RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

General Certificate of Secondary Education

PHYSICS

1982/6

PAPER 6

HIGHER TIER

Specimen Paper 2003

Candidates answer on the question paper.

Additional materials:

Pencil, Ruler (cm, mm)

TIME 45 minutes

Candidate Name	Centre Number	Candidate Number

INSTRUCTIONS TO CANDIDATES

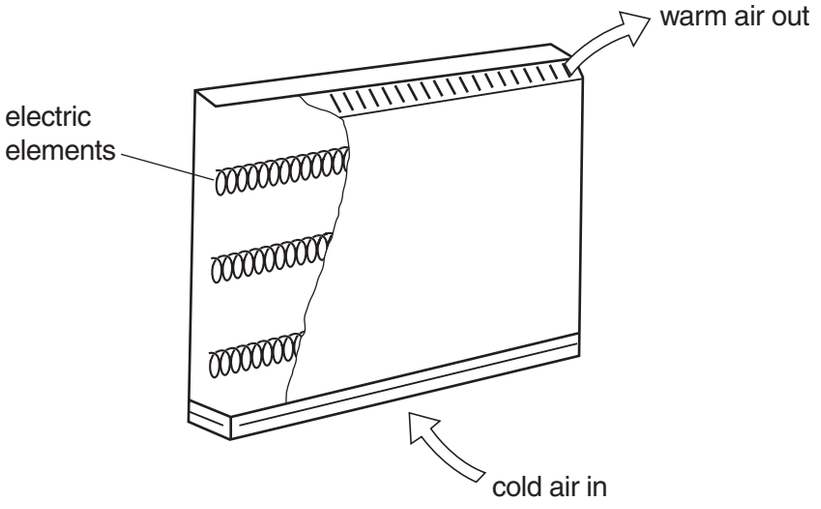
- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer all the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

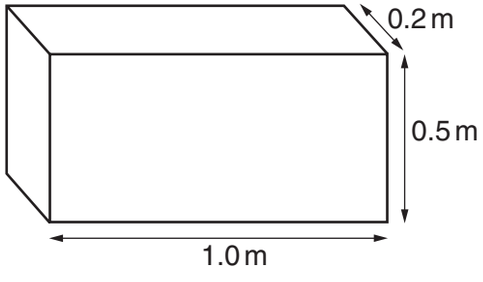
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 50.
- *You will be awarded marks for the quality of written communication where an answer requires a piece of extended writing.*

Question number	For examiner's use only
1	
2	
3	
4	
5	
TOTAL	

1 A heating engineer designs a storage heater, which must contain either concrete or oil. Electric elements are used to heat up the heater at night when electricity costs less.



(a) The storage heater contains a box measuring 1.0 m long, 0.5 m high and 0.2 m deep.



Calculate the volume of this box.
You **must** show how you work out your answer.

volume = _____ m^3 [1]

(b) The engineer works out the mass of concrete which would fill the box.
He writes this in the table.

material	energy to raise the temperature of 1 kg by 1 deg C	density	mass of material to fill box
concrete	3400 J	2200 kg/m^3	220 kg
oil	2000 J	760 kg/m^3	_____ kg

Write down **two** reasons which support his decision.

1 _____

_____

2 _____

_____ [2]

(d) The box is filled with concrete blocks.
Each of the concrete blocks has a mass of 5kg.
One of the blocks is heated from 15 °C to 65 °C.

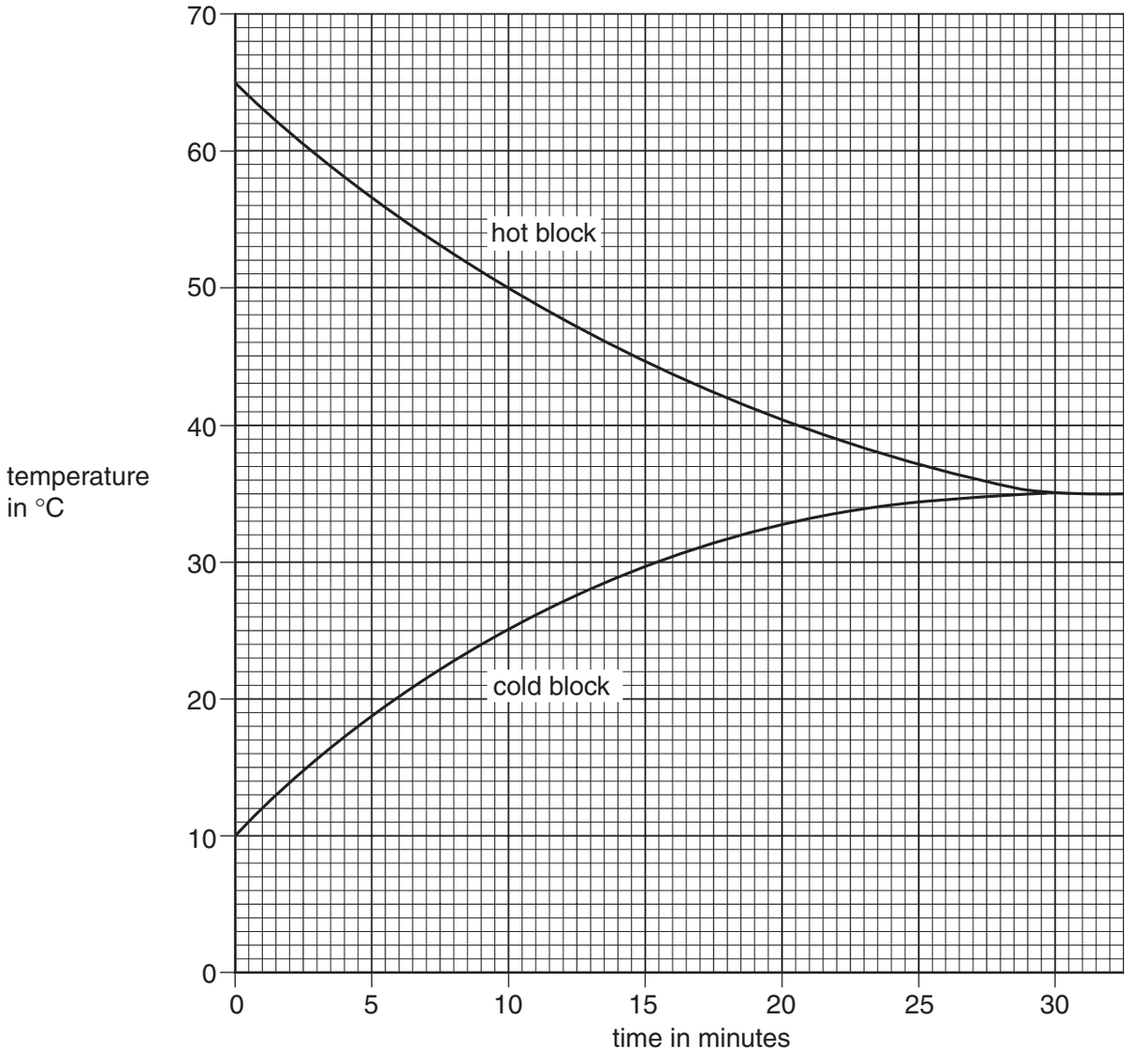
Calculate the energy gained by this block.
Use the equation below. You **must** show how you work out your answer.

energy gained = mass × specific heat capacity × temperature rise

energy = _____ J [2]

For Examiner's Use

(e) The hot concrete block is put in contact with a cold concrete block.
Both blocks are covered with a good insulator so that no heat is lost.
The graph shows how the temperature of each block changes with time.



How can you tell from the graph that the cold concrete block has a larger mass than the hot concrete block?

_____

_____

_____

_____ [2]

(f) The graph shows that:

- initially the hot block cools down and the cold block warms up.
- after 30 minutes the temperatures of both blocks become steady.

A model for explaining how energy transfers between the blocks involves the random transfer of tiny packets of energy.

Use your ideas about these energy packets and the rate at which they transfer energy to explain these observations.

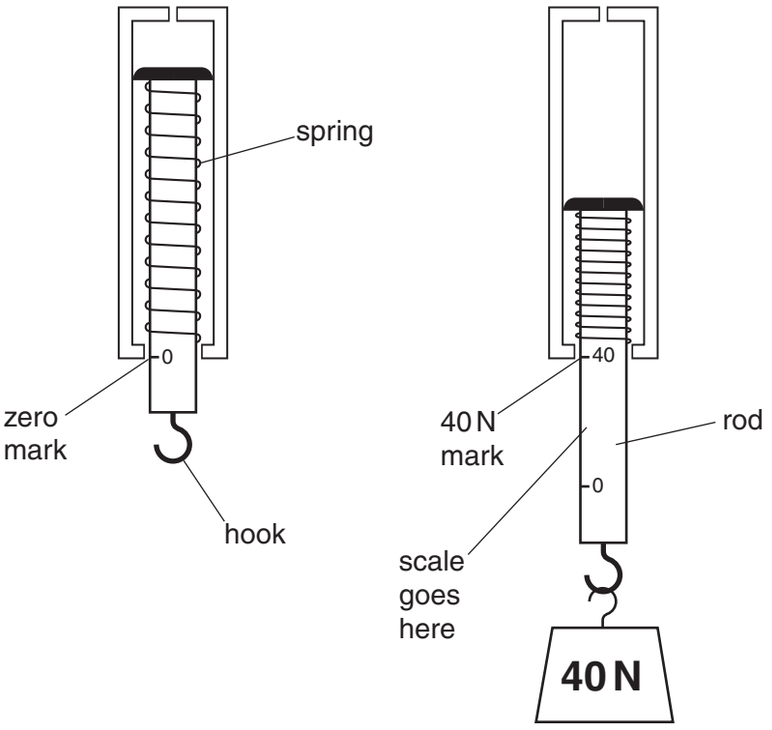
You will be given credit for the correct use of technical terms and the correct use of spelling, punctuation and grammar.

[5]

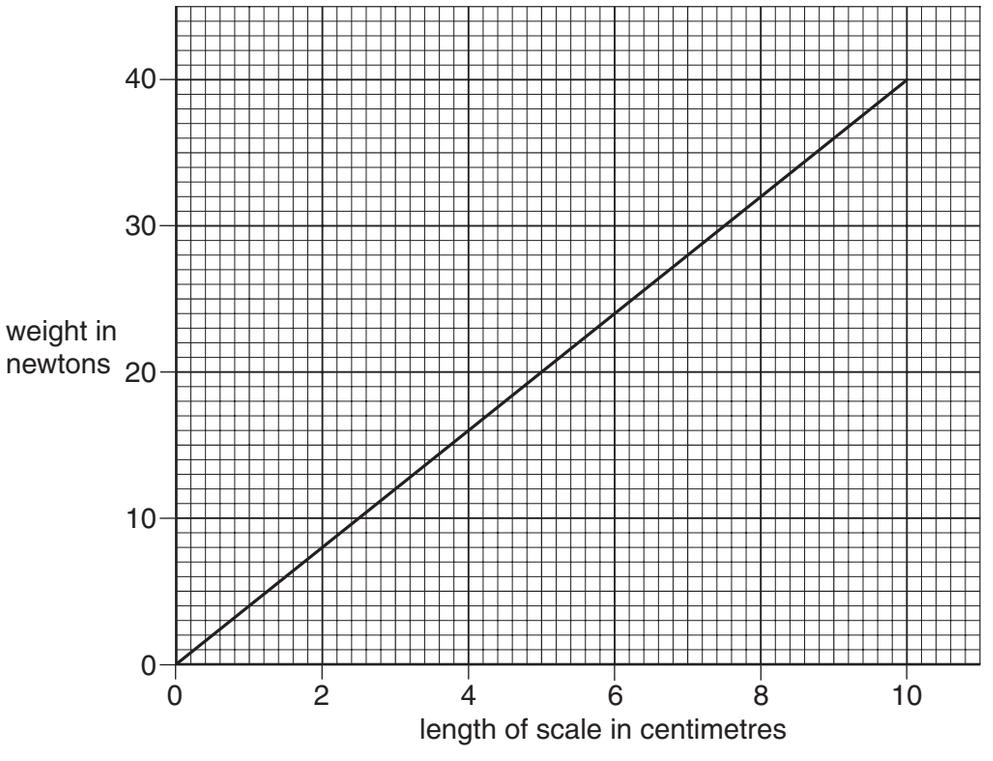
[Total: 13]

[Turn over

2 Jerry makes a spring balance (newton-meter) for weighing fish.
She uses a stiff spring and parts of a bicycle pump.
She puts a scale in newtons on the rod.



(a) Jerry loads the spring balance.
Each time she adds another 5 newtons to the weight, she makes another scale mark on the rod.
The graph below shows how adding weights increases the length of the scale.



Put one tick (✓) in the box which shows the correct link between the **weight** and the **length of the scale**.

compressed	☐
constant	☐
parallel	☐
proportional	☐

[1]

(b) (i) Use the graph to find the value of the spring constant in N/cm.

spring constant = _____ N/cm [2]

(ii) What is the value of the spring constant in N/m?

spring constant = _____ N/m [1]

(c) Jerry catches a fish which weighs 20N. She hangs the fish on her balance.
Use the graph to work out the energy stored in the spring.
You **must** show how you work out your answer.

energy = _____ joules [4]

This makes their van bounce up and down.

At a certain speed the van bounces 8 times in 10 seconds.

(i) What is the frequency of the bounces?

frequency = _____ unit _____ [2]

(ii) If the van slows down slightly the amplitude of the oscillations increases.
Explain why this happens. Use your ideas about oscillations.

_____

_____

_____

_____ [3]

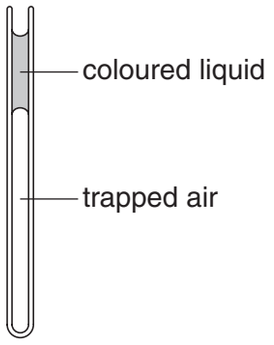
[Total: 13]

3 Anna investigates whether a trapped column of air in a thin glass tube acts like a thermometer.

The tube is sealed at the bottom and open at the top.

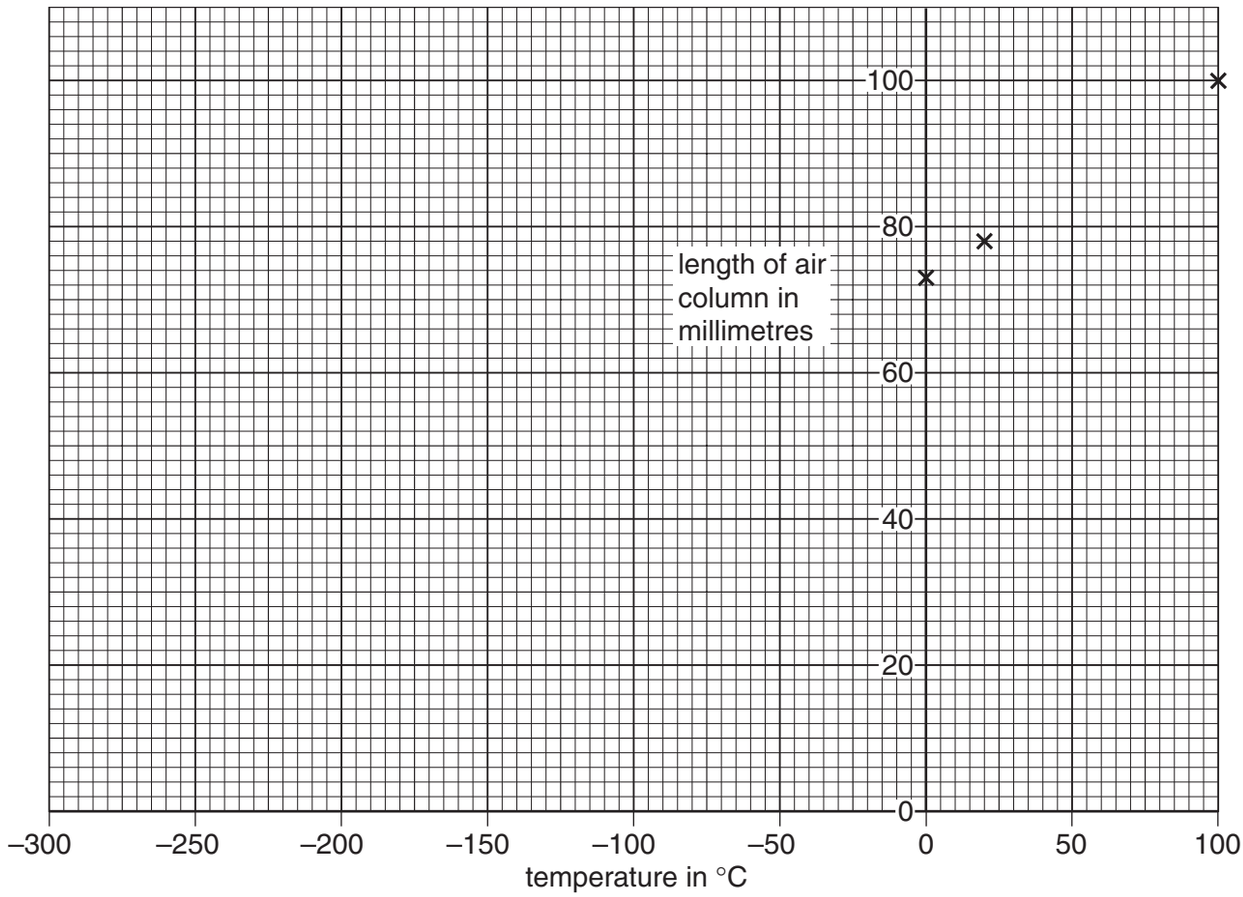
The air is trapped by a short length of coloured liquid.

She measures the length of the column of air.



	temperature	**length of air column**
at room temperature	20 °C	78 mm
when the tube is in melting ice	0 °C	73 mm
when the tube is in boiling water	100 °C	100 mm

She plots these results on a graph:



(a) **(i)** Use your graph to find the temperature at which the length of the air column is zero.

temperature = _____ °C [2]

(ii) What do we call this temperature? _____ [1]

(iii) Explain why the pressure of a gas at this temperature is zero.

_____

_____ [1]

(b) Use your ideas about particles in air to explain why the column of liquid does not fall to the bottom of the tube at room temperature.

You will be given credit for the correct use of technical terms and for correct use of spelling, punctuation and grammar.

_____

_____

_____

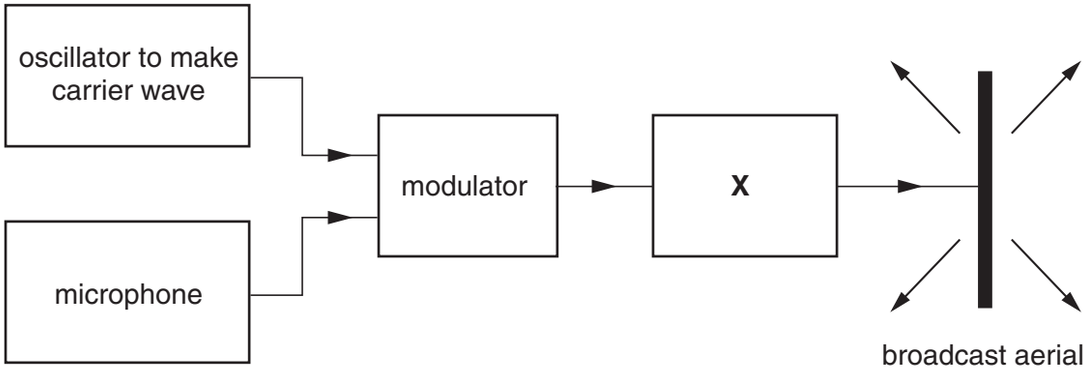
_____

_____

_____ [5]

[Total: 9]

4 The diagram shows a simple AM (amplitude modulation) radio system for generating a radio signal.



(a) What does the microphone do?

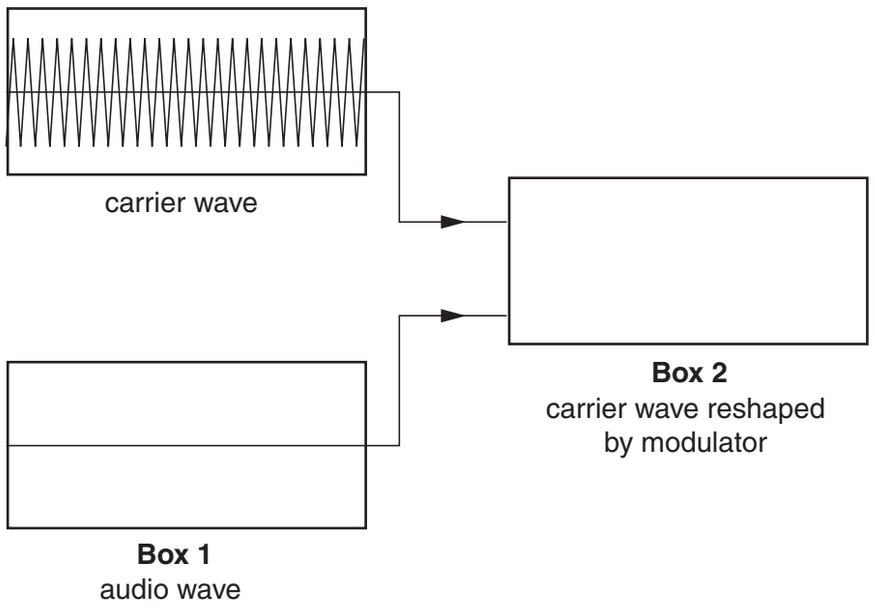
_____ [1]

(b) What is required in box **X** to make the signal strong enough to be received over a wide area?

_____ [1]

(c) The wave trace for the carrier wave is shown.
In **Box 1** sketch a possible wave trace for the audio wave.

Now show in **Box 2** how the carrier wave is reshaped by the modulator. [2]



(d) Each radio station sends out a modulated carrier wave in this way.

How is it possible to listen to the signal from just one radio station at a time?

_____

_____

_____

_____ [2]

Mobile telephones are now very often used for communication. Scientists are concerned about the health hazards from the use of mobile telephones. A report in a recent newspaper suggested that radiation from mobile telephones could cause memory loss.

Scientists tell each other about their work in many ways. One way they do this is in the media.

(i) Write down **one** other way that scientists tell each other about their work.

_____ [1]

(ii) Why is it important that scientists tell each other about their work. Write down **two** reasons.

1 _____

2 _____

[2]

[Total: 9]

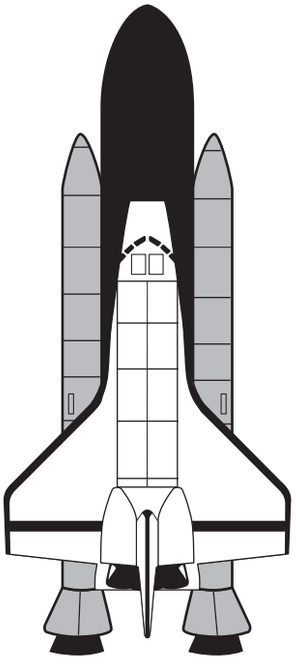
For Examiner's Use

5 For this question these equations may be useful.

$$v = u + at$$

$$s = ut + \tfrac{1}{2}at^2$$

The diagram shows the Shuttle spacecraft as it is launched into space.



During the first eight minutes of the launch the average acceleration of the Shuttle is 17.5 m/s^2.

(a) Calculate the speed of the Shuttle after the first 8 minutes.
You **must** show how you work out your answer.

speed = _____ m/s [2]

[Turn over

(b) Calculate how far the Shuttle travels in the first 8 minutes.
You **must** show how you work out your answer.

distance = _____ m [2]

(c) In fact the acceleration of the Shuttle is increasing. Suggest a reason for this.

_____

_____

Explain your answer.

_____

_____ [2]

[Total: 6]