4.

(a) gravitational potential

1

kinetic

chemical

1

1

(b) flying drones may damage aircraft
or
falling drones may injure people
or
damage buildings / vehicles

allow any sensible suggestion of a hazard caused by a flying / falling drone

1

(c) energy transferred = power × time

allow E = Pt

1

(d) t = 25 × 60 = 1500 (s)

1

E = 65 × 1500

1

E = 97 500 (J)

an answer of 97 500 (J) scores 3 marks
allow 2 marks for an answer of 1625 (J)

1

[8]

Q5.

(a) fan

1

drill

1

washing machine

*four circled including correct three scores **1** mark*
five circled scores zero

1

(b) Appliances only transfer part of the energy usefully

1

The energy transferred by appliances makes the surroundings warmer

1

[5]

Q6.

(a) electrical

1

sound

correct order only

1

(b) the energy transformed by the TV will be destroyed

1

(c) a higher efficiency than

1

[4]

Q7.

light;
sound;
heat;
kinetic/movement

for 1 mark each

[4]

Q8.

(a) 60% sector correct
other two sectors closer to 13:7 than 12:8 or 14:6
sectors correctly labelled (w.r.t rank order of size)

each for 1 mark

3

(b) (i) *ideas that wasted energy*
is transferred to   surrounding air
            pan
            stove
is converted to another/correctly named energy form

any 2 for 1 mark each

2

(ii) 40

for 1 mark

1

[6]