Name: _____

Foundation Energy

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Some students investigate the efficiency of electric motors.

One of the students states that all of the energy supplied to a motor is transferred into other forms.

Complete the following sentence by putting a cross (☒) in the box next to your answer.
This statement is one example of the idea of

(1)

☒ **A** renewable energy

☒ **B** conservation of energy

☒ **C** non-renewable energy

☒ **D** sustainable energy

Q2.

The photograph shows a man dropping an egg inside a padded box from a height.

He is investigating to see if the padding stops the egg from breaking.

State the type of energy which the egg gains as it falls.

(1)

.....

Q3.

Figure 6 shows a spinning flywheel.

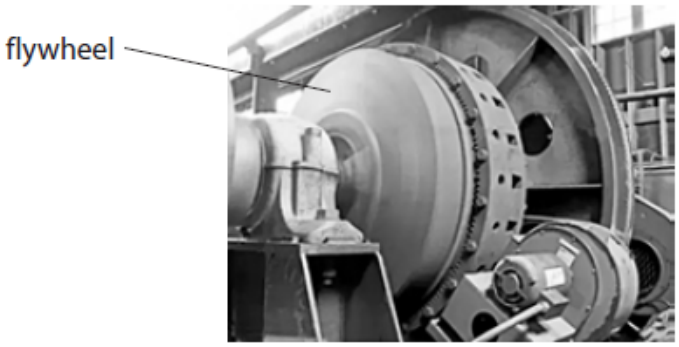

Figure 6

(i) State how energy is stored in a spinning flywheel.

(1)

.....

(ii) State **one** way to increase the amount of energy stored in the flywheel.

(1)

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(Total for question = 2 marks)

Q4.

Figure 11 shows a wind turbine.

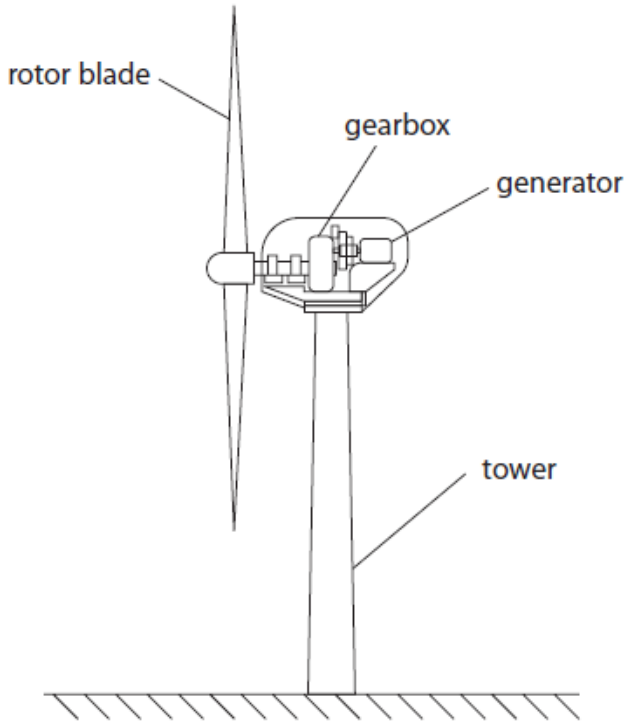

Figure 11

Explain how unwanted energy transfers could be reduced in the gear box.

(2)

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(Total for question = 2 marks)

Q5.

The photographs show two ways of supplying thermal energy.

Use words from the box to complete the sentence under each photograph.

chemical	electrical	kinetic	light	sound

(i) The photograph shows a kettle.

The kettle transfers ..... energy to thermal energy.

(1)

(ii) The photograph shows a barbecue.

The barbecue transfers ..... energy to thermal energy.

(1)

Q6.

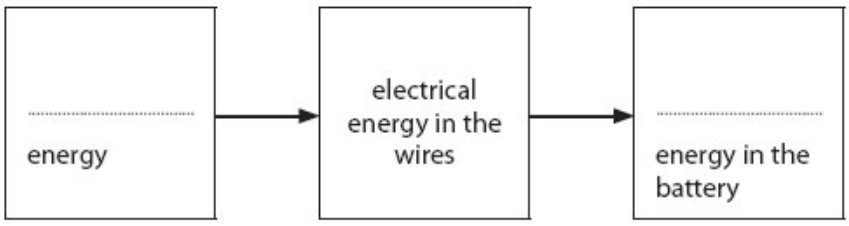
A student uses a solar powered battery charger to charge some batteries.

The diagram is an energy transfer diagram for a battery being charged.

Use words from the box to complete the energy transfer diagram.

light	kinetic	sound
electrical	chemical	

Energy transfer diagram



Q7.

A model train has a mass of 8.0 kg.
It travels at a speed of 1.5 m/s.

Calculate the kinetic energy of the model train.

Use the equation

$$\text{kinetic energy} = \tfrac{1}{2} \times \text{mass} \times (\text{speed})^2$$

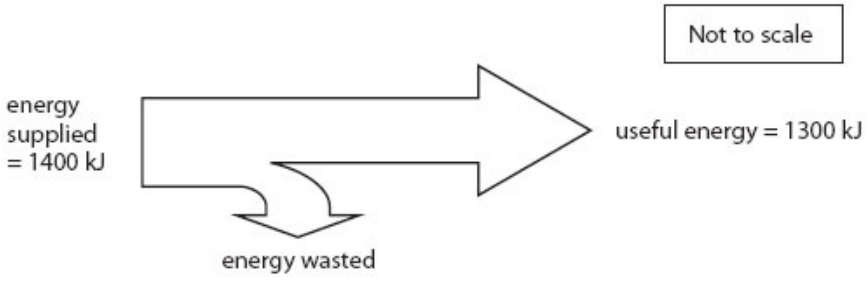
(3)

kinetic energy = ... J

(Total for question = 3 marks)

Q8.

The diagram represents the energy transfer in one second in the generator.



(i) Calculate the amount of energy wasted in one second in the generator.

(1)

energy wasted = ...kJ

(ii) Calculate the efficiency of the generator.

(2)

efficiency of generator = ...

Q9.

Andrew skis down a hill.

Andrew starts from the top of the hill and his speed increases as he goes downhill.

He controls his speed and direction by using his skis.

He brings himself to a stop at the bottom of the hill.

Describe the energy changes that happen between starting and stopping.

(3)

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Q10.

Many appliances are sold with an energy efficiency rating.

A-rated appliances are the most energy efficient.

Here is some information about two types of electric lamp.

	halogen lamp	compact fluorescent lamp (CFL)
energy efficiency rating	B	A
energy transfer diagrams (not drawn to scale)	energy transfer in one second electrical energy = 20 J light energy = 2 J	energy transfer in one second electrical energy = 20 J light energy = 8 J

(i) Calculate how much energy is wasted in one second by the compact fluorescent lamp (CFL).

(1)

energy wasted = ...J

(ii) Use the energy transfer diagrams to explain why the CFL lamp has a better efficiency rating than the halogen lamp.

(2)

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Q11.

This photograph shows a fan.

The blades of the fan are turned by an electric motor.

In one second, the motor gets 200 J of electrical energy from the mains supply.
Only 180 J of this energy is used to turn the blades of the fan.

The rest of the energy is wasted.

(i) Calculate how much of the 200 J of energy is wasted.

(1)

wasted energy = ... J

(ii) State what happens to the wasted energy.

(1)

.....

.....

(iii) Calculate the efficiency of the motor.

(2)

efficiency = ...

Q12.

(i) Which of these would be a typical speed for a racing cyclist travelling down a steep straight slope?

(1)

☒ **A** 0.2 m/s

☒ **B** 2 m/s

☒ **C** 20 m/s

☒ **D** 200 m/s

(ii) A cyclist travels down a slope.
The top of the slope is 20 m vertically above the bottom of the slope.
The cyclist has a mass of 75 kg.

Calculate the change in gravitational potential energy of the cyclist between the top and the bottom of the slope.

The gravitational field strength, g, is 10 N/kg.

(3)

change in gravitational potential energy = ... J

(Total for question = 4 marks)

Q13.

Here are some forms of energy:

chemical	elastic potential	electrical
heat (thermal)	kinetic	light
nuclear	sound	

(i) Use words from the box to complete the table.
Each word may be used once, more than once, or not at all.

The first one has been done for you.

(3)

device	energy transferred from...	energy is mostly transferred into...
electric motor	electrical	kinetic
bow and arrow	elastic potential	
electric kettle	electrical	
microphone		electrical

(ii) In the electric motor only some of the electrical energy is transferred into kinetic energy.

State what happens to the remaining electrical energy.

(1)

.....

Q14.

Figure 7 shows a skier going down a hill.

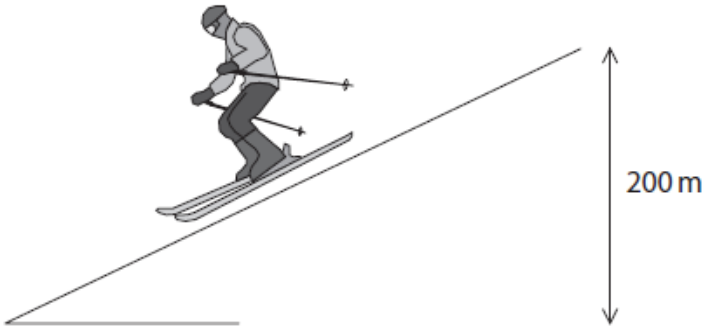

Figure 7

She descends through a vertical height of 200 m.

The skier's mass is 65 kg.

(i) Calculate the change in gravitational potential energy.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

Take the gravitational field strength, g, as 10 N / kg.

(2)

change in gravitational potential energy = ... J

(ii) At the bottom of the slope her speed was 36 m/s.

Calculate her kinetic energy at the bottom of the slope.

Use the equation

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

(3)

kinetic energy = ... J

(Total for question = 5 marks)

Q15.

Figure 2 shows an energy transfer diagram for a steam engine.

The diagram shows the amounts of energy transferred each second by the steam engine.

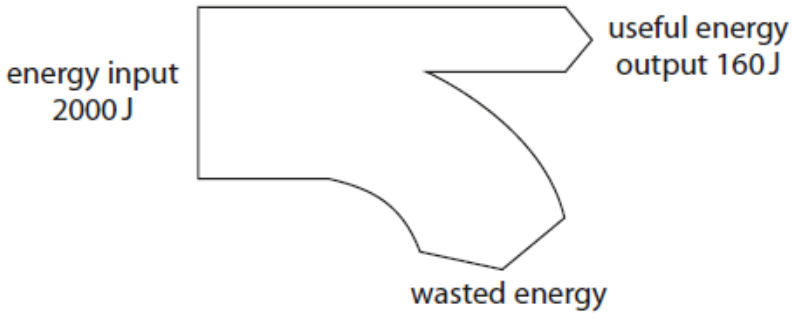

Figure 2

(i) Calculate the amount of wasted energy.

(1)

wasted energy = ... J

(ii) Calculate the efficiency of the steam engine.

Use the equation

$$\text{efficiency} = \frac{\text{(useful energy transferred by the steam engine)}}{\text{(total energy supplied to the steam engine)}}$$

(2)

efficiency = ...

(iii) State what happens to the wasted energy.

(1)

.....

.....

(iv) Coal is a fossil fuel that is burnt in some steam engines.

State **two** ways that the use of coal might be harmful to the environment.

(2)

1 .....

.....

2 .....

.....

(Total for question = 6 marks)

Q16.

*Some students found this information about an energy saving lamp and a filament lamp that give out almost the same amount of light.

energy saving lamp

power = 15 W

cost = £1.50

lifetime = 10 000 hours

produces 20 J of light energy for each 100 J of electrical energy supplied

filament lamp

power = 60 W

cost = £0.30

lifetime = 1 000 hours

produces 5 J of light energy for each 100 J of electrical energy supplied

Describe the advantages and disadvantages of each type of lamp.

(6)

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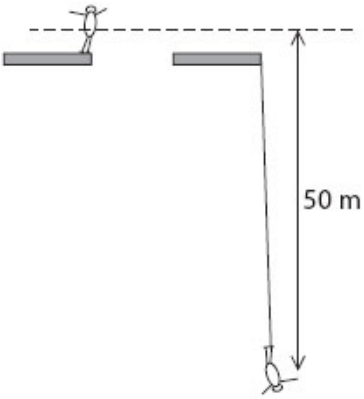
Q17.

A 60 kg student weighs 600 N.
He does a bungee jump.



The bungee cord becomes straight and starts to stretch when he has fallen 50 m.

(i) Calculate the change in gravitational potential energy as the student falls 50 m.

Give the unit.

(3)

change in gravitational potential energy = ...unit ..... .

(ii) State at what point in the bungee jump the student has maximum kinetic energy.

(1)

.....

.....

(iii) Explain why his maximum kinetic energy is likely to be less than your answer to (c)(i).

(2)

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Q18.

* There are several large-scale energy resources which are suitable alternatives to fossil fuels in some situations.
Two of these alternatives are hydro-electric power and solar power.

Compare hydro-electric power with solar power as energy resources for the large-scale generation of electricity.

(6)

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Q19.

* A student stands on the ground with an egg in his hand.
He throws the egg vertically upwards.
The egg rises to a height of 10 m.
Then the egg falls and lands on the ground.

Describe the energy changes of the egg during this sequence of events.

(6)

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Q20.

Some students investigate the efficiency of electric motors.

(a) (i) The students find that one electric motor has an efficiency of 60%.

Explain in terms of energy what is meant by an efficiency of 60%.

(2)

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(ii) The students use some motors to lift weights.

The students measure the input power and output power of two motors.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The power of a motor is the rate at which it transfers

(1)

☒ **A** current

☒ **B** energy

☒ **C** voltage

☒ **D** charge

(iii) The first motor has a power rating of 20 W.

The motor is used for 15 s.

Calculate the energy supplied to the motor.

(2)

energy supplied to the motor =..... .J

(iv) In the second motor, the useful output power was 18 W when the input power was 24 W.
Calculate the efficiency of this motor.

(2)

efficiency =..... .%

(b) One of the students states that all of the energy supplied to a motor is transferred into other forms.

Complete the following sentence by putting a cross (☒) in the box next to your answer.
This statement is one example of the idea of

(1)

☒ **A** renewable energy

☒ **B** conservation of energy

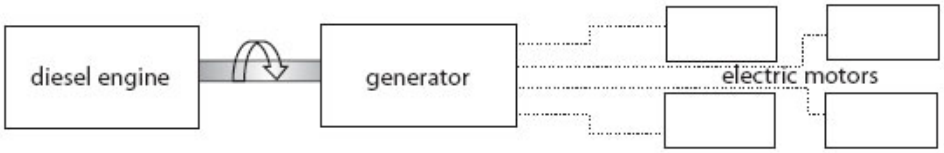
☒ **C** non-renewable energy

☒ **D** sustainable energy

(Total for Question = 8 marks)

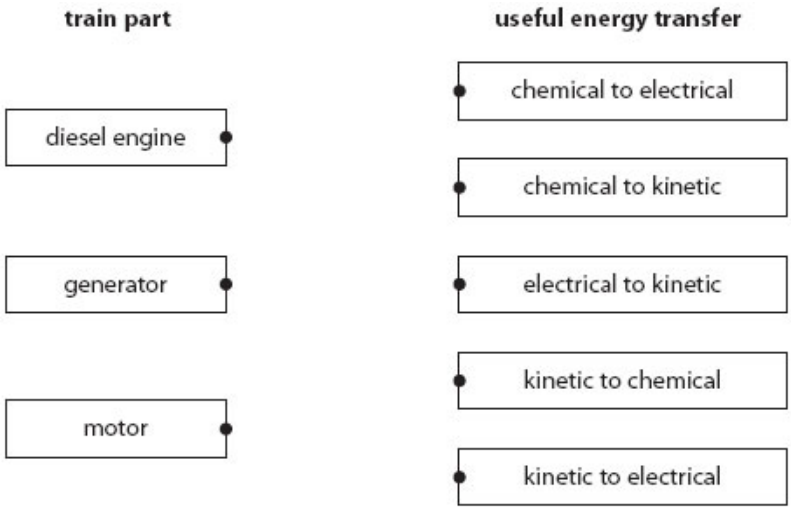
Q21.

(a) A train is powered by a diesel engine.
The diesel engine is used to turn a generator.
The generator provides electricity for electric motors which drive the wheels.



(i) Draw one straight line from each train part to its useful energy transfer.

(3)

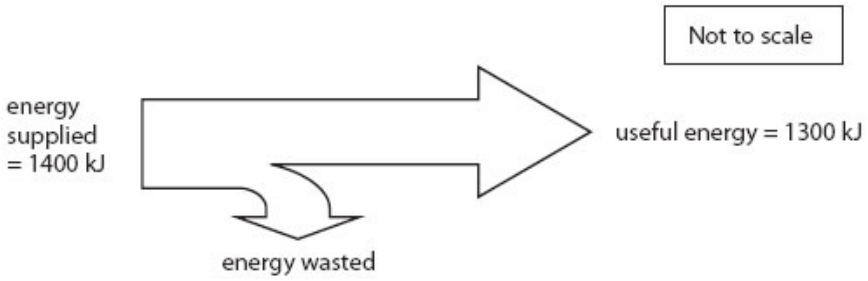


(ii) State **one** example of a non-useful energy transfer in the motor.

(1)

.....

(b) The diagram represents the energy transfer in one second in the generator.



(i) Calculate the amount of energy wasted in one second in the generator.

(1)

energy wasted = ...kJ

(ii) Calculate the efficiency of the generator.

(2)

efficiency of generator = ...

(c) The electric motors which drive the wheels are painted black.

Suggest why the motors are painted black.

(1)

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.....

(Total for Question is 8 marks)

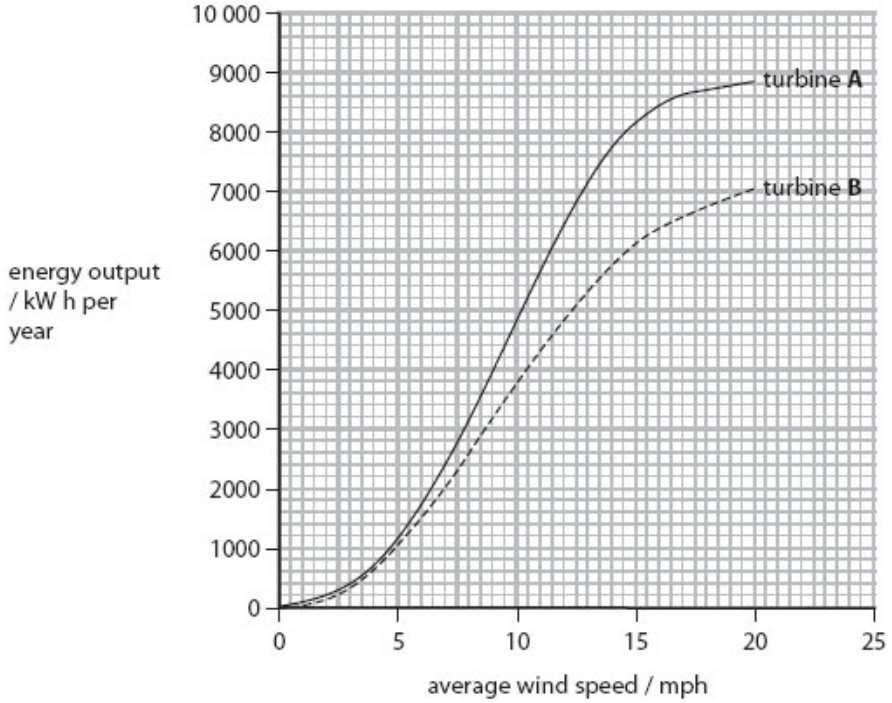
Q22.

(a) Eric owns a small farm where chicks are hatched from eggs.

He is considering generating his own electricity to heat and light a barn rather than using electricity from the National Grid.

This graph shows how the energy output varies with wind speed for two different wind turbines,

Aand **B**.



The average wind speed at Eric's farm is 13 mph.
The total heating and lighting in the barn requires 6000 kW h of electrical energy each year.

(i) Use the data in the graph to recommend the best turbine for Eric's barn.

(1)

The best turbine is.....because .....

.....

.....

(ii) Eric pays 14p per kW h for electrical energy supplied by the National Grid.
Calculate how much he could expect to save each year by using the energy from this wind turbine to heat and
light the barn.

(2)

annual saving = £ .....

(iii) Eric looks at the cost of installing the turbine.

State how he should work out the payback time.

(1)

.....

.....

(iv) The chicks need to be kept warm at all times.
Eric uses halogen lamps to provide heat and light for most of the day.
Eric thinks about changing his halogen lamps for energy saving lamps.
Suggest why this might not actually be a benefit.

(2)

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.....

*(b) There are several large-scale energy resources which are suitable alternatives to fossil fuels in some situations.
Two of these alternatives are hydro-electric power and solar power.

Compare hydro-electric power with solar power as energy resources for the large-scale generation of electricity.

(6)

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(Total for Question is 12 marks)

Q23.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

An electric current is the rate of flow of

(1)

☒ **A** atoms

☒ **B** charge

☒ **C** voltage

☒ **D** watts

(b) An electric kettle is connected to a mains voltage of 230 V.
The current in the kettle is 12 A.

Calculate the power of the kettle.

(2)

power of the kettle = ...W

(c) A television has a power of 400 W.
The cost of 1 kW h of electrical energy is 15p.

Calculate the cost of using the television for 10 hours.

(3)

cost of using the television for 10 hours = ...p

*(d) Some students found this information about an energy saving lamp and a filament lamp that give out almost the same amount of light.

energy saving lamp

power = 15 W

cost = £1.50

lifetime = 10 000 hours

produces 20 J of light energy for each 100 J of electrical energy supplied

filament lamp

power = 60 W

cost = £0.30

lifetime = 1 000 hours

produces 5 J of light energy for each 100 J of electrical energy supplied

Describe the advantages and disadvantages of each type of lamp.

(6)

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(Total for Question = 12 marks)