EXAM PAPERS PRACTICE

Energy Changes in System

These practice questions can be used by students and teachers and is

Suitable for GCSE AQA Physics Topic Question 8463

Level: GSCE AQA 8463

Subject: Physics

Exam Board: GCSE AQA

Topic: Energy changes in System

Q1.

The specific heat capacity of aluminium can be determined by experiment.

(a) Draw a labelled diagram showing how the apparatus used to determine the specific heat capacity of aluminium should be arranged.

(3)

(b) Describe how you could use the apparatus you drew in part (a) to determine the specific heat capacity of aluminium.

(6)

(c) Methods used to determine the specific heat capacity of aluminium may give a value greater than the actual value.

Explain why.

___

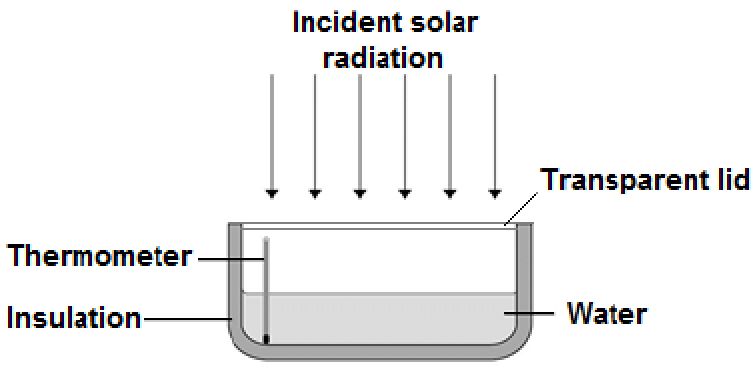
(2)
(Total 11 marks)

Q2.

A student investigated how much energy from the Sun was incident on the Earth's surface at her location.

She put an insulated pan of water in direct sunlight and measured the time it took for the temperature of the water to increase by 0.6 °C.

The apparatus she used is shown in the figure below.



(a) Choose the most appropriate resolution for the thermometer used by the student.

Tick **one** box.

0.1 °C ☐

0.5 °C ☐

1.0 °C ☐

(1)

(b) The energy transferred to the water was 1050 J.

The time taken for the water temperature to increase by 0.6 °C was 5 minutes.

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

Write down the equation which links energy transferred, power and time.

___

(1)

(c) Calculate the mean power supplied by the Sun to the water in the pan.

____

____

____

Average power = ______________________ W

(2)

(d) Calculate the mass of water the student used in her investigation.

Use the correct equation from the Physics Equation Sheet.

____

____

____

Mass = ______________________ kg

(3)

(e) The student's results can only be used as an estimate of the mean power at her location.

Give **one** reason why.

____

____

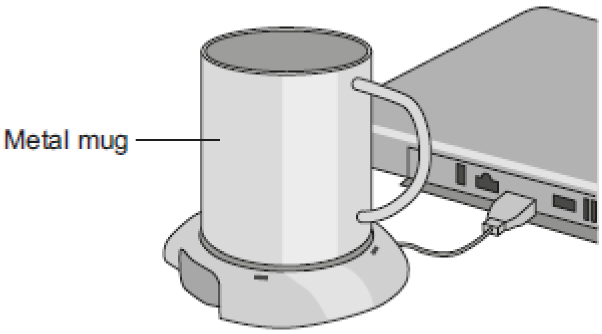
(1)

(Total 8 marks)

Q3.

A heater uses energy from a laptop computer to keep a drink hot.

The image shows a metal mug on the heater.



(a) The laptop computer is operating on battery power.
How would connecting the heater affect the amount of time the laptop computer would operate for, before needing to be recharged?

Tick (✓) **one** box.

	Tick (✓)
it would decrease the time	
it would not affect the time	
it would increase the time	

(1)

(b) The power output from the heater is 12 W.

Calculate the energy transferred to the metal mug in 60 seconds.

___

___

___

Energy = ________ joules

(2)

(c) The table lists changes that may affect the energy transfer per second from the heater to the liquid.

Tick (✓) **one** box to show the effect of each change.

Change	**Energy transfer per second to the liquid**		
	increases	**decreases**	**does not change**
use a mug with a smaller base			
use a lower power heater			
use a plastic mug instead of a metal mug			

(3)

(Total 6 marks)

Q4.

Under the same conditions, different materials heat up and cool down at different rates.

(a) What is meant by specific heat capacity?

___

___

____

____

(2)

(b) ‘Quenching’ is a process used to change the properties of steel by cooling it rapidly.

The steel is heated to a very high temperature and then placed in a container of cold water.

(i) A metalworker quenches a steel rod by heating it to a temperature of 900 °C before placing it in cold water. The mass of the steel rod is 20 kg.

The final temperature of the rod and water is 50 °C.

Calculate the energy transferred from the steel rod to the water.

Specific heat capacity of steel = 420 J/kg °C.

____

____

____

Energy transferred = ____________________ J

(3)

(ii) The temperature of the steel rod eventually returns to room temperature.

Compare the movement and energies of the particles in the steel rod and in the air at room temperature.

____

____

____

____

____

____

(3)

(iii) When the steel rod is being quenched, the temperature of the water rises to 50 °C. After a few hours the water cools down to room temperature.

Some of the cooling of the water is due to evaporation.

Explain in terms of particles how evaporation causes the cooling of water.

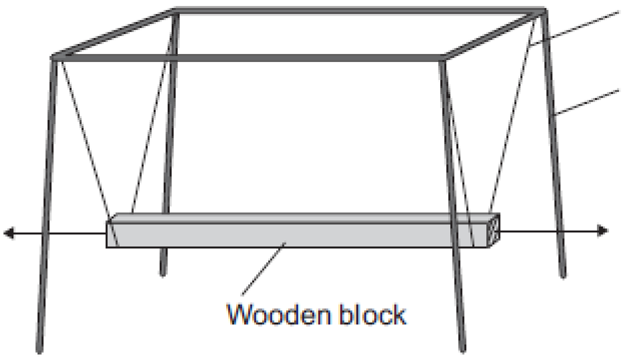
____

(4)
(Total 12 marks)

Q5.

Figure 1 shows the design of a playground ride.

Figure 1



A large wooden block rests on ropes. The ropes are attached to a metal frame.

Children sit on the wooden block.

When the wooden block is moved to the left and released it moves to and fro.

When the wooden block returns to the point of release it has completed one cycle.

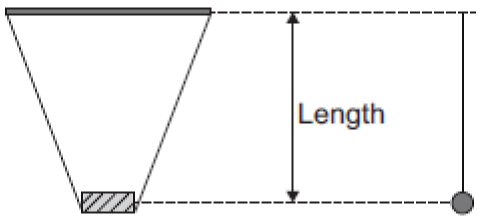
(a) Identify **two** possible hazards of the ride in **Figure 1**.

(2)

(b) The designer of the ride wants to know if the ride has the same time period as a pendulum of the same length.

The designer used a model of the ride and a pendulum as shown in **Figure 2**.

Figure 2



The designer measured the time taken to complete 10 cycles for different lengths of both the model ride and the pendulum.

The results for the model ride are shown in **Table 1**.

Table 1

Length in metres	Time for 10 cycles in seconds				Mean time period in seconds
	First time	Second time	Third time	Mean	
0.100	6.36	6.37	6.29	6.34	0.63
0.150	7.76	7.74	7.80		
0.200	8.97	8.99	8.95	8.97	0.90

The results for the pendulum are shown in **Table 2**.

Table 2

Length in metres	Time for 10 cycles in seconds				Mean time period in seconds
	First time	Second time	Third time	Mean	
0.250	10.00	10.04	10.02	10.02	1.00
0.300	10.99	11.01	10.94	10.98	1.10
0.350	11.88	11.83	11.87	11.86	1.19

(i) Complete **Table 1**, giving values to an appropriate number of significant figures.

(3)

(ii) The investigation already includes repeated readings.

Suggest **one** improvement that could be made to this investigation.

(1)

(iii) The designer reads in an Advanced Physics textbook that:
'The square of the time period, T, for a simple pendulum is proportional to its length, l.'

$$T^2 \propto l$$

Would the model ride have the same time period as a simple pendulum of the same length?

Use **one** row of data from **Table 1** and **one** row of data from **Table 2** to work out your answer.

State your conclusion.

(3)

(c) The ride was redesigned and built to make it safer.

The wood was moving at maximum speed. The maximum kinetic energy of the wood was 180 J.

A parent applied a force to the wood and stopped it in a distance of 0.25 m.

Calculate the force required.

Force = _______________ N

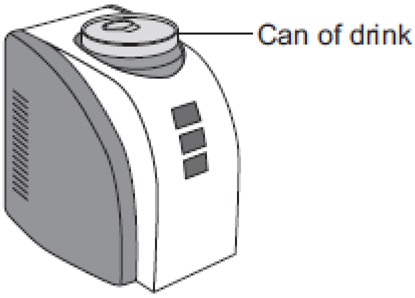
(3)
(Total 12 marks)

Q6.

A 'can-chiller' is used to make a can of drink colder.

Figure 1 shows a can-chiller.

Figure 1



(a) The can-chiller decreases the temperature of the liquid in the can by 15 °C.
The mass of liquid is 0.33 kg.
The specific heat capacity of the liquid is 4200 J / kg °C.

Calculate the energy transferred from the liquid as it cools.

____

____

____

Energy = ___________________________ J

(2)

(b) Complete the following sentence.

The specific heat capacity of a substance is the amount of energy required to

change the _________________________________ of one kilogram of the

substance by one degree Celsius.

(1)

(c) To calculate the specific heat capacity of a material, the mass of the material needs to be measured.

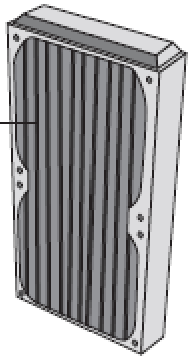
State the name of a measuring instrument used to measure mass.

____

(1)

(d) The back of the can-chiller has cooling fins, as shown in **Figure 2**.

Figure 2



The cooling fins increase the rate of energy transfer from the can-chiller to the surroundings.

Complete the following sentences.

The cooling fins are a ________________ colour because that makes them

good emitters of infrared radiation.

The large surface area of the cooling fins allows the air around the can-chiller

to gain energy quickly and rise, transferring energy by ________________ .

(2)

(e) (i) The energy input to the can-chiller is the same as the energy output. This shows that energy is conserved.

Complete the following sentence.

Energy can be transferred usefully, stored or dissipated, but cannot be

________________ or destroyed.

(1)

(ii) The temperature of the can of drink decreases while it is in the can-chiller.

What happens to the temperature of the air around the cooling fins?

____

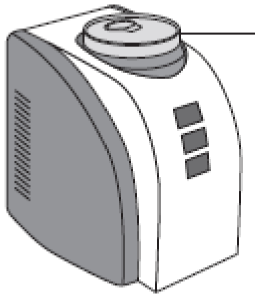
(1)

(Total 8 marks)

Q7.

A 'can-chiller' is used to make a can of drink colder.

The image below shows a can-chiller.



(a) The initial temperature of the liquid in the can was 25.0 °C.
The can-chiller decreased the temperature of the liquid to 20.0 °C.
The amount of energy transferred from the liquid was 6930 J.
The mass of liquid in the can was 0.330 kg.

Calculate the specific heat capacity of the liquid.

Give the unit.

____

____

____

____

Specific heat capacity = ____________________ unit ________________

(4)

(b) Energy is transferred through the metal walls of the can of drink by conduction.
Explain how.

____

____

____

____

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____

____

____

(4)

(c) The energy from the can of drink is transferred to the air around the can-chiller.
A convection current is set up around the can-chiller. Explain how.

____

____

____

____

____

____

(3)

(d) The can-chiller has metal cooling fins that are designed to transfer energy quickly to the surroundings.

Give **two** features that would help the metal cooling fins to transfer energy quickly to the surroundings.

1. ____

2. ____

(2)

(Total 13 marks)

Q8.

All objects emit and absorb infrared radiation.

(a) Use the correct answer from the box to complete each sentence.

dark matt	**dark shiny**	**light matt**	**light shiny**

The best emitters of infrared radiation have

____ surfaces.

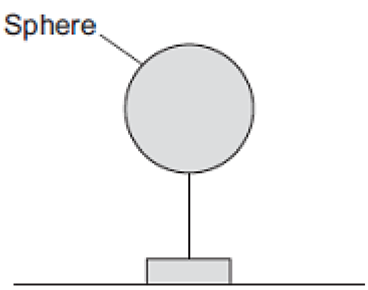
The worst emitters of infrared radiation have

____ surfaces.

(2)

(b) **Diagram 1** shows a sphere which is at a much higher temperature than its surroundings.

Diagram 1



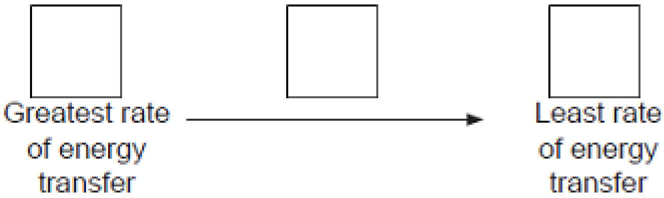
Energy is transferred from the sphere to the surroundings.

The table shows readings for the sphere in three different conditions, **A**, **B** and **C**.

Condition	Temperature of sphere in °C	Temperature of surroundings in °C
A	70	5
B	80	0
C	90	30

In each of the conditions, **A**, **B** and **C**, the sphere transfers energy to the surroundings at a different rate.

Put conditions **A**, **B** and **C** in the correct order.



Give a reason for your answer.

____

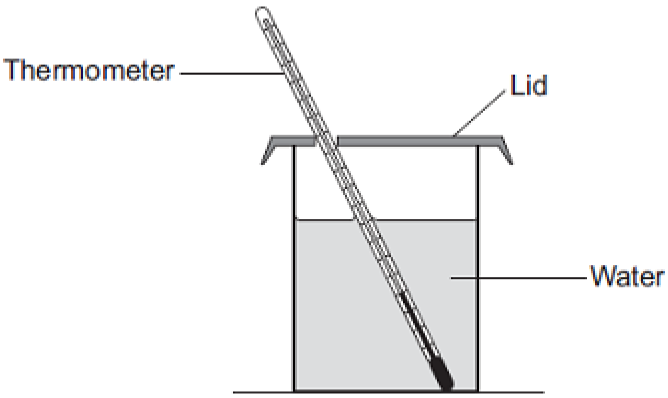
____

(2)

(c) **Diagram 2** shows a can containing water.

A student investigates how quickly a can of water heats up when it is cooler than room temperature.

Diagram 2



The student has four cans, each made of the same material, with the following outer surfaces.

dark matt **dark shiny** **light matt** **light shiny**

The student times how long it takes the water in each can to reach room temperature.

Each can contains the same mass of water at the same starting temperature.

(i) Which can of water will reach room temperature the quickest?

Give a reason for your answer.

____

____

____

____

(2)

(ii) Apart from material of the can, mass of water and starting temperature, suggest **three** control variables for the student's investigation.

1. ____

____

2. ____

____

3. ____

____

(3)

(d) The photographs show two different foxes.

Fox A

By Algkalv (Own work) [CC-BY-3.0], via Wikimedia Commons

Fox B

© EcoPic/iStock

Which fox is better adapted to survive cold conditions?

Give reasons for your answer.

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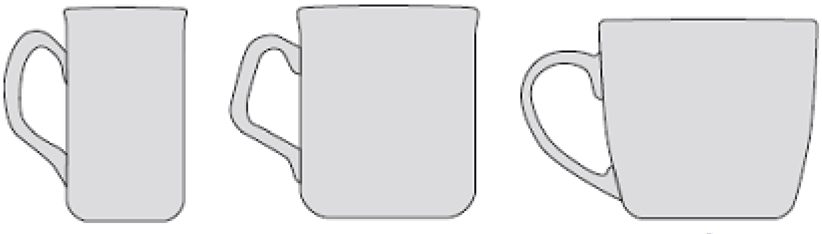
(3)
(Total 12 marks)

Q9.

The diagram shows three cups **A**, **B** and **C**.

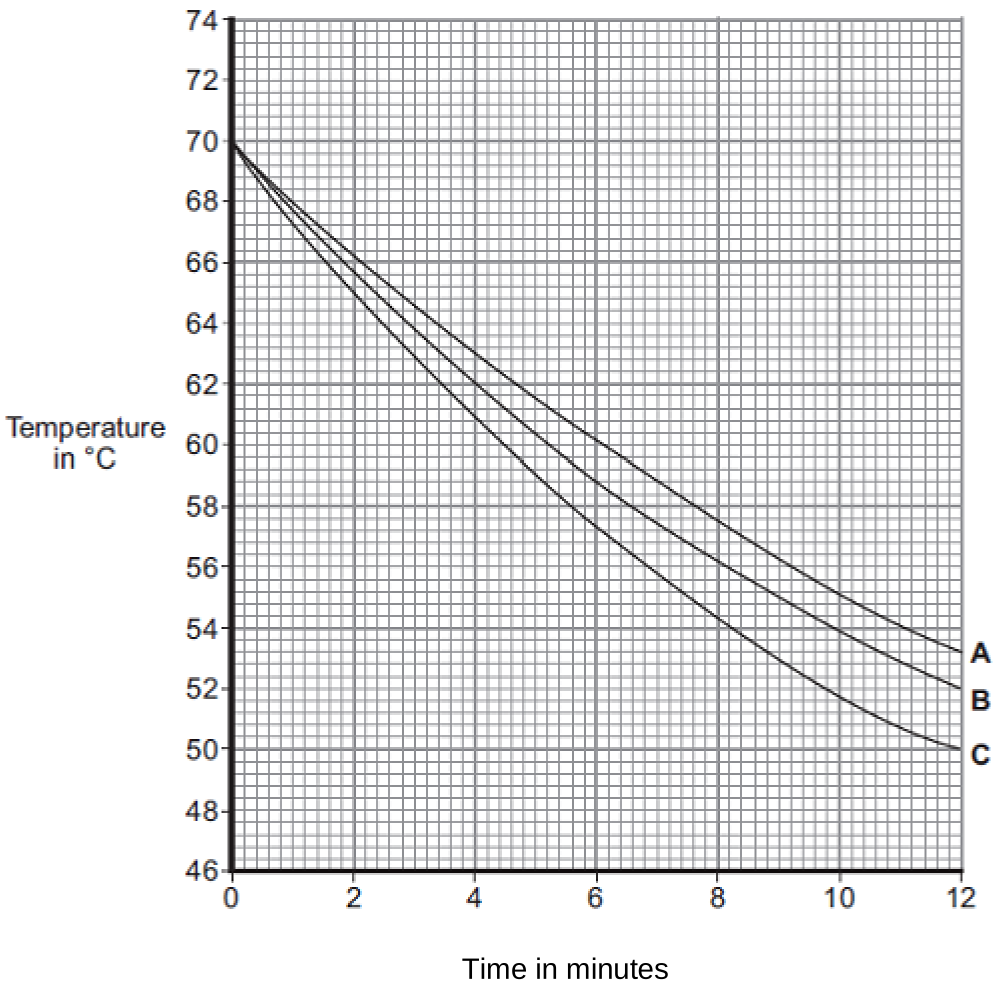


Energy is transferred from hot water in the cups to the surroundings.

(a) Some students investigated how the rate of cooling of water in a cup depends on the surface area of the water in contact with the air.

They used cups **A**, **B** and **C**. They poured the same volume of hot water into each cup and recorded the temperature of the water at regular time intervals.

The results are shown on the graph.



(i) What was the starting temperature of the water for each cup?

Starting temperature = ____________________ °C

(1)

(ii) Calculate the temperature fall of the water in cup **B** in the first 9 minutes.

____

Temperature fall = ____________________ °C

(2)

(iii) Which cup, **A**, **B** or **C**, has the greatest rate of cooling? ☐

Using the graph, give a reason for your answer.

____

____

(2)

(iv) The investigation was repeated using the bowl shown in the diagram.

The same starting temperature and volume of water were used.

Draw on the graph in part **(b)** another line to show the expected result.

(1)

(v) After 4 hours, the temperature of the water in each of the cups and the bowl was 20°C.

Suggest why the temperature does **not** fall below 20°C.

____

(1)

(b) (i) The mass of water in each cup is 200 g.

Calculate the energy, in joules, transferred from the water in a cup when the temperature of the water falls by 8°C.

Specific heat capacity of water = 4200 J / kg°C.

____

____

____

Energy transferred = ____________________ J

(3)

(ii) Explain, in terms of particles, how evaporation causes the cooling of water.

____

____

____

____

____

____

____

____

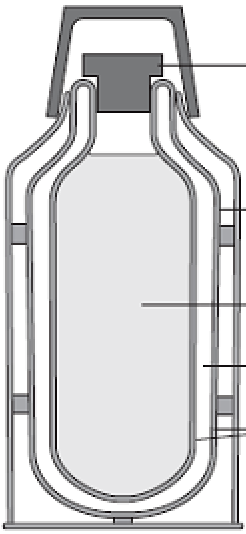
(4)

(Total 14 marks)

Q10.

(a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The diagram shows the structure of a vacuum flask.



A vacuum flask is designed to reduce the rate of energy transfer by heating processes.

Describe how the design of a vacuum flask keeps the liquid inside hot.

____

____

____

____

____

____

____

____

____

____

(6)

(b) Arctic foxes live in a very cold environment.

© Purestock/Thinkstock

Arctic foxes have small ears.

How does the size of the ears help to keep the fox warm in a cold environment?

____

____

____

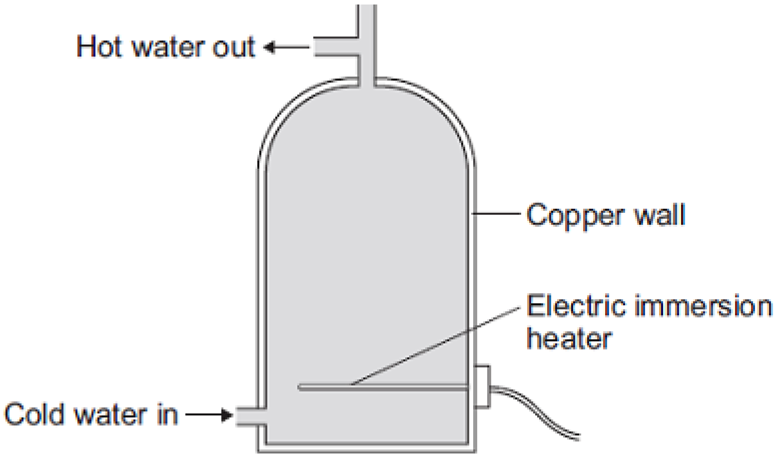
____

____

(2)
(Total 8 marks)

Q11.

An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



(a) Complete the following sentence.

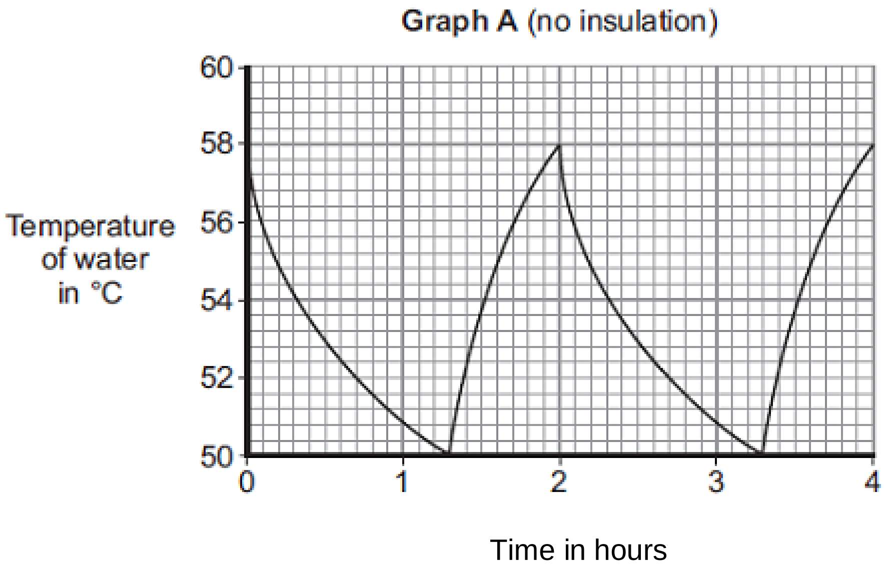
The main way the energy is transferred through the copper wall of the water tank is by the process of ____ .

(1)

(b) The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C.

Graph A shows how the temperature of the water inside a hot water tank changes with time. The tank is **not** insulated.



(i) The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

____

____

____

____

(2)

(ii) To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

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

____

____

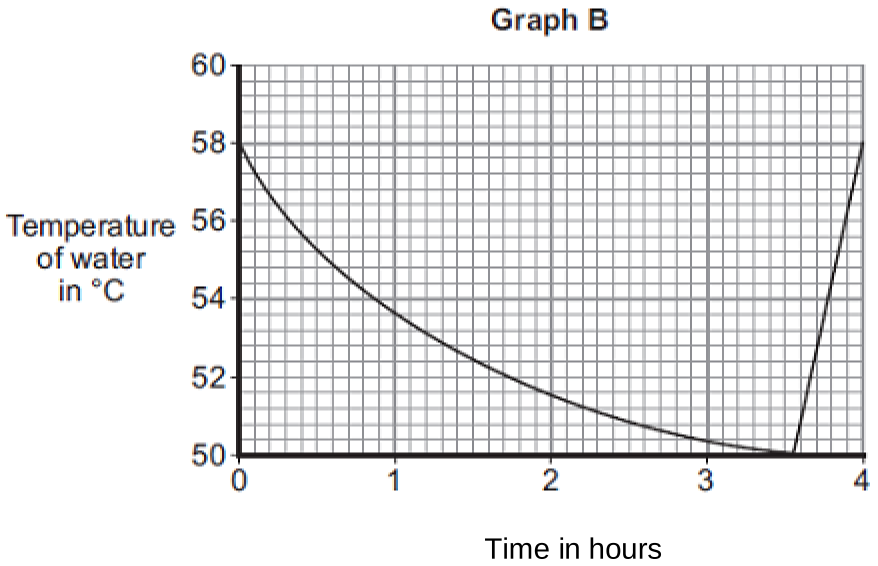
____

Mass = ______________________________ kg

(3)

(iii) An insulating jacket is fitted to the hot water tank.

Graph B shows how the temperature of the water inside the insulated hot water tank changes with time.



An insulating jacket only costs £12.

By comparing **Graph A** with **Graph B**, explain why fitting an insulating jacket to a hot water tank saves money.

____

____

____

____

____

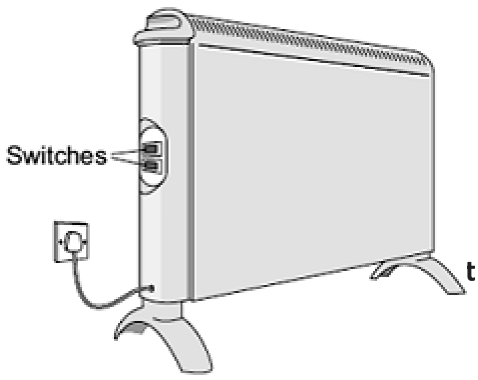
____

(3)

(Total 9 marks)

Q12.

(a) The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.



Setting	Power in watts

t exampaperspractice.co.uk

Low	700
Medium	1400
High	

(i) When both switches are on, the heater works at the high power setting.

What is the power of the heater, in kilowatts, when it is switched to the **high** power setting?

____

Power = ______________________________ kilowatts

(1)

(ii) The heater is used on the **high** power setting. It is switched on for 1½ hours.

Calculate the energy transferred from the mains to the heater in 1½ hours.

Show clearly how you work out your answer and give the unit.

____

____

____

Energy transferred = ______________________________

(3)

(iii) This type of heater is a very efficient device.

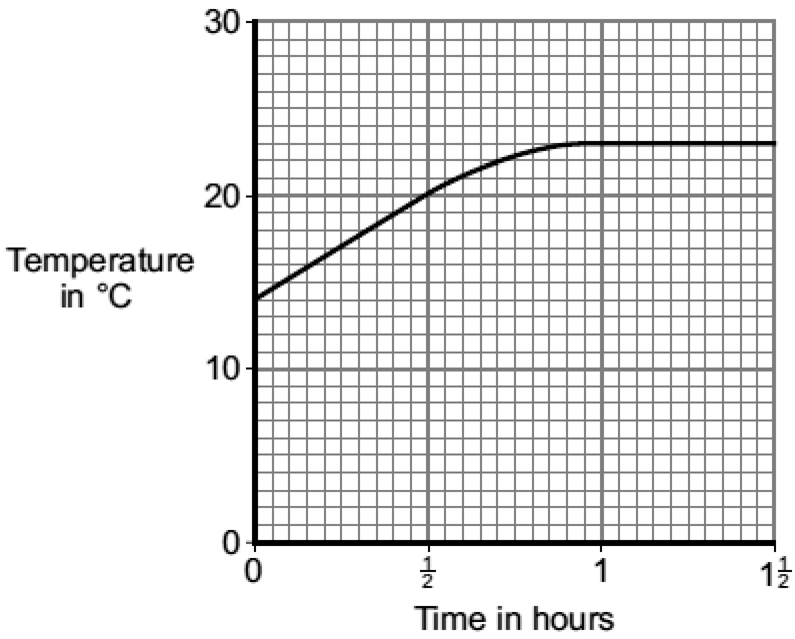
What is meant by a device being very efficient?

____

____

(1)

(b) The graph shows how the temperature of a room changes during the 1½ hours that the heater is used.



After 1 hour, the temperature of the room has become constant, even though the heater is still switched on.

Explain why.

____

____

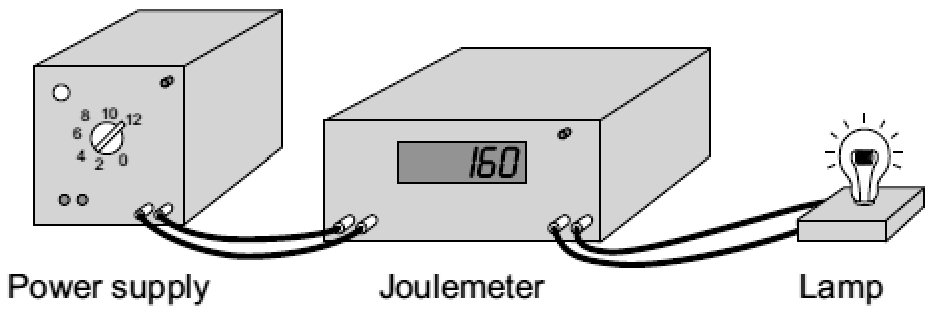
____

____

(2)
(Total 7 marks)

Q13.

A student used a joulemeter to measure the energy transformed by a lamp.



The student set the joulemeter to zero, and then switched on the power supply.

After 120 seconds (2 minutes), the reading on the joulemeter had increased to 2880.

(a) In the space below, draw the circuit symbol used to represent a lamp.

(1)

(b) (i) Use the equation in the box to calculate the power of the lamp.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer.

____

____

Power = ___________________________

(2)

(ii) Which **one** of the following is the unit of power?

Draw a ring around your answer.

joule **newton** **watt**

(1)

(c) Complete the following sentence using one of the phrases from the box.

larger than	the same as	smaller than

If the lamp was left switched on for 10 minutes, the amount of energy transformed

would be ____ the amount of energy

transformed in 2 minutes.

(1)
(Total 5 marks)

Q14.

When you transfer *energy* to a shopping trolley, the amount of *work done* depends on the *force* used and the *distance moved*.

Complete the table by using the correct units from the box.

joule (J)	**metre (m)**	**newton (N)**

The first one has been done for you.

Quantity	**Unit**
energy (transferred)	joule
force	
distance (moved)	
work done	

(Total 2 marks)

Mark schemes

Q1.

(a) apparatus diagram to show:

- aluminium block (surrounded by insulation)

1

- thermometer and immersion heater inside (or in contact with) aluminium

1

- joulemeter connected to immersion heater
  or
  ammeter and voltmeter connected correctly around immersion heater

  full credit can be given for a correct alternative method

  ignore position or absence of stopclock

  ignore position or absence of electric balance

1

(b)

Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5-6
Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3-4
Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1-2
No relevant content	0
Indicative content **measurements:** • energy (transferred) using joulemeter **or** ammeter, voltmeter and stopclock • mass using electric balance • temperature change using thermometer **SHC calculation:** E = mcθ **or** $c = \frac{E}{m\theta}$ **valid results:**	

• repeat practical and calculate a mean • plot a graph of temperature against time and use linear section of graph for temperature change • small (eg 10 °C) temperature change (so cylinder isn't significantly hotter than surroundings) **safety:** immersion heater gets very hot so avoid touching (heating element) with bare hand	

6

(c) some thermal energy
transferred to the surroundings
(not to the metal block)

allow not all of the energy (as measured by the joulemeter) is transferred to the block

1

(so) temperature increase not as high as it should be for the total energy transferred

allow justification using the equation: $C = \frac{E}{m\theta}$

1

[11]

Q2.

(a) 0.1 (°C)

1

(b) power = energy transferred / time

allow P = E / t

1

allow E = P × t

(c) 1050 / 300

1

3.5 (W)

1

*accept 3.5 (W) with no working shown for **2** marks*

(d) 1050 = m × 4200 × 0.6

1

m = 1050 / (4200 × 0.6)

1

m = 0.417 (kg)

1

*accept 0.417 (kg) with no working shown for **3** marks*

(e) any **one** from:

- energy used to heat metal pan (as well as the water)
- energy transfer to the surroundings (through the insulation)
- angle of solar radiation will have changed during investigation
- intensity of solar radiation may have varied during investigation

1

[8]

Q3.

(a) it would decrease the time

1

(b) 720 (J)

*allow **1** mark for correct substitution ie 12 × 60 provided no subsequent step*

2

(c) decreases

1

decreases

1

decreases

1

more than one tick in any row negates the mark

[6]

Q4.

(a) energy required to raise the temperature of a substance by 1 °C

accept heat for energy

1

unit mass / 1 kg

1

(b) (i) 7 140 000 (J)

allow 2 marks for a correct substitution, ie

E = 20 × 420 × 850

provided no subsequent step

*850 gains **1** mark if no other mark awarded*

3

(ii) particles in the air have more (kinetic) energy than the particles in the steel

allow particles in the air have a greater speed.

1

steel
particles vibrate (about fixed positions)

1

air
particles move freely

1

(ii) the most energetic particles

accept molecules for particles throughout

accept the fastest particles

1

have enough energy to escape from (the surface of) the water

1

therefore the mean energy of the remaining particles decreases

accept speed for energy

1

as energy decreased, temperature has decreased

1

[12]

Q5.

(a) any **two** from:

- wood falls off ropes
- child falls off
- wood hits child standing at side.

accept any reasonable suggestion

2

(b) (i) 7.77

1

0.78

*0.777 or 0.77 gain **1** mark*

*their mean value / 10 gains **1** mark*

2

(ii) use longer lengths (so longer times)

or

do both with the same lengths (so comparison can be made)

timing more than 10 cycles is insufficient

1

(iii) **1** value of k from **table 4**

k values 3.969…

4.056…

4.05

$k = T^2 / l$

allow full credit for an equivalent correct method

eg. allow inverse of

$k = l / T^2 = 0.25$

1

1 value of k from **table 5**

k values 4

4.03…

4.046

allow if average time for 10 cycles used

1

conclusion that matches student's results

1

(c) 720 N

*180 = F × 0.25 gains **2** marks*

*work done = maximum kinetic energy gains **1** mark*

3

[12]

Q6.

(a) 20 790 (J)

*an answer of 21 000 (J) (2 s.f.) gains **2** marks*

*allow **1** mark for correct substitution:*
ie E = 0.33 × 4200 × 15 provided no subsequent step shown

2

(b) temperature

1

(c) (top pan) balance

accept scales

*do **not** accept a scale*
*do **not** accept weighing scales*
*do **not** accept newtonmeter*
*do **not** accept spring balance*

1

(d) dark / black / (dark) grey

1

convection

correct order only

1

(e) (i) created

accept made

1

(ii) increases

1

[8]

Q7.

(a) 4200

*allow **2** marks for correct substitution*
ie 6930 = 0.330 × c × 5.0

*answers of 1050 **or** 840*

or

correctly calculated answer from correct substitution of incorrect temperature change

or

identification of temperature change ie 5 °C
*gain **1** mark*

3

J / kg°C

accept J / kg K

1

(b) (in a metal) free electrons

to gain full credit the answer must be in terms of free electrons

1

gain kinetic energy

accept move faster

1

(free electrons) transfer energy to other electrons / ions / atoms

*do **not** accept particles*

1

by collision

*allow a maximum of **2** marks for answers in terms of atoms / ions / particles*

- *gaining kinetic energy or vibrating faster / more*
- *transferring energy by collisions*

1

(c) (air) particles spread out

1

(which causes the) air to become less dense / expand

*do **not** accept particles become less dense*

1

(so the) warm air rises

*do **not** accept heat rises*
particles rise is insufficient

1

(d) large surface area

ignore references to type of metal or external conditions

1

black / dark (colour)

1

[13]

Q8.

(a) dark matt 1

light shiny 1

(b) B A C 1

biggest temperature difference (80 °C)

dependent on first mark 1

(c) (i) (the can that is) dark matt 1

best absorber (of infrared radiation) 1

(ii) any **three** from:

- same area / shape of can
- surrounding temperature is the same for all cans
- same surface underneath cans
- same position in the room

3

(d) fox A

smaller ears 1

thicker fur 1

these minimise energy transfer

dependent on first 2 marks 1

[12]

Q9.

(a) (i) 70

accept ± half a square
(69.8 to 70.2)

1

(ii) 15

*accept 14.6 to 15.4 for **2** marks*
*allow for **1** mark 70 − 55*
ecf from (b)(i) ± half a square

2

(iii) C 1

biggest drop in temperature during a given time

accept it has the steepest gradient this is a dependent

1

(iv) starting at 70 °C and below graph for C
must be a curve up to at least 8 minutes

1

(v) because 20 °C is room temperature

accept same temperature as surroundings

1

(b) (i) 6720

*correct answer with or without working gains **3** marks*

*6 720 000 gains **2** marks*

*correct substitution of E = 0.2 × 4200 × 8 gains **2** marks*

*correct substitution of E = 200 × 4200 × 8 gains **1** mark*

3

(ii) the fastest particles have enough energy

accept molecules for particles

1

to escape from the surface of the water

1

therefore the mean energy of the remaining particles decreases

accept speed for energy

1

the lower the mean energy of particles the lower the temperature (of the water)

accept speed for energy

1

[14]

Q10.

(a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance.

0 marks
No relevant content.

Level 1(1-2 marks)
There is a basic explanation of **one** feature
or
a simple statement relating reduction in energy transfer to **one** feature.

Level 2(3-4 marks)
There is a clear explanation of **one** feature
or
a simple statement relating reduction in energy transfer to **two** features.

Level 3(5-6 marks)
There is a detailed explanation of at least **two** features
or
a simple statement relating reduction in energy transfer to all **four** features.

Examples of the points made in response

extra information

accept throughout:
heat for energy
loss for transfer

plastic cap:

- plastic is a poor conductor
  accept insulator for poor conductor
- stops convection currents forming at the top of the flask so stopping energy transfer by convection
- molecules / particles evaporating from the (hot) liquid cannot move into the (surrounding) air so stops energy transfer by evaporation
- plastic cap reduces / stops energy transfer by conduction / convection / evaporation

glass container:

- glass is a poor conductor so reducing energy transfer by conduction
- glass reduces / stops energy transfer by conduction

vacuum:

- both conduction and convection require a medium / particles
- so stops energy transfer between the two walls by conduction and convection
- vacuum stops energy transfer by conduction / convection

silvered surfaces:

- silvered surfaces reflect infrared radiation
  accept heat for infrared
- silvered surfaces are poor emitters of infrared radiation
- infrared radiation (partly) reflected back (towards hot liquid)
- silvered surfaces reduce / stop energy transfer by radiation

6

(b) (the ears have a) small <u>surface</u> <u>area</u>

ears are small is insufficient

1

so reducing energy radiated / transferred (from the fox)

accept heat lost for energy radiated

*do **not** accept stops heat loss*

1

[8]

Q11.

(a) conduction

1

(b) (i) there is a bigger temperature difference between the water and the surrounding air

accept the water is hottest / hotter

1

so the transfer of energy (from hot water) is faster

accept heat for energy

ignore temperature falls the fastest

1

(ii) 120

*allow **1** mark for converting kJ to J correctly, ie 4 032 000*

or

correctly calculating temperature fall as 8°C

or

allow **2** marks for correct substitution, ie 4 032 000 = m × 4200 × 8

answers of 0.12, 19.2 **or** 16.6 gain **2** marks

answers of 0.019 **or** 0.017 gain **1** mark

3

(iii) water stays hot for longer

1

so heater is on for less time

accept so less energy needed to heat water

1

so cost of the jacket is soon recovered from) lower energy costs / bills

accept short payback time

1

[9]

Q12.

(a) (i) 2.1

correct answer only

1

(ii) 3.15

or

their (a)(i) × 1.5 correctly calculated

*allow **1** mark for correct substitution*

ie 2.1 × 1.5

or

their (a)(i) × 1.5

2

kilowatt-hour

accept kWh

or

*a substitution 2100 × 5400 scores **1** mark*

*2100 × 5400 incorrectly calculated with answer in joules scores **2** marks*

*an answer of 11 340 000 scores **2** marks*

*an answer of 11 340 000 J scores **3** marks*

1

(iii) most (input) energy is usefully transformed

accept does not waste a lot of energy

accept most of the output / energy is useful

*do **not** accept it does not waste energy*

1

(b) the room is losing energy / heat

1

at the same rate as the heater supplies it

this mark only scores if the first is scored

*do **not** accept heater reaches same temperature as room / surroundings*

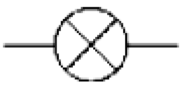
rate of heat gain = rate of heat loss scores both marks

1

[7]

Q13.

(a)



accept 'the humpback bridge' symbol

accept circle with cross but no lines

if more than one symbol drawn, no mark unless lamp is labelled

1

(b) (i) 24

*allow **1** mark for correct substitution ie* $\frac{2800}{120}$

*allow **1** mark for an answer 1440*
ignore any unit

2

(ii) watt

1

(c) larger than

accept correct indication inside the box
accept an answer meaning larger than ie greater than

1

[5]

Q14.

newton **or** N

metre **or** m

joules **or** J

all three correct 2 marks
two or one correct 1 mark

[2]