Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | Candidate Number

Combined Science

Paper 2: Physics 2

Higher Tier

Sample Assessment Materials for first teaching September 2016

Time: 1 hour 10 minutes

Paper Reference
1SC0/2PH

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 60
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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PEARSON

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Figure 1 shows part of a roller coaster ride seen from the side.

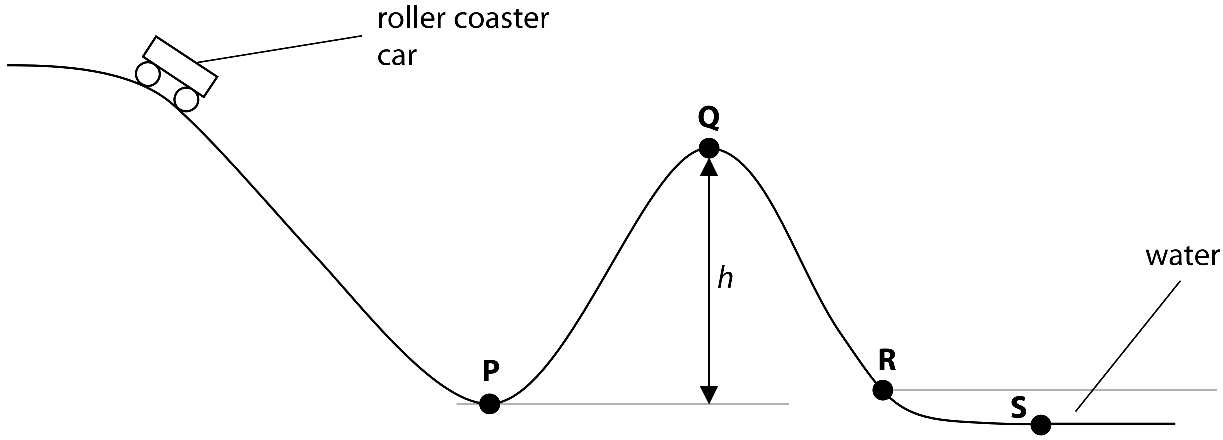

Figure 1

(a) The roller coaster car rolls down towards **P**. The car has mass, *m* kg and velocity, *v* m/s.

Which of these is the correct equation for calculating the kinetic energy of the car?

(1)

☐ **A** $KE = mv$

☐ **B** $KE = mv^2$

☐ **C** $KE = ½mv^2$

☐ **D** $KE = 2mv^2$

(b) The mass of the car is 580 kg.

The car gains 39 000 J of gravitational potential energy as it climbs from **P** to **Q**.

(i) State the equation relating change in gravitational potential energy, mass, gravitational field strength and change in vertical height.

(1)

(ii) Calculate the height *h*, shown in Figure 1.

(gravitational field strength, $g = 10$ N/kg)

(3)

$h =$ .... m

(c) The car enters a pool of water at **R**. It slows down and stops at **S**.

Describe how the total energy of the system is conserved as the car travels between **R** and **S**.

(2)

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(Total for Question 1 = 7 marks)

2 A student investigates how the resistance of a thermistor varies with temperature.

(a) The student sets up the circuit shown in Figure 2 to measure current and voltage.

He finds that it does not work.

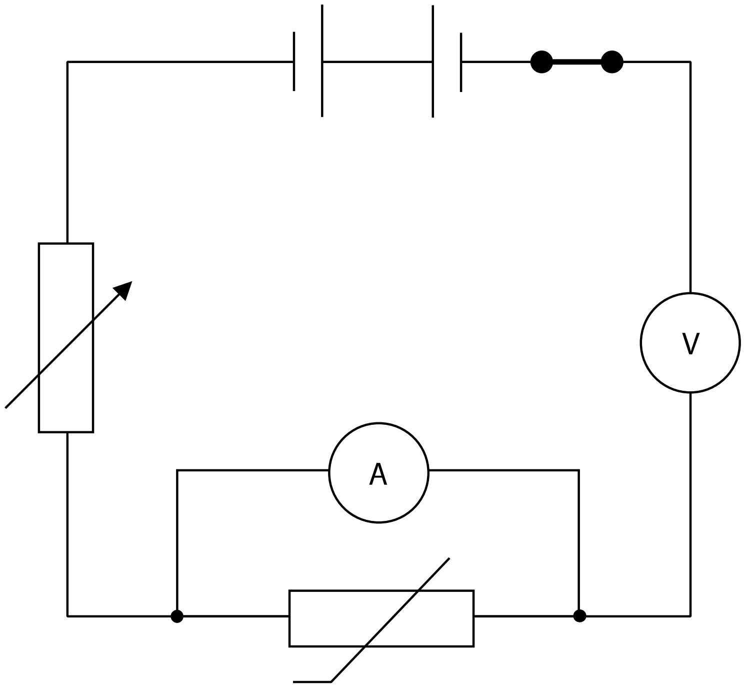

Figure 2

Give **three** modifications the student should make to the circuit so that the circuit works correctly.

(3)

1 ....

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2 ....

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3 ....

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(b) The student uses the equipment shown in Figure 3 to measure the temperature of the thermistor.

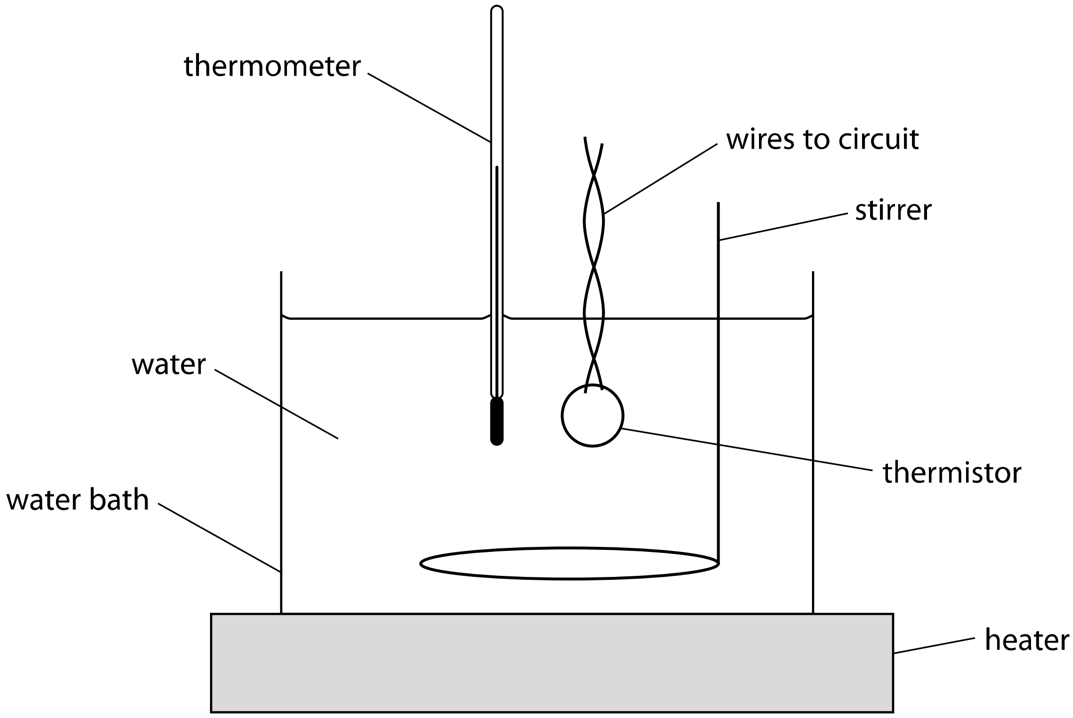


Figure 3

(i) Give **one** reason for using the water bath.

(1)

....

....

(ii) The equipment shown in Figure 3 is for investigations in the temperature range from 20 °C to 100 °C.

State **one** way the student could develop this experimental procedure to investigate temperatures outside this range.

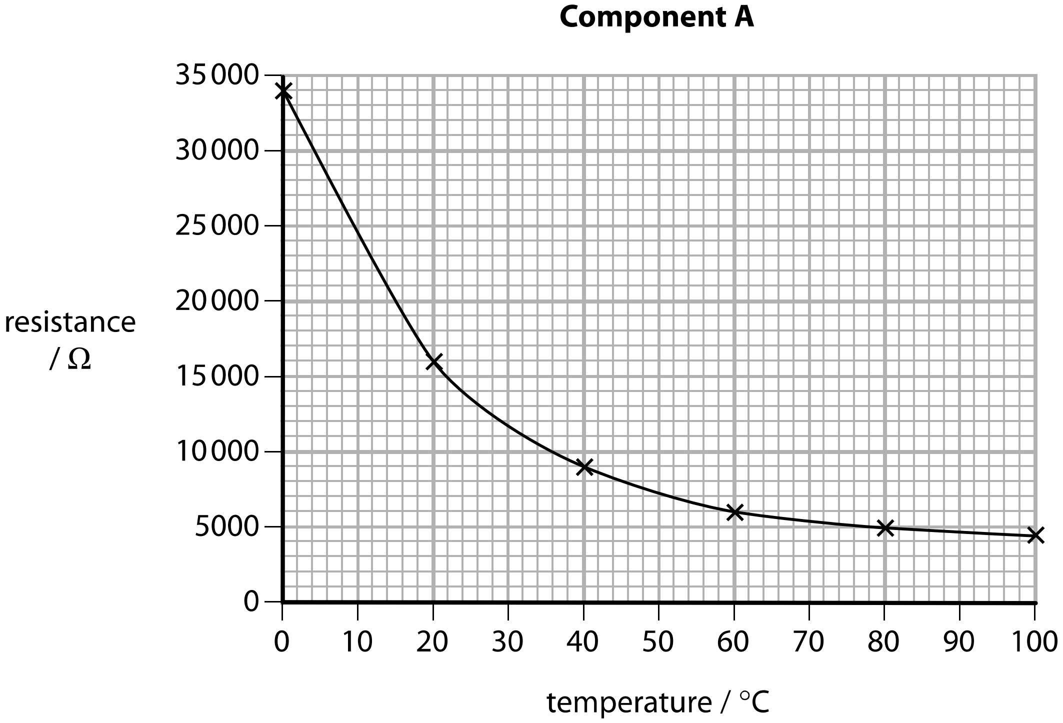
(1)

....

....

(c) The student takes measurements for two other components, **A** and **B**.

The results for both these components are shown in Figure 4.



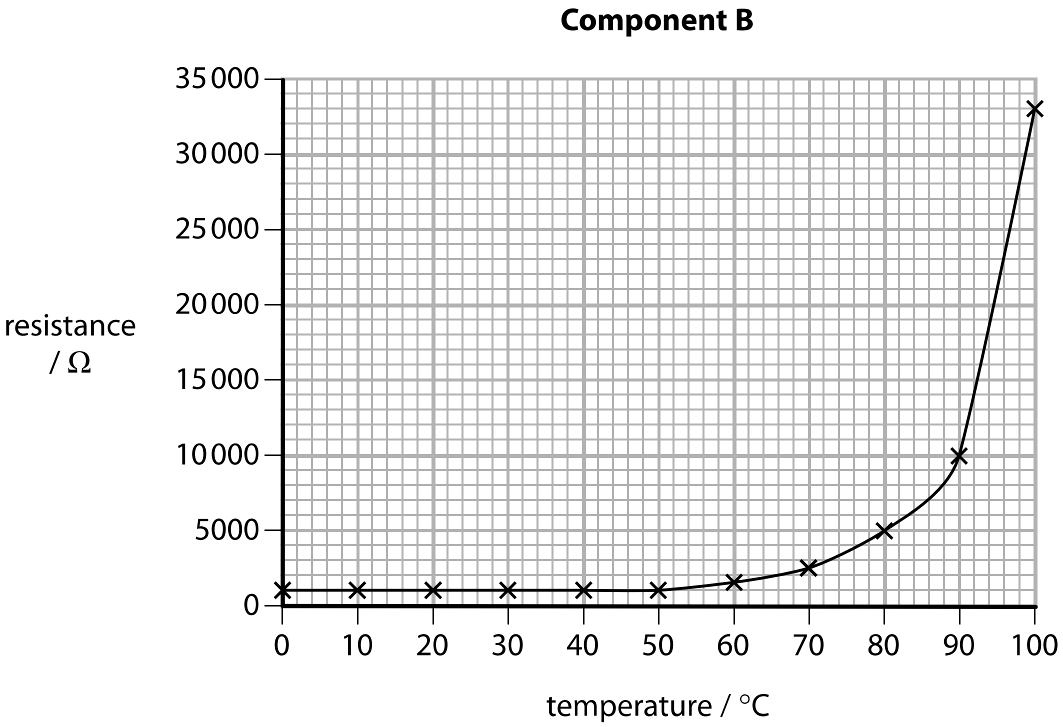


Figure 4

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(i) Compare and contrast how the resistances of component **A** and component **B** vary with temperature.

(3)

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(ii) Component **A** is connected to a 12V supply.

Which of these is the current in component **A** when the temperature is 80 °C?

(1)

☒ **A** $I = 12 \times 5000$

☒ **B** $I = \frac{12}{5000}$

☒ **C** $I = \frac{12^2}{5000}$

☒ **D** $I = \sqrt{\left(\frac{12}{5000}\right)}$

(Total for Question 2 = 9 marks)

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3 A student uses a digital calliper to measure the length of a spring, as shown in Figure 5.

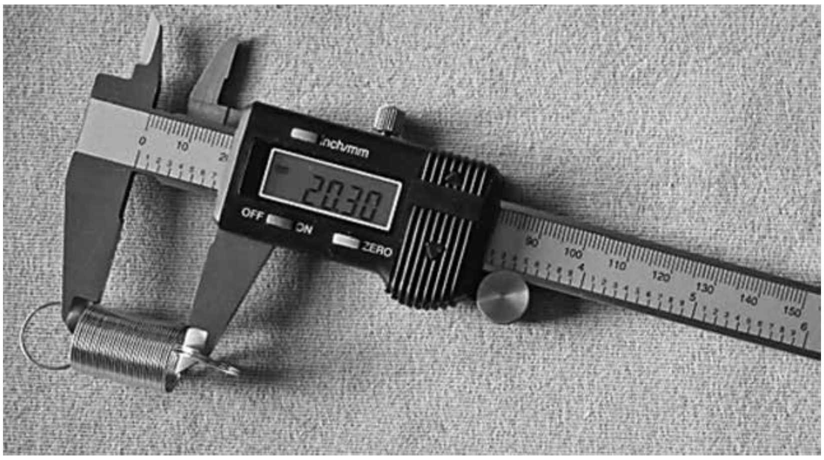


Figure 5

The spring is bendy and difficult to measure.

The student takes the six readings shown in Figure 6.

Figure 6

(a) Calculate the average length of the spring.

(2)

average length = ... mm

(b) The student investigates the stretching of a spring with the equipment shown in Figure 7.

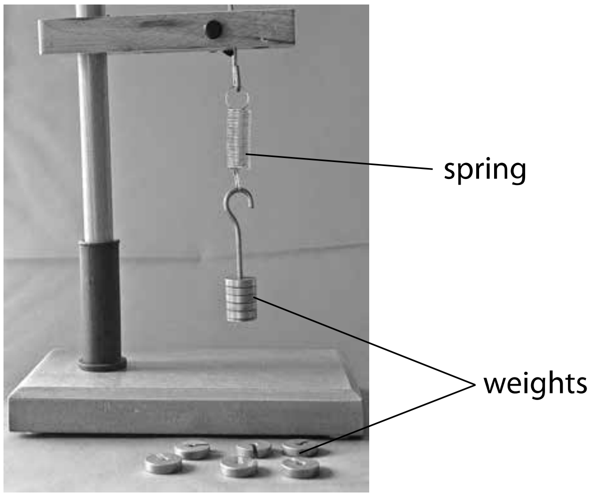


Figure 7

The student investigates the extension of the spring using six different weights.

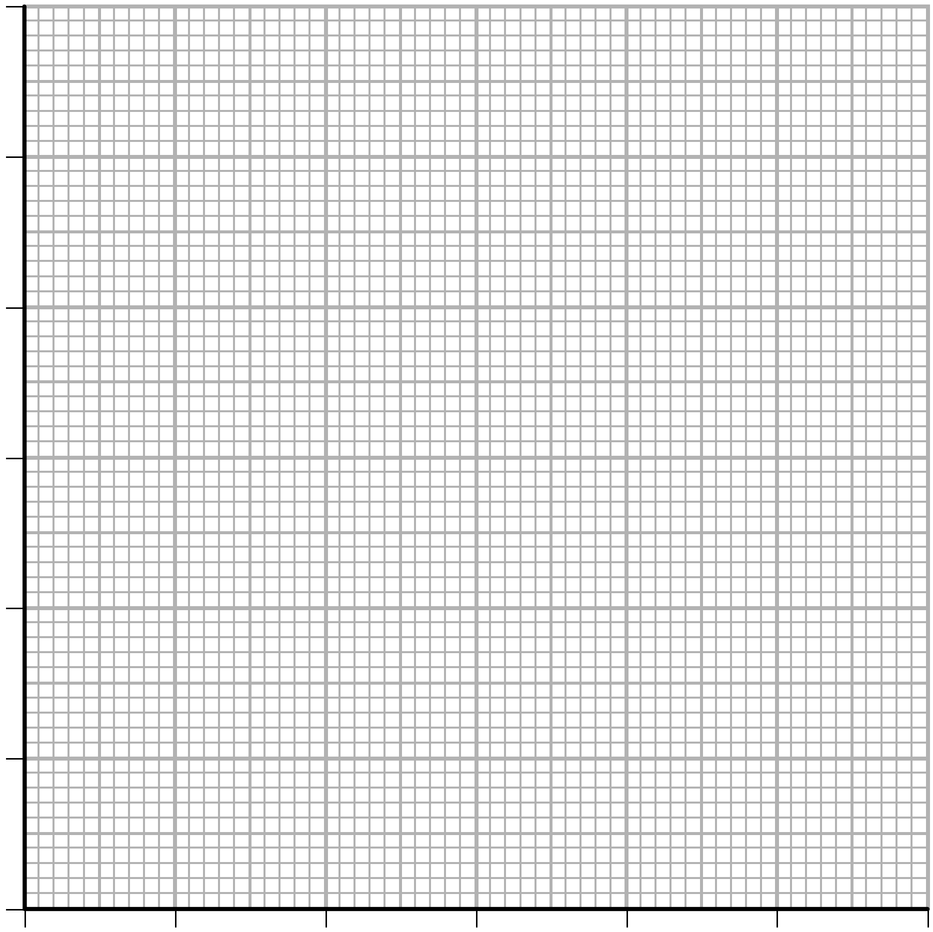
The results are shown in Figure 8.

weight (N)	extension (mm)
0.20	4.0
0.40	8.0
0.60	12.0
0.80	16.0
1.00	20.0
1.20	24.0

Figure 8

(i) Draw a graph for the readings, using the grid shown.

(3)



(ii) The student writes this conclusion:

'The extension of the spring is directly proportional to the weight stretching the spring.'

Comment on the student's conclusion.

(3)

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(c) The student extends the investigation by finding information about the stretching of wires.

The student finds the graph shown in Figure 9 for the stretching of a wire.

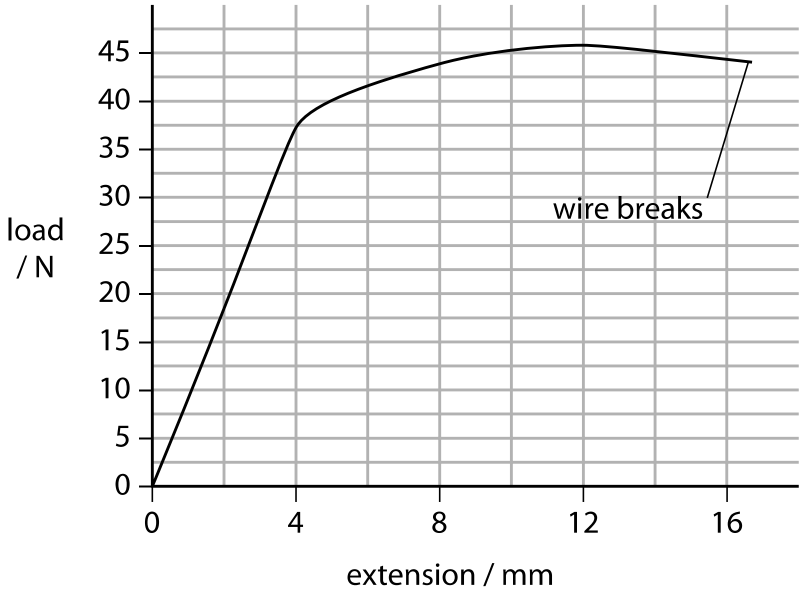

Figure 9

Describe the non-linear stretching of the wire shown in Figure 9.

(3)

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....

(Total for Question 3 = 11 marks)

4 Wooden trucks on a toy railway have permanent magnets that hold the train together.

The magnets are arranged so that an N-pole touches an S-pole between each truck, as shown in Figure 10.

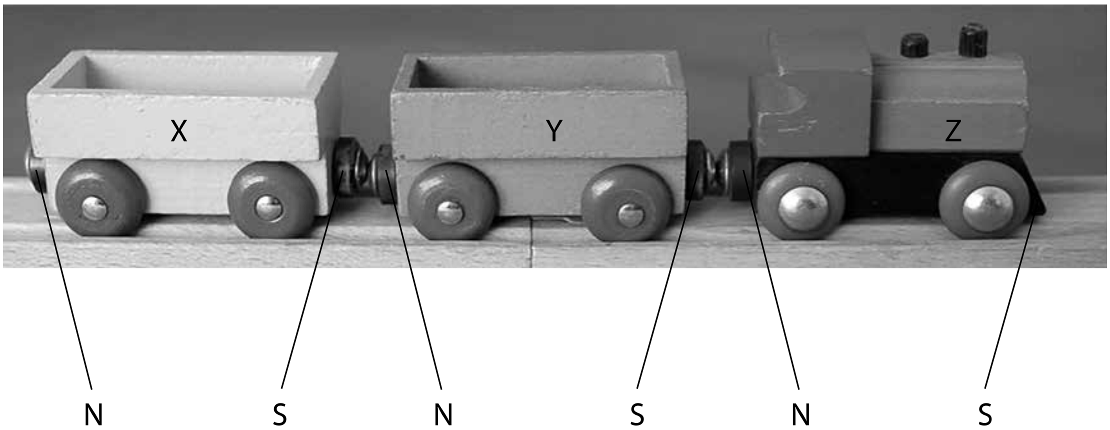


Figure 10

(a) Truck Y is removed from the train, turned through 180° and is then replaced between truck X and Z.

How does this affect the train?

(1)

☒ **A** Y attracts both X and Z as before

☒ **B** Y still attracts X but now repels Z

☒ **C** Y still attracts Z but now repels X

☒ **D** Y now repels both X and Z

(b) The structure of a truck, seen from above, is shown in Figure 11.

The permanent magnets cause a magnetic field both inside and outside the truck.

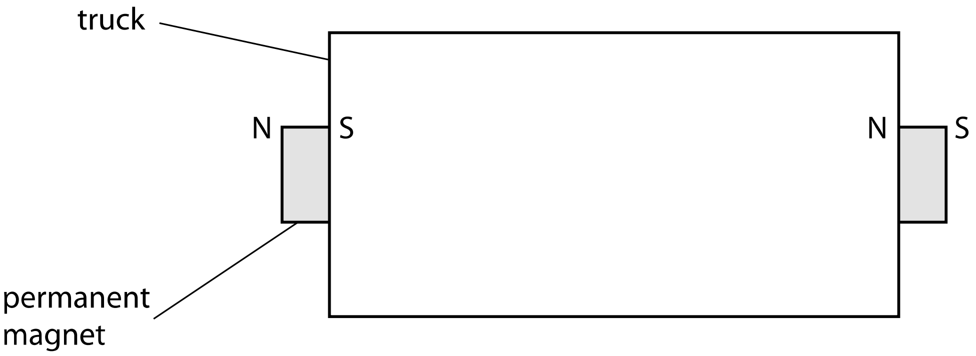
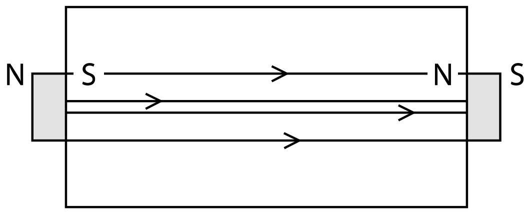


Figure 11

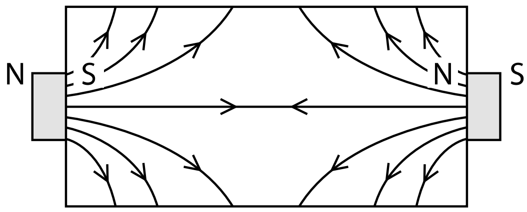
Which of these correctly shows the field inside the truck?

(1)

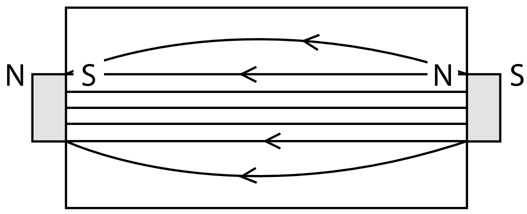
☒ **A**



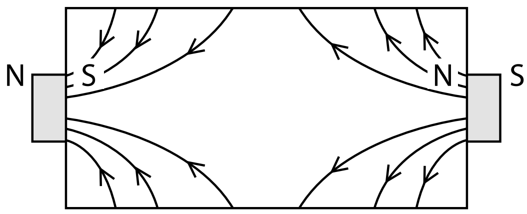
☒ **B**



☒ **C**



☒ **D**



(c) A student investigates the forces between the trucks in the toy railway.

She places another truck, **W**, next to truck **X**.

She pulls truck **Z** in the direction shown by the arrow.

The whole train travels at a constant speed as shown in Figure 12.

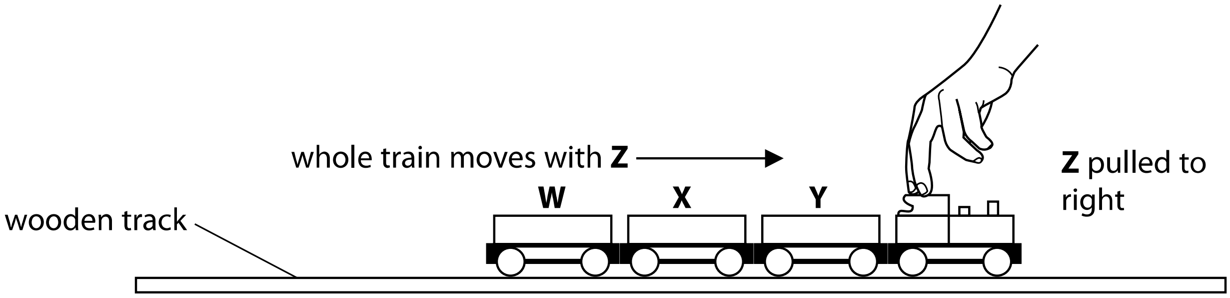


Figure 12

The student repeats this method of adding trucks and pulling the train each time.

When there are seven trucks in total, the train comes apart between **Y** and **Z** when tested as shown in Figure 13.

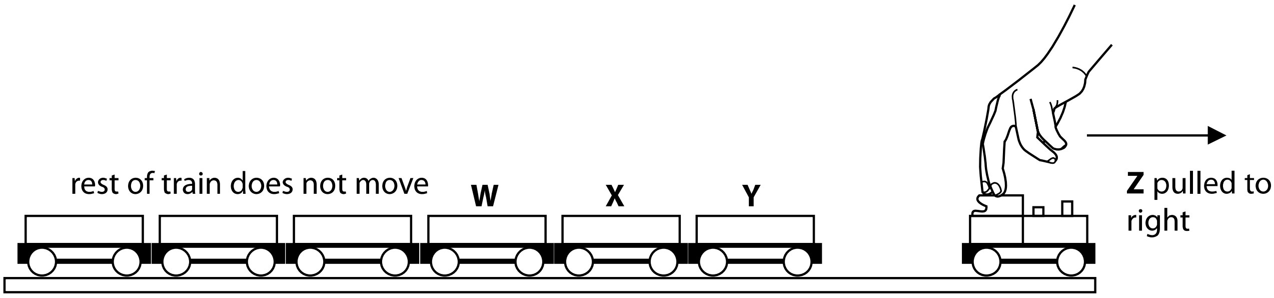


Figure 13

(i) Explain why the train acts in this way by considering the forces involved.

(2)

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....

....

....

(ii) Devise an experiment to investigate the horizontal force needed to separate the trucks from the engine.

(3)

(iii) Explain why a larger force is needed to separate the trucks from the engine if the force is applied at an angle to the horizontal.

(2)

(Total for Question 4 = 9 marks)

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5 Figure 14 shows an electric car connected to a battery charger.

(Source: © Danil Roudenko/123RF)

Figure 14

The car has a rechargeable battery to drive its motor.

The rechargeable battery provides a potential difference of 330 V and can store up to 64 MJ.

It takes 8 hours for the battery to receive a full charge.

(a) Calculate the total charge that flows while the battery is being charged.

(3)

total charge = ... C

(b) Calculate the average charging current.

(3)

current = ... A *(c) The battery charger shown in Figure 14 is connected to the 230 V a.c. domestic mains supply.

The output voltage of the charger is 335 V and it provides a d.c. charging current. Charging stops if the charging current exceeds 15 A.

Explain how electrical components in the charger can be connected together to give this type of output.

(6)

(Total for Question 5 = 12 marks)

6 The espresso machine shown in Figure 15 is an electrical appliance.

(Source: © tanawaty/123RF)

Figure 15

(a) The espresso machine has an electrical heater connected to a 440 V mains supply.

The power of the electrical heater is 3.5 kW.

(i) The rating of a fuse is the current above which it melts.

Which of these is the most suitable fuse for the espresso machine circuit?

(1)

☒ **A** 1 A

☒ **B** 5 A

☒ **C** 10 A

☒ **D** 13 A

(ii) Before the espresso machine can be used, its heater must raise the temperature of some cold water.

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

Show that it takes the heater about 90 s to raise the temperature of 1 kg of water from 18 °C to 95 °C.

Use an equation from the formula sheet.

(3)

(b) The espresso machine has a steam pipe that can be used to heat milk in a jug, as shown in Figure 16.

(Source: © Wavebreak Media Ltd/123RF)

Figure 16

Steam from the pipe enters the milk, where steam condenses to water.

The steam and hot water heat the milk.

(i) Describe, in terms of energy, how the arrangement and movement of particles in the steam changes as the steam enters the milk, condenses and cools.

(2)

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(ii) The specific heat capacity of milk is 3840 J/kg K.

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

The specific latent heat of condensation of steam is 2260 kJ/kg.

The temperature of the steam is 100 °C.

The mass of steam that condenses is 25 g.

The temperature of the milk rises from 5 °C to 65 °C.

By considering the transfer of energy from the steam to the milk, calculate the mass of milk that is heated by the steam and hot water.

Use equations from the formula sheet.

(4)

mass of milk = ... kg

(iii) Give **two** reasons why the actual mass of steam needed to heat the milk from 5 °C to 65 °C is greater than 25 g.

(2)

1 ....

....

2 ....

....

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Equations

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
force = change in momentum ÷ time $F = \frac{(mv - mu)}{t}$
energy transferred = current × potential difference × time $E = I \times V \times t$
force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length $F = B \times I \times l$
$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil $V_p \times I_p = V_s \times I_s$
change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta\theta$
thermal energy for a change of state = mass × specific latent heat $Q = m \times L$
$P_1 V_1 = P_2 V_2$ to calculate pressure or volume for gases of fixed mass at constant temperature
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$
pressure due to a column of liquid = height of column × density of liquid × gravitational field strength $P = h \times \rho \times g$

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