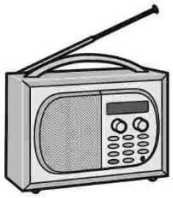
1 Electrical appliances transfer energy. Some of the energy transferred is useful.

Draw a line from each electrical appliance to the correct useful energy output.

Only draw **three** lines.

electrical appliance	useful energy output
 torch	sound
 radio	light
 electric fan	chemical
	kinetic

[3]

[Total: 3]

2 The diagram shows three horizontal forces acting on a car as it moves along a straight road.

The horizontal forces act along the same straight line.

The driver presses the brake pedal and the car slows down.
As the car slows down, the kinetic energy of the car decreases by 100 kJ.

Describe and explain what happens to this 100 kJ of energy.

.....

..... [2]

[Total: 2]

3 A man lifts 40 blocks onto a platform, as shown in diagram A.

He lifts 10 blocks at once and does this four times.

A machine can lift 40 blocks at once onto the same platform, as shown in diagram B.

Diagram A

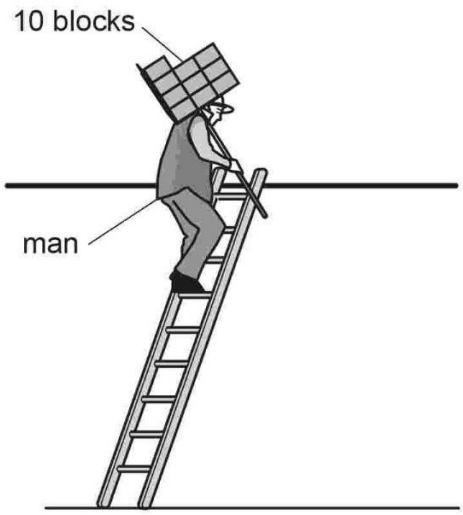
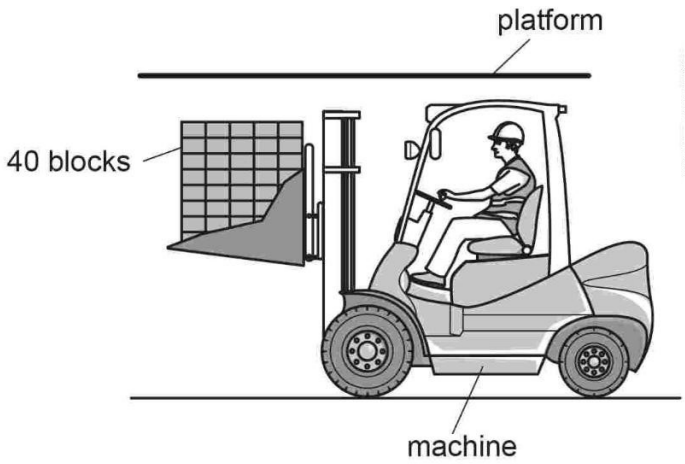


Diagram B



(a) State the term used for energy gained by the blocks when they are lifted onto the platform.

..... [1]

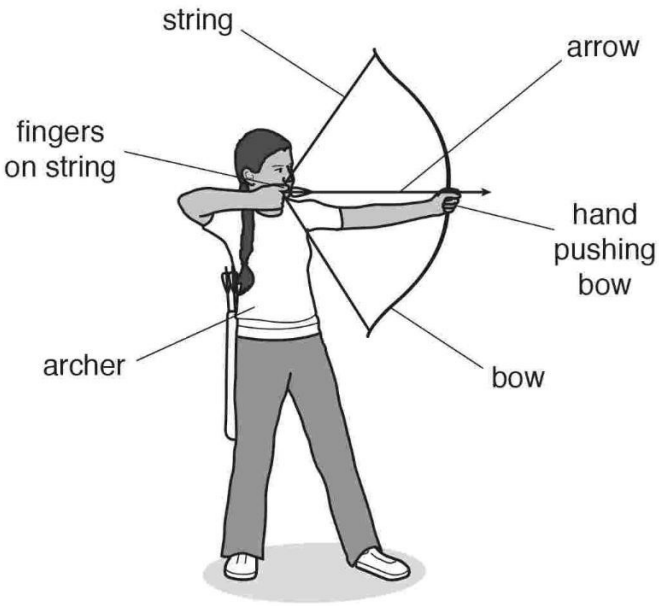
(b) State how the energy gained by 40 blocks when lifted by the man compares with the energy gained by 40 blocks when lifted by the machine.

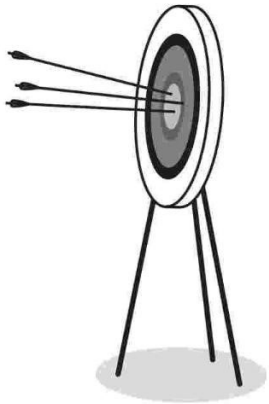
.....

..... [1]

[Total: 2]

4 The diagram shows an archer pulling the string of a bow.





State the type of energy stored in the bow when the archer bends it as shown in the diagram.

..... [1]

[Total: 1]

5 As an aeroplane decelerates, its kinetic energy decreases.

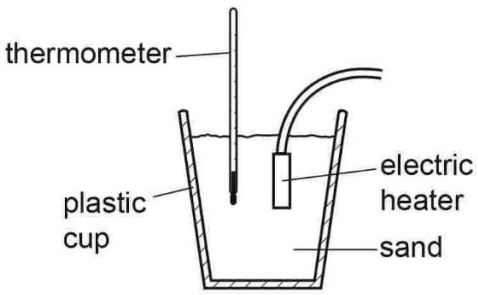
Suggest what happens to this energy.

.....

..... [1]

[Total: 1]

6 The diagram shows a plastic cup. The cup contains sand, an electric heater and a thermometer.



The power of the heater is 50 W. The mass of the sand in the cup is 550 g. The initial temperature of the sand is 20 °C. The heater is switched on for 2.0 minutes. The temperature is recorded until the temperature stops increasing. The highest temperature recorded by the thermometer is 33 °C.

(a) Calculate the energy supplied by the heater.

energy = ... [2]

(b) Calculate a value for the specific heat capacity of the sand, using your answer to **(a)** and the data in the question.

specific heat capacity = ... [3]

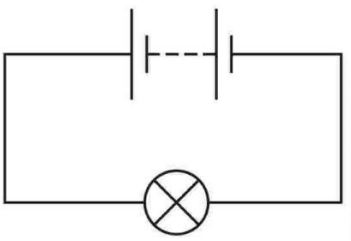
(c) Explain why the specific heat capacity of sand may be different from the value calculated in **(b)**.

.....

..... [2]

[Total: 7]

7 The diagram shows an electric circuit.



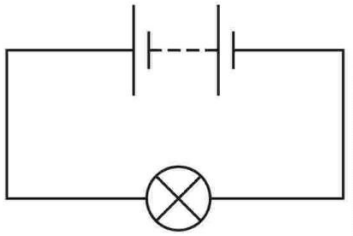
An electric current transfers energy from the battery to the filament lamp.

State which form of energy in the battery is decreasing.

..... [1]

[Total: 1]

8 The diagram shows an electric circuit.



An electric current transfers energy from the battery to the filament lamp.

Explain how the principle of conservation of energy applies to this circuit.

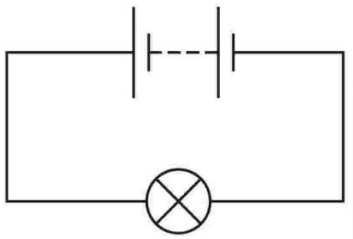
.....

.....

..... [1]

[Total: 1]

9 The diagram shows an electric circuit.



An electric current transfers energy from the battery to the filament lamp.

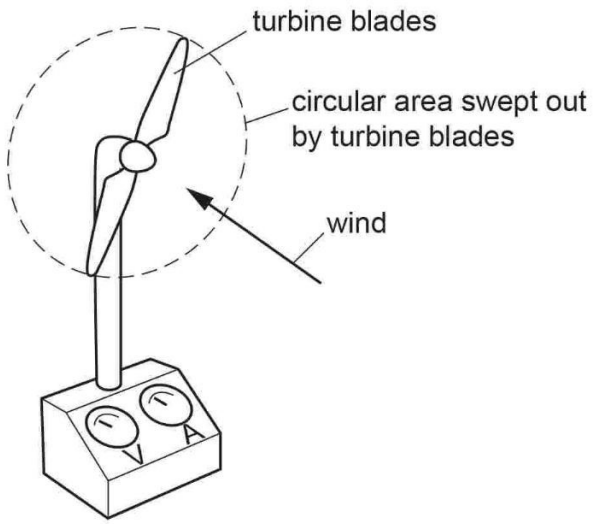
State the **two** forms of energy emitted by the filament lamp.

1. .....

2. ..... [2]

[Total: 2]

10 The diagram shows a model of a wind turbine used to demonstrate the use of wind energy to generate electricity. The wind is blowing towards the model, as shown.



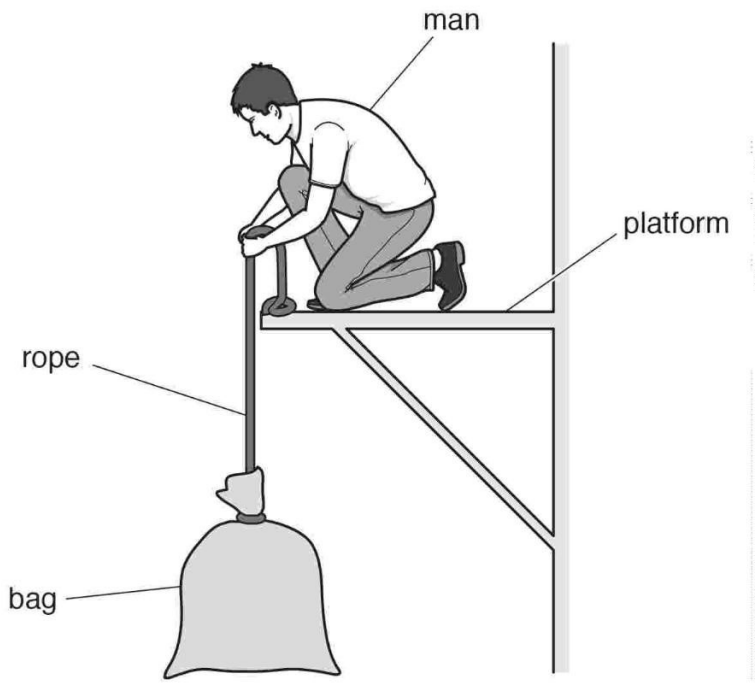
The mass of air passing through the circular area swept out by the turbine blades each second is 7.5 kg. The kinetic energy of the air that passes through this circular area each second is 240 J.

Calculate the speed of the air.

speed = ... [3]

[Total: 3]

11 A man is working on a platform. He uses a rope to raise a bag from the ground to the platform as shown in the diagram.



(a) State the type of energy gained by the bag as it is lifted at constant speed.

..... [1]

(b) The man then lifts a second bag from the ground to the platform. The first bag weighs 100 N and the second bag weighs 150 N.

On which bag of materials does the man do more work?

.....

Explain your answer.

.....

.....

[1]

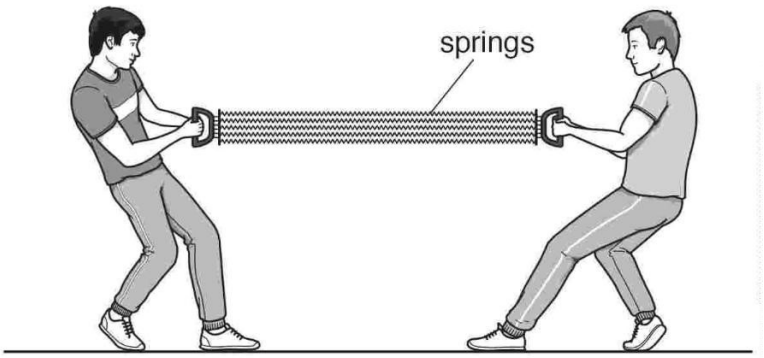
(c) The man wants to determine his useful power as he lifts one of the bags. He knows the weight of the bag. State the **two** other quantities he needs to know.

1 .....

2 ..... [2]

[Total: 4]

12 A chest expander is a piece of equipment used by athletes in a gym. The diagram shows a chest expander that consists of five identical springs connected in parallel between two handles.



Two athletes are stretching the chest expander by pulling on the two handles in opposite directions.

State the energy changes taking place as the two athletes use their muscles to stretch the chest expander.

.....

.....

..... [2]

[Total: 2]

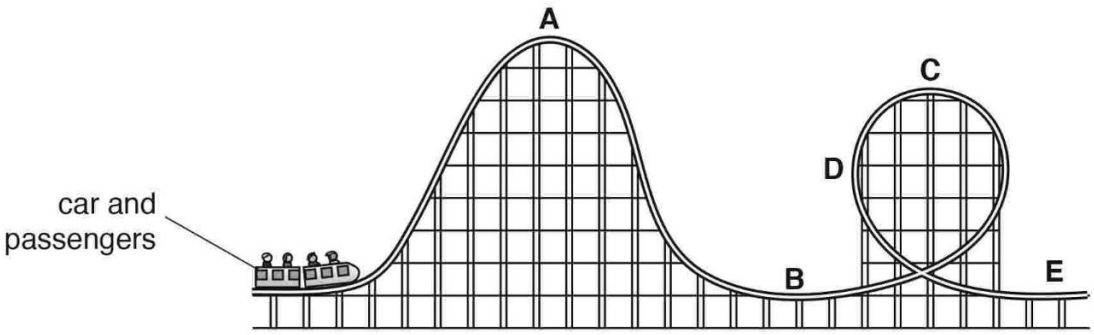
13 When fully charged, a 1.2 V rechargeable battery can deliver a current of 210 mA for 10 hours.

State the type of energy stored when the battery is charged.

..... [1]

[Total: 1]

14 The diagram represents part of a roller coaster track.



The car is lifted to point **A** and then released. It continues along the track.

Complete the sentences about the energy of the car using letters from the diagram.

The car has maximum gravitational potential energy at point ..... .

The car has maximum kinetic energy at point ..... .

[2]

[Total: 2]

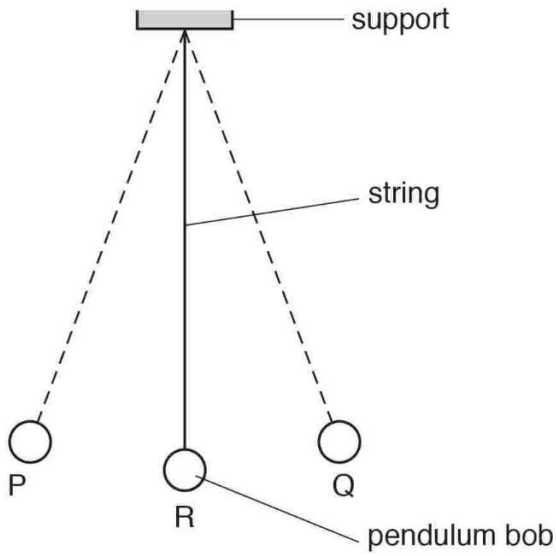
15 State the principle of conservation of energy.

.....

..... [2]

[Total: 2]

16 The diagram shows a simple pendulum swinging backwards and forwards between P and Q. One complete oscillation of the pendulum is when the bob swings from P to Q and then back to P.



As the pendulum bob moves from R to Q it gains 0.4 J of gravitational potential energy.

Air resistance can be ignored.

State the value of kinetic energy of the pendulum bob at

1. R ..... J

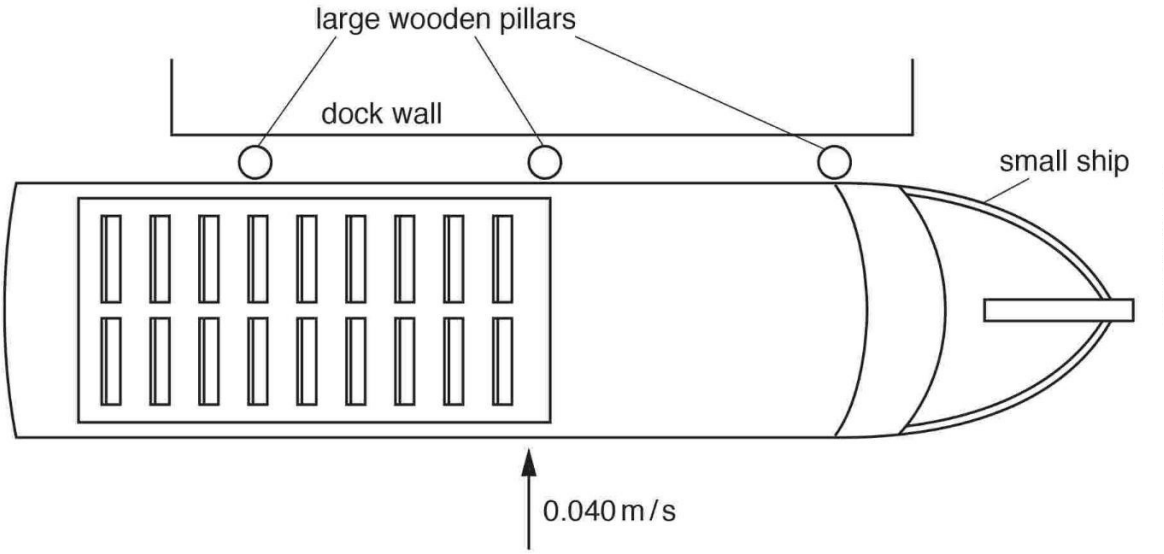
2. Q ..... J

[2]

[Total: 2]

17 The diagram is the top view of a small ship of mass 1.2×10^6 kg. The ship is moving slowly sideways at 0.040 m / s as it comes in to dock.

1.2×10^6 kg. The ship is moving slowly sideways at 0.040 m / s as it comes in to dock.



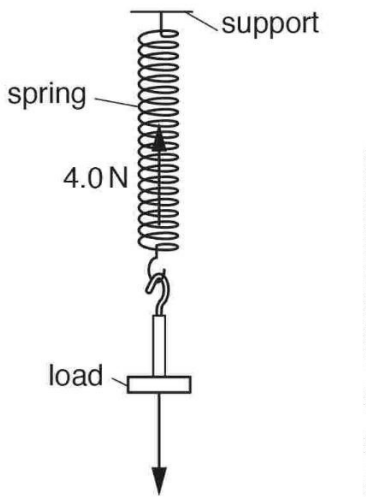
The ship hits the wooden pillars which move towards the dock wall.

Calculate the kinetic energy of the ship before it hits the pillars.

kinetic energy = ... [2]

[Total: 2]

18 A load is attached to a spring, as shown in the diagram. Two arrows indicate the vertical forces acting on the load. The spring and the load are stationary.



The load is pulled downwards and then released. The load moves up and down.

(a) State the principle of conservation of energy.

.....

..... [1]

(b) Eventually the load stops moving up and down.

Describe and explain why the load stops moving. Use your ideas about conservation of energy.

.....

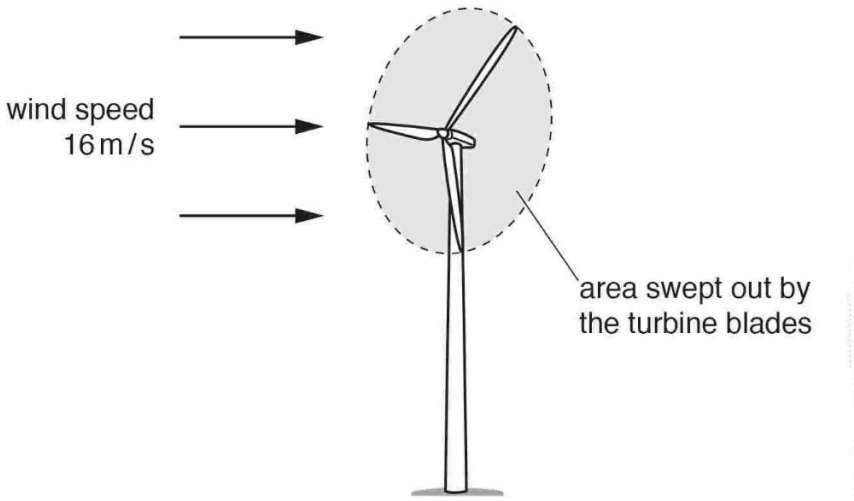
.....

.....

..... [2]

[Total: 3]

19 The diagram shows a wind turbine.



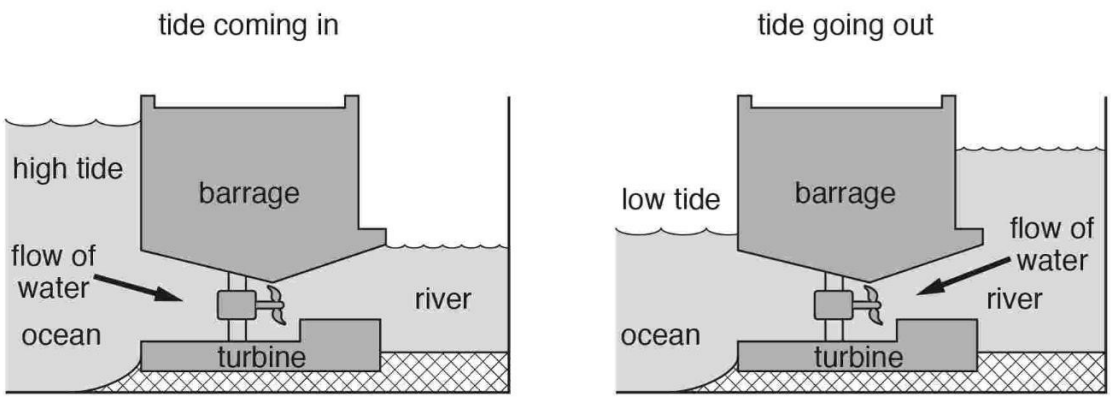
Suggest why some of the kinetic energy of the air that passes through the circular area swept out by the blades is **not** converted into electrical energy.

.....

..... [1]

[Total: 1]

20 A tidal barrage (dam) produces electricity using tides. The diagram shows a tidal barrage (simplified).



(a) The water behind the barrage (dam) is a store of energy. State the name of this stored energy.

..... [1]

(b) Explain how the tidal barrage (dam) produces electricity.

.....

.....

.....

..... [3]

[Total: 4]

21 A drone is a machine that can fly. The diagram shows a drone rising into the air, lifting a camera.

The drone obtains energy from a battery of cells.

When the drone moves, it wastes some energy. State the form of wasted energy and describe what happens to this energy.

form of energy .....

description .....

..... [2]

[Total: 2]

22 A drone is a machine that can fly. The diagram shows a drone rising into the air, lifting a camera.

The drone obtains energy from a battery of cells.

The drone can move in any direction up or down, backwards or forwards, left or right. It can also remain stationary above the ground.

Describe the motion and position of the drone when it has both a **large** quantity of potential energy and a **small** quantity of kinetic energy.

.....

..... [2]

[Total: 2]

23 A drone is a machine that can fly. The diagram shows a drone rising into the air, lifting a camera.

The drone obtains energy from a battery of cells.

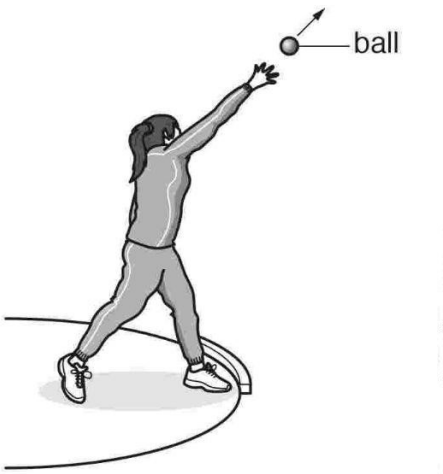
Complete the sequence of useful energy transfers as the drone rises into the air. One part is done for you.

..... → electrical energy → .....

[2]

[Total: 2]

24 The diagram shows a girl throwing a heavy ball.



State the energy changes that take place from when the girl begins to exert a force on the ball until the ball hits the ground and stops moving.

.....

.....

.....

.....

..... [2]

[Total: 2]

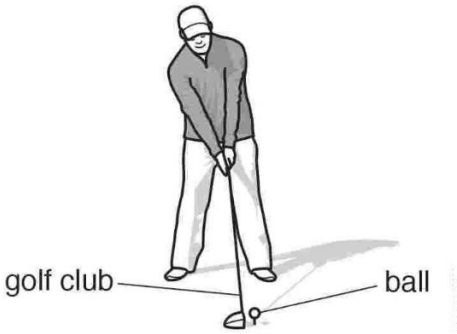
25 State what is meant by *the principle of conservation of energy*.

.....

..... [1]

[Total: 1]

26 The diagram shows a man hitting a ball with a golf club.



While the golf club is in contact with the ball, the ball becomes compressed and changes shape.

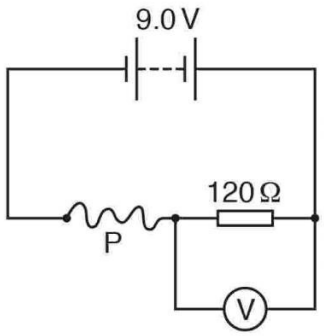
State the type of energy stored in the ball during its contact with the golf club.

..... [1]

[Total: 1]

27 A 9.0 V battery is connected to a 120 Ω resistor in series with wire P.

The diagram shows a voltmeter connected across the 120 Ω resistor.



State the energy changes that are taking place in the circuit.

.....

.....

..... [2]

[Total: 2]

28 In a game of tennis, a player hits a stationary ball with his racquet.

State the energy transfer that takes place:

1. as the ball changes shape during the contact between the racquet and the ball .....

.....

.....

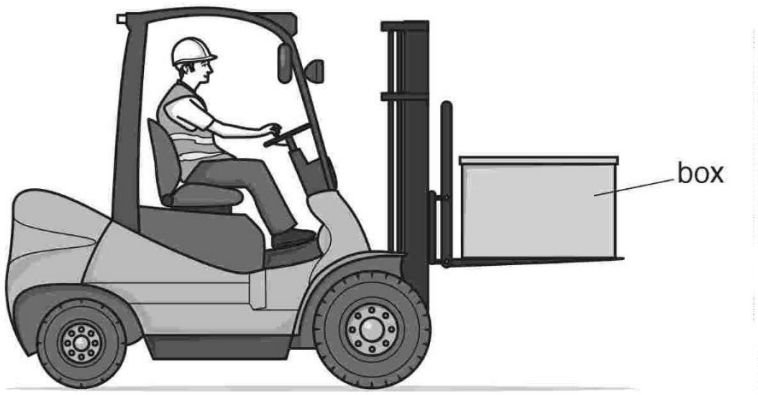
2. as the ball leaves the racquet. .....

.....

..... [2]

[Total: 2]

29 The diagram shows a fork-lift truck lifting a box.



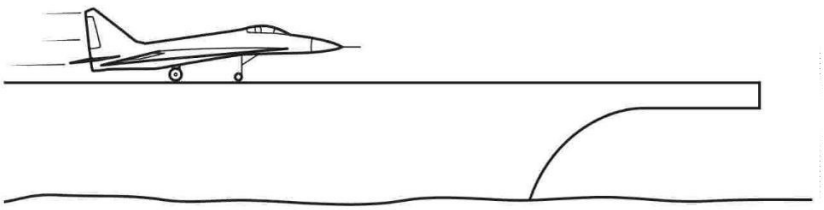
The electric motor that drives the lifting mechanism is powered by batteries.

State the form of the energy stored in the batteries.

..... [1]

[Total: 1]

30 The diagram shows an aircraft on the deck of an aircraft carrier.



The aircraft accelerates from rest along the deck. At take-off, the aircraft has a speed of 75 m/s.
The mass of the aircraft is 9500 kg.

(a) Calculate the kinetic energy of the aircraft at take-off.

kinetic energy = ... [3]

(b) On an aircraft carrier, a catapult provides an accelerating force on the aircraft. The catapult provides a constant force for a distance of 150 m along the deck.

Calculate the resultant force on the aircraft as it accelerates. Assume that all of the kinetic energy at take-off is from the work done on the aircraft by the catapult.

force = ... [2]

[Total: 5]

31 A rifle fires a bullet of mass 0.020 kg vertically upwards through the air. As it leaves the rifle, the speed of the bullet is 350m / s.

(a) Calculate

(i) the kinetic energy of the bullet as it leaves the rifle,

kinetic energy = ... [3]

(ii) the maximum possible height that the bullet can reach.

maximum height = ... [2]

(b) The actual height reached by the bullet is less than the value calculated in **(a)(ii)**.

(i) Explain, in terms of the forces acting on the bullet, why this is so.

.....

.....

..... [2]

(ii) As the bullet rises through the air, its kinetic energy decreases.

State what happens to this energy.

.....

..... [2]

[Total: 9]

32 An electric drill is shown in the diagram. It uses electrical energy.

Complete the sentences about the electric drill.

Use words from the box. Each word may be used once, more than once, or not at all.

efficient	kinetic	potential	powerful	reliable	thermal

(a) The electric drill **usefully** transforms electrical energy into ..... energy. [1]

(b) A second electric drill transforms the same amount of electrical energy per second as the first one. It wastes more of this energy.

The second drill is **less** ..... than the first drill. [1]

[Total: 2]

33 A force is used to move an object from the Earth's surface to a greater height.

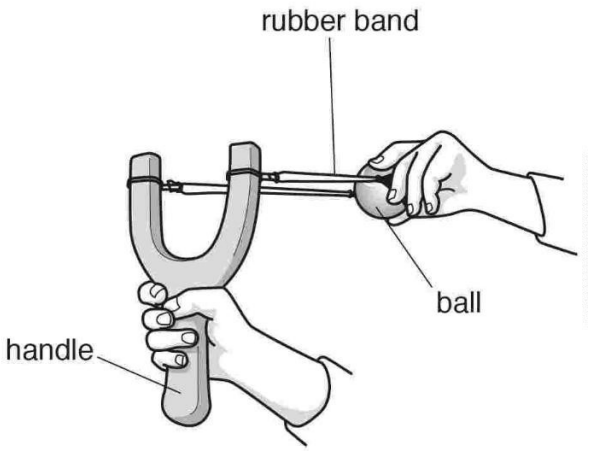
Explain why the gravitational potential energy (g.p.e.) of the object increases.

.....

..... [1]

[Total: 1]

34 A catapult consists of a rubber band attached to a handle. A student uses the catapult to fire a ball towards a target. The diagram shows the catapult just before the student releases the rubber band.



(a) When the student releases the rubber band, the ball moves towards the target.

Complete the following sentences about energy transfers during this process. Use words from the box. You may use each word once, more than once or not at all.

elastic	force	friction	gravitational	kinetic	thermal

(i)

As the rubber band is pulled back, the work done is transferred into

..... potential energy. [1]

(ii)

When the student releases the rubber band, the ball moves forward horizontally. Stored ..... potential energy is transferred into

..... energy. [2]

(iii)

As the ball travels through the air there is friction with air molecules. This causes some of the ball's ..... energy to be transferred into ..... energy.

[2]

(b) The ball does not reach the target, as shown in the diagram.

Describe how the student can increase the energy of the ball, using the same catapult.

..... [1]

[Total: 6]

35 A steel ball is fired vertically upwards with a velocity v. The ball reaches a height h.

The same ball is now fired vertically upwards from the same position with a velocity $2v$.

Air resistance can be ignored.

What is the new height reached by the ball?

A h **B** $2h$ **C** $4h$ **D** $8h$

[1]

[Total: 1]