Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Physics (1PH0) Foundation

Resource Set Topic C – Test 2: Waves, Light and the electromagnetic spectrum

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

3 (a) A copper can, painted black, contains boiling water at 100 °C.

The can is left to cool and a measurement of the water temperature is taken every 5 minutes.

Figure 3 shows the measurements.

time in minutes	temperature in °C
0	100
5	74
10	60
15	56
20	37
25	30
30	25

Figure 3

(i) Two points, shaded in the table, have not been plotted.

Plot these two points on the graph, in Figure 4.

(2)

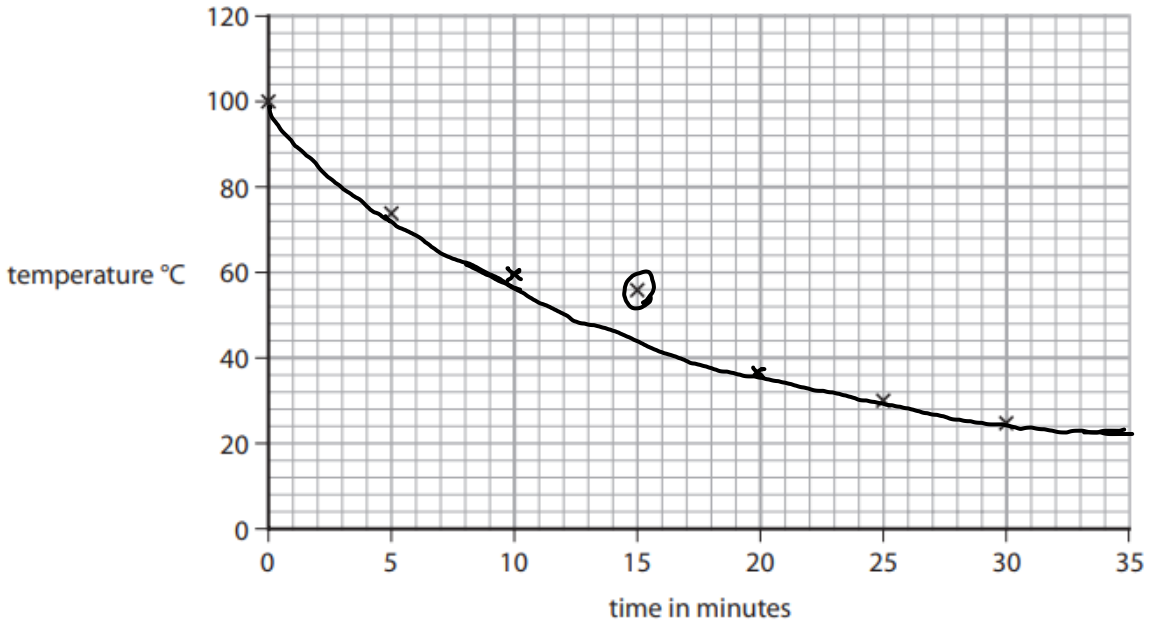


Figure 4

(ii) One of the points on the graph in Figure 4 is anomalous.

Circle the anomalous point.

(1)

(iii) Draw the best fit curve on the graph in Figure 4.

(1)

(iv) An identical can contains the same amount of boiling water.

This can has a shiny silver surface.

The measurements are repeated with this can and a new curve is drawn.

State how the cooling curve would be different from the curve in the graph in Figure 4.

(1)

The new curve will be above the one in Figure 4.

(b) Figure 5 is a graph showing the intensity–wavelength curves for two hot objects, L and M.

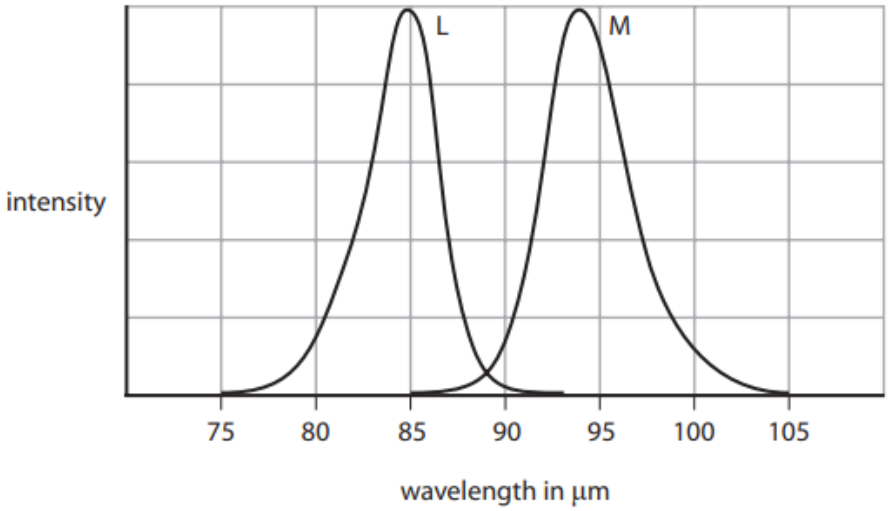


Figure 5

(i) Estimate the wavelength where the intensity is at a maximum for each of the objects.

(2)

wavelength at maximum intensity for object L = 84 μm

wavelength at maximum intensity for object M = 93 μm

(ii) State, with a reason, which object is the hotter object.

(1)

Object L

Reason Since it has a shorter wavelength

7 (a) Figure 12 is a diagram showing a lens, with some light rays passing through it.

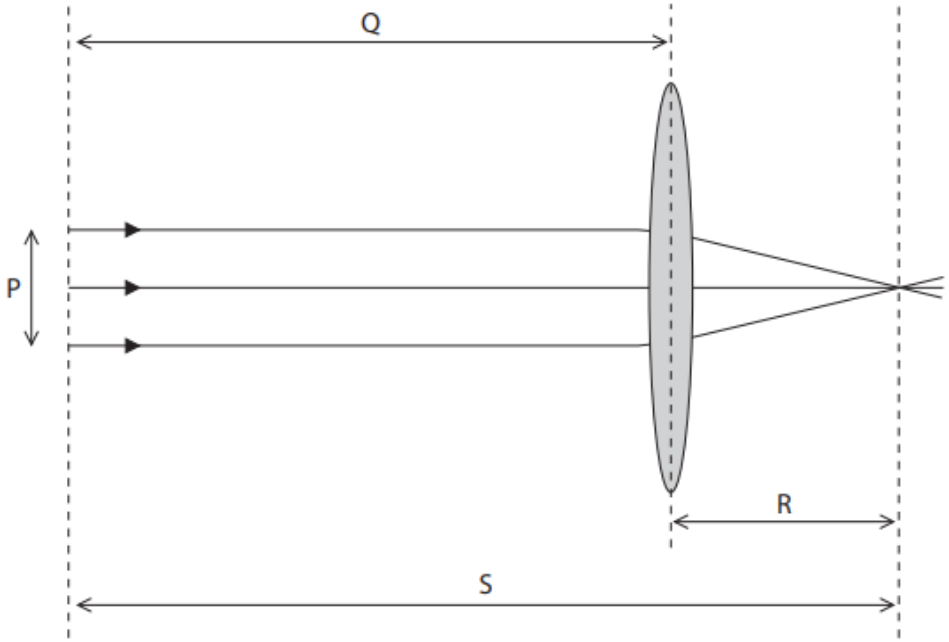


Figure 12

(i) This diagram shows a

(1)

- [x] **A** converging lens forming a real image
- [ ] **B** diverging lens forming a real image
- [ ] **C** converging lens forming a virtual image
- [ ] **D** diverging lens forming a virtual image

(ii) Which length, labelled on Figure 12, shows the focal length of the lens?

(1)

- [ ] **P**
- [ ] **Q**
- [x] **R**
- [ ] **S**

(b) Calculate the power of a lens of focal length 17 cm.

Use the equation

$$\text{power (in dioptres)} = \frac{1}{\text{focal length (in metres)}}$$

Give the answer to 2 significant figures.

(3)

$$= \frac{1}{\left(\frac{17}{100}\right)} = 5.882 \approx 5.9$$

power = 5.9 dioptres

8 (a) A student investigates what happens when light travels from air to glass.

Figure 15 shows some of the apparatus used in the investigation.

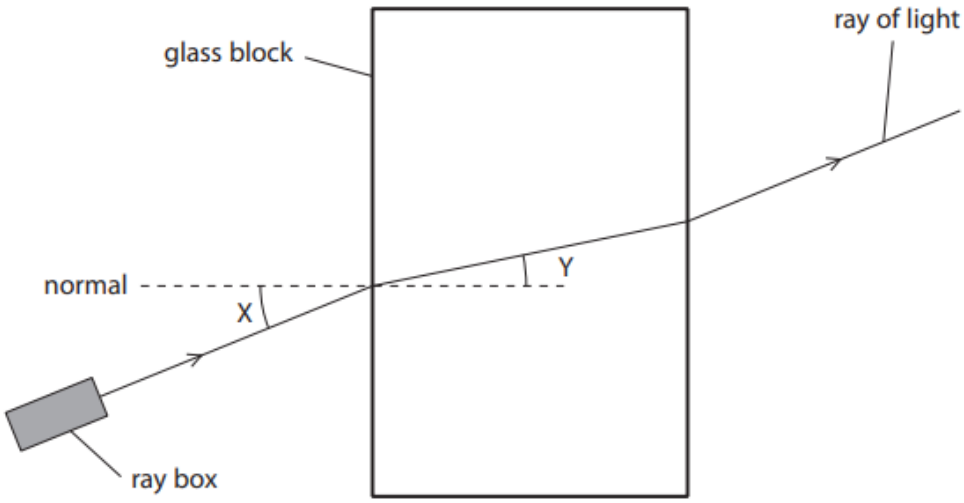


Figure 15

(i) In Figure 15, angle Y is the angle of

(1)

- ☐ **A** deflection
- ☐ **B** incidence
- ☐ **C** reflection
- ☒ **D** refraction

(ii) Figure 16 is a graph of the student's results.

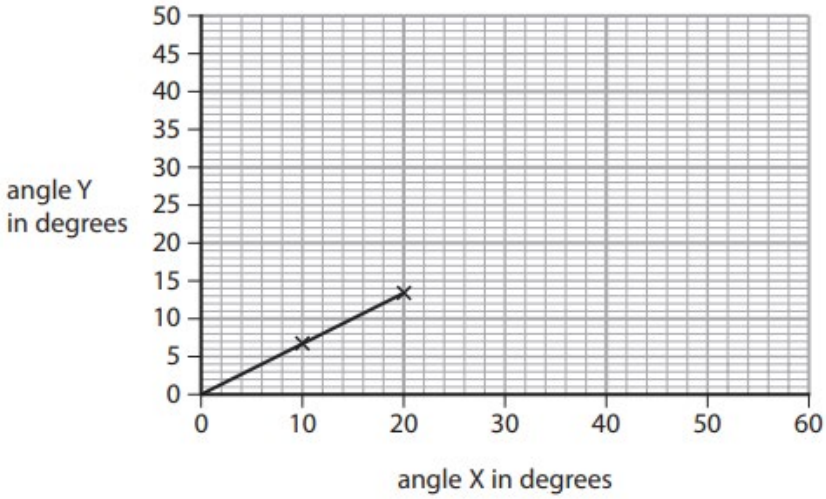


Figure 16

Use the graph to calculate a value for

$$\frac{\text{angle Y}}{\text{angle X}}$$

(2)

gradient = $\frac{13}{20}$

$\frac{\text{angle Y}}{\text{angle X}}$ = 0.65

(iii) The student concludes that angle Y is directly proportional to angle X.

Explain what the student must do to test this conclusion in more detail.

(3)

The student should carry out the experiment to get more readings for more incident and refracted angles and add those readings to the curve. The student can then arrive at a conclusion in more detail.

(b) The speed of light is 3.0×10^{8} m/s.

The wavelength of yellow light is 5.8×10^{-7} m.

Calculate the frequency of yellow light.

State the unit.

Use the equation

$$\text{frequency} = \frac{\text{speed}}{\text{wavelength}}$$

(3)

$$f = \frac{3 \times 10^{8}}{5.8 \times 10^{-7}}$$

$$= 5.1724 \times 10^{14}$$

$$\approx 5.2 \times 10^{14}$$

frequency = 5.2×10^{14} unit Hz

(c) (i) Give **one** colour of light that has a longer wavelength than yellow light.

(1)

Red

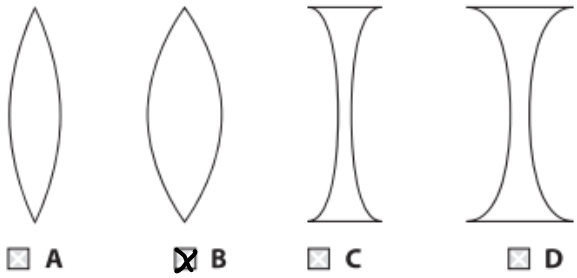
(ii) Give **one** colour of light that has a higher frequency than yellow light.

(1)

Green

10 (a) (i) Which lens is a converging lens with the greatest power?

(1)



☐ A ☒ B ☐ C ☐ D

(ii) The equation that relates the power of a lens to the focal length of the lens is

$$\text{power (in dioptres)} = \frac{1}{\text{focal length (in metres)}}$$

The power of a lens is 5 dioptres.

Use the equation to calculate the focal length of the lens in cm.

(2)

$5 = \frac{1}{f}$

$f = 0.2\text{m}$

focal length = 20 cm

(b) Figure 12 shows a semicircular glass block.

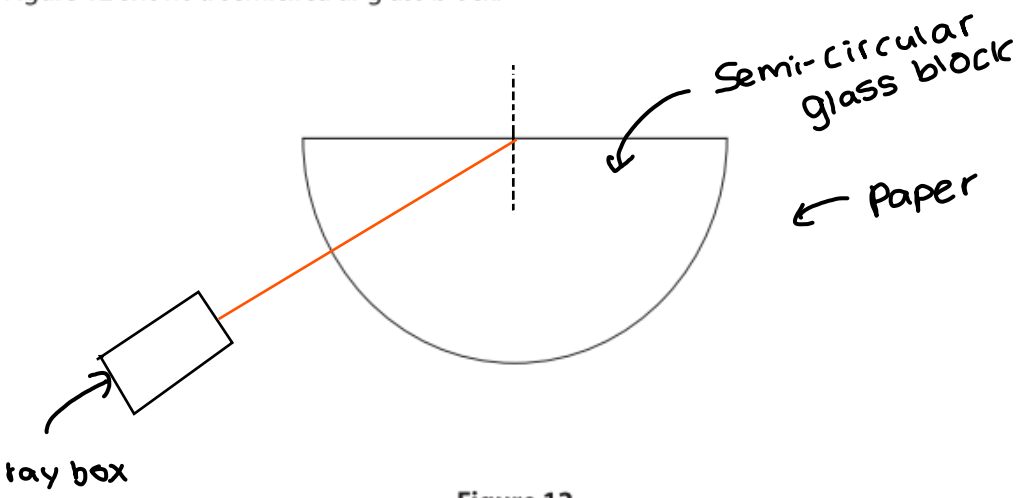


Figure 12

Describe how a student could use the semicircular glass block and other apparatus to determine the critical angle for a glass-air boundary.

You should add to the diagram in Figure 12 to help with your answer.

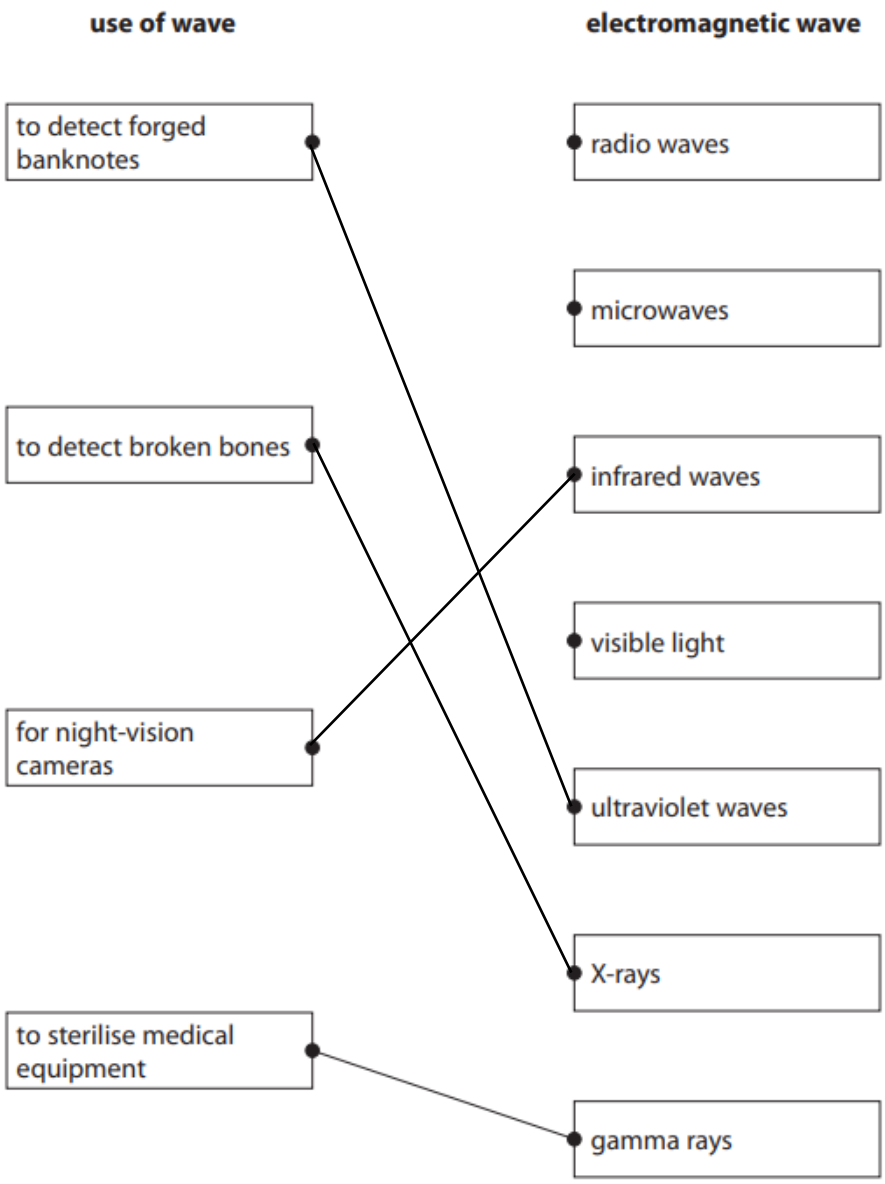
(4)

Keep the block on paper and draw round its outline. Use a ruler to measure the length of the flat side and mark the mid-point with a cross. Draw a normal line through this cross. Use a ray box to direct the incident ray through the curved surface towards the mid-point, and change the angle of incidence until the refracted ray passes parallel to the flat side of the block. Mark the entry point of the incident ray on the curved surface with a cross, then remove the block, join the crosses to draw the path of the ray, and measure the incident angle between this line and the normal. This is equal to the critical angle

1 (a) Draw one line from each **use of wave** to the matching **electromagnetic wave**.

One line has been drawn for you.

(3)



(b) Ultraviolet light has a higher frequency than infrared light.

Which of these colours of visible light has the highest frequency?

(1)

- ☒ **A** blue
- ☐ **B** green
- ☐ **C** orange
- ☐ **D** yellow

(c) Figure 1 shows how the brightness of a source of light changes with wavelength.

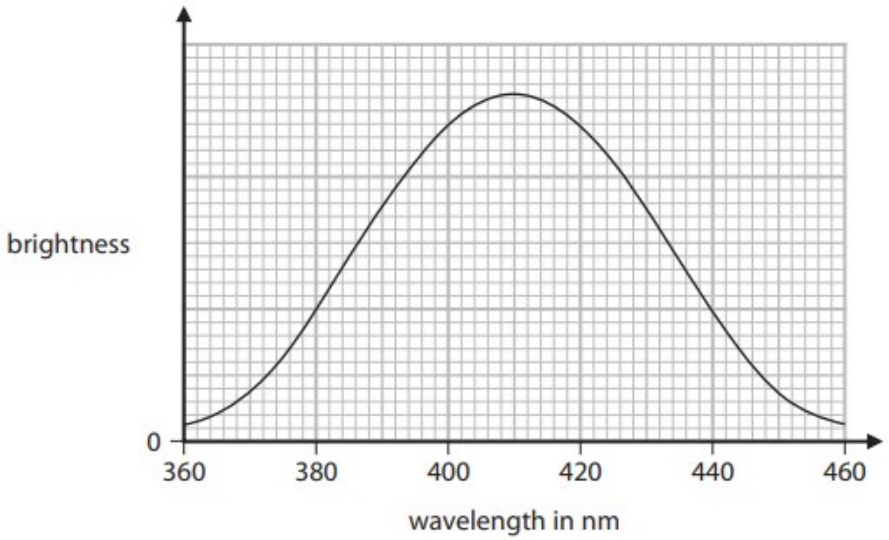


Figure 1

Describe how the brightness changes with wavelength.

(2)

The brightness increases as wavelength increases from 360nm to a maximum value at 410nm and decreases back to a minimum value at 460nm.

4 (a) (i) Figure 4 shows two light rays hitting a glass lens.

On Figure 4, draw the two light rays after they leave this lens.

(1)

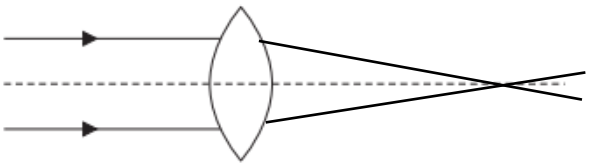


Figure 4

(ii) Figure 5 shows two light rays hitting a different glass lens.

On Figure 5, draw the two light rays after they leave this lens.

(1)

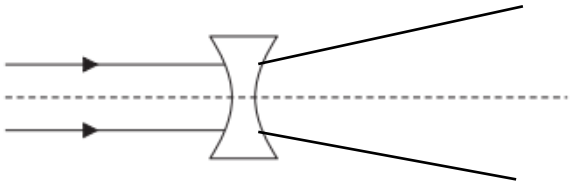


Figure 5

(iii) A lens has a focal length of 25 cm.

Calculate the power of the lens.

Use the equation

$$\text{power in dioptres} = \frac{1}{\text{focal length in metres}}$$

(2)

$= \frac{1}{\left(\frac{25}{100}\right)}$

power of the lens = 4 dioptres

(b) Figure 6 shows two solid metal balls, **P** and **Q**.

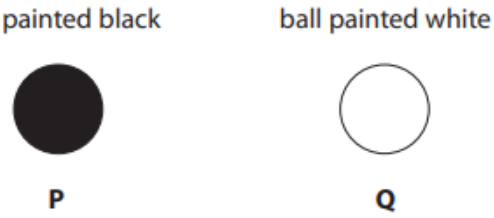


Figure 6

P and **Q** are made from the same metal and have the same radius.

P is painted black and **Q** is painted white.

Each ball is heated to a different temperature.

The balls then cool in the same room.

The graph in Figure 7 shows how the temperature of each ball changes with time.

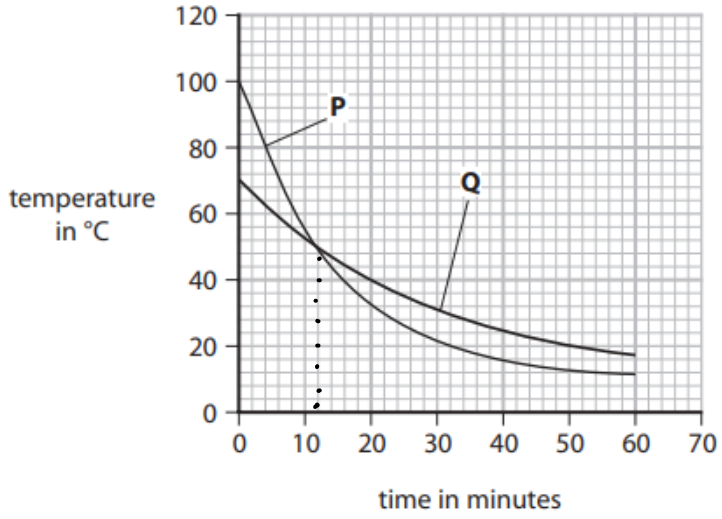


Figure 7

(i) Use the graph in Figure 7 to determine the time when **P** and **Q** were at the same temperature.

Show your working on the graph.

(2)

time = 12 minutes

(ii) Which of these temperatures is most likely to be room temperature, as shown by the graph in Figure 7?

(1)

- ☐ **A** 100 °C
- ☐ **B** 70 °C
- ☒ **C** 10 °C
- ☐ **D** 0 °C

(iii) Explain why the curve for **P** is different from the curve of **Q**. Use information from Figure 6 and Figure 7 to help your answer.

(2)

The curve P which corresponds to the black painted ball is heated to a higher temperature initially and cools faster because black is a good emitter of heat compared to white. Hence, the curve P has a higher intercept and has a larger curvature due to the above reasons respectively.

TOTAL FOR PAPER IS 46 MARKS