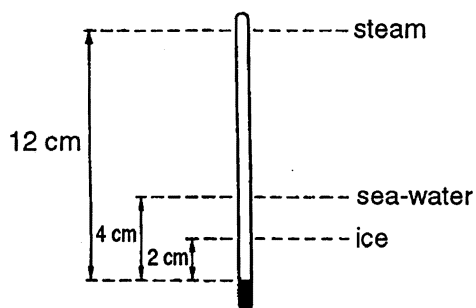


TOPIC 10

Temperature

1



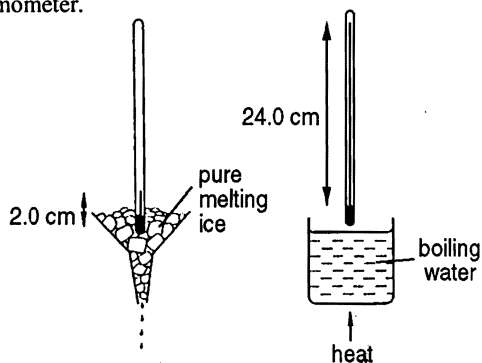
A student using an unmarked liquid-in-glass thermometer puts the bulb into melting ice, then into steam above boiling water and finally into sea-water. Each time she waits until the liquid level is steady, and then marks the level. The liquid levels, measured from the bulb, are shown on the diagram.

What is the approximate temperature of the sea-water?

- A 2 °C
- B 20 °C
- C 33 °C
- D 40 °C
- E 80 °C

J90/I/14

2 The diagram shows the positions of the mercury threads in a thermometer.



What is the distance between each 1 °C mark on the thermometer?

- A 0.22 cm
- B 0.24 cm
- C 2.0 cm
- D 2.2 cm
- E 24.0 cm

N90/I/13

3 How can the sensitivity of a liquid-in-glass thermometer be increased?

- A use a liquid which is a better conductor of heat
- B use a thinner-walled bulb
- C use a longer tube
- D use a liquid of higher boiling point
- E use a tube with a narrower bore

N90/I/15

4 To enable a mercury-in-glass thermometer to respond quickly to changes in temperature

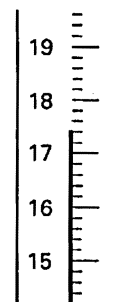
- A the bore should be narrow.
- B the stem wall should be thin.
- C the bulb should contain a lot of mercury.
- D the bulb should be large.
- E the bulb wall should be thin.

J91/I/14

5 The diagram shows part of a thermometer.

What is the reading on the thermometer?

- A 17.2 °C
- B 17.4 °C
- C 17.7 °C
- D 18.3 °C
- E 18.6 °C



J91/I/15

6 The lengths of mercury thread in the uniform tube above the bulb of a mercury thermometer are:

- 20 mm when the bulb is in melting ice;
- 170 mm when the bulb is in the steam above boiling water;
- 50 mm when the bulb is in a liquid X.

What is the temperature of liquid X?

- A 20 °C
- B 25 °C
- C 30 °C
- D 33.3 °C
- E 50 °C

N91/I/14

7 Which of the following determines the range of a mercury thermometer?

- A the length of the stem
- B the thickness of the bulb
- C the volume of the bulb only
- D the volume of the stem only
- E the volumes of the bulb and stem

J92/I/14

8 What is special about a mercury-in-glass thermometer that has a high sensitivity?

- A The scale is uniform.
- B The scale has two fixed points.
- C The thermometer measures low temperatures.
- D The thermometer measures high temperatures.
- E The thermometer measures small changes in temperature.

N92/I/14

9 Which instrument can give a reading of 24 °C?

- A an ammeter
- B a barometer
- C a micrometer
- D a thermometer
- E a voltmeter

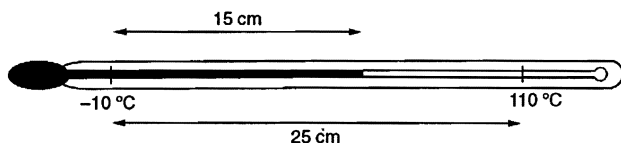
N93/I/14

10 Why is mercury suitable to use as the liquid in many thermometers?

- A It expands evenly with rise in temperature.
- B It freezes at a high temperature.
- C It has a high density.
- D It is transparent.

J95/I/13

11 The diagram shows a mercury-in-glass thermometer. The distance between the $-10\text{ }^\circ\text{C}$ and the $110\text{ }^\circ\text{C}$ markings is 25 cm.



At which temperature is the end of the mercury thread 15 cm from the $-10\text{ }^\circ\text{C}$ mark?

- A $50\text{ }^\circ\text{C}$
- B $60\text{ }^\circ\text{C}$
- C $62\text{ }^\circ\text{C}$
- D $72\text{ }^\circ\text{C}$

N97/I/16

12 Why is mercury used in thermometers?

- A It has a boiling point of $100\text{ }^\circ\text{C}$.
- B It has a melting point of $0\text{ }^\circ\text{C}$.
- C It is cheap and readily available.
- D It is liquid over a convenient range.

N98/I/13

13 The lengths of mercury thread in the stem of a mercury thermometer are given in three situations.

- length in melting ice = 20 mm
- length in steam above boiling water = 170 mm
- length in liquid X = 50 mm

What is the temperature of liquid X?

- A $20\text{ }^\circ\text{C}$
- B $25\text{ }^\circ\text{C}$
- C $30\text{ }^\circ\text{C}$
- D $33.3\text{ }^\circ\text{C}$

J99/I/14

14 Which of the following expands most when its temperature is raised by 10 K ($^\circ\text{C}$)?

- A 10 cm^3 of air
- B 10 cm^3 of copper
- C 10 cm^3 of ice
- D 10 cm^3 of water

N99/I/13

15 A thermometer reads $1\text{ }^\circ\text{C}$ in pure melting ice and $101\text{ }^\circ\text{C}$ in steam above boiling water. It is used to measure the temperature of water before and after it is heated.

What is the error when the temperature rise is calculated?

- A $2\text{ }^\circ\text{C}$ too low
- B $1\text{ }^\circ\text{C}$ too low
- C zero
- D $1\text{ }^\circ\text{C}$ too high

N99/I/14

16 What is reduced when a mercury thermometer is made using a larger bulb, but with a capillary tube of the same diameter and length?

- A accuracy
- B linearity
- C range
- D sensitivity

J2000/I/14

17 The sensitivity of a liquid-in-glass thermometer depends on the volume of liquid used and the diameter of the bore of the thermometer.

Which changes will produce the greatest increase in sensitivity?

	volume of liquid	bore diameter
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

N2000/I/13

18 Two mercury thermometers A and B are constructed with identical bulbs. The capillary bore of A has an area of cross-section twice that of B.

Which thermometer will be more sensitive to a small change in temperature? Give a reason to justify your answer.

A third thermometer is identical to A except that the glass walls of the bulb are thinner. Explain in what respect it would behave differently from A.

J81/I/2

19 Why does a mercury-in-glass laboratory thermometer have

- (a) a narrow capillary bore,
- (b) a bulb of very thin glass?

N84/I/3

20 The diagram (not to scale) shows two mercury thermometers, A and B, identical in every respect except that the bulb of A is much larger than that of B.



State, giving a reason for your answer in each case, which thermometer

- (i) will cover the larger range of temperature, [2]
- (ii) will indicate more quickly a small rise in temperature.

[2] J88/I/4

21 (a) Fig. 1 shows a cross-sectional view of a mercury-in-glass thermometer. The bulb has a volume V and the bore of the stem has a length x and a diameter d .

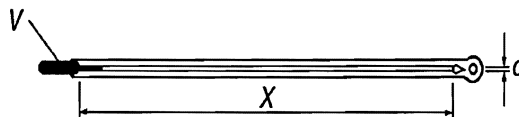


Fig. 1

State the effect on the maximum possible range of the thermometer of

- (i) increasing V , keeping x and d constant.
- (ii) increasing x , keeping V and d constant,
- (iii) increasing d , keeping V and x constant.

Justify your answer in each case. [4]

J92/II/10(a)

- 22 (a) A mercury-in-glass thermometer has a scale starting at -10°C and finishing at 110°C . The length of the scale is 240 mm.
- What is the range of the thermometer?
 - Determine the sensitivity of the thermometer in mm/K ($\text{mm}/^{\circ}\text{C}$). [3]
- (b) A second thermometer has a bulb with twice the volume of the thermometer in part (a). Its length and bore are just the same as those of the thermometer in part (a).
- State, justifying your answer in each case,
- the range of the second thermometer,
 - the sensitivity of the second thermometer. [4]

J94/II/10(a, b)

- 23 Figure 2 shows the whole of the scale of a mercury-in-glass thermometer. The range of the thermometer is from -10°C to 110°C .

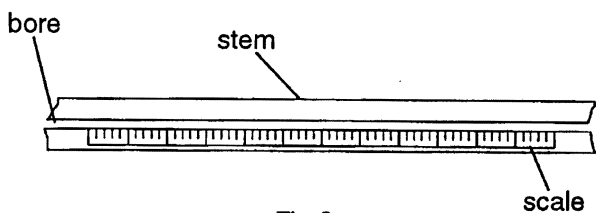


Fig. 2

- On Fig. 2 show, as accurately as possible, the position of the mercury when the thermometer indicates a temperature of 47°C . [2]
- Given that Fig. 2 is accurately full-size, determine the temperature change required to cause the mercury meniscus to move by 1.0 mm. [2]

N94/II/4

- 24 The scale of a mercury-in-glass thermometer is linear. One such thermometer has a scale extending from -10°C to 110°C . The length of that scale is 240 mm.

- What is meant by the statement that *the scale is linear*? [2]
- Calculate the distance moved by the end of the mercury thread when the temperature of the thermometer rises
 - from 0.0°C to 1.0°C ,
distance moved =
 - from 1.0°C to 100.0°C .
distance moved = [3]
- What is the sensitivity of the thermometer?
sensitivity = [1]

J97/II/4

ANSWERS

- | | | | | |
|---------|--|-------------------------------------|-------|-------|
| 1. B | 2. A | 3. E | 4. E | 5. B |
| 6. A | 7. E | 8. E | 9. D | 10. A |
| 11. C | 12. D | 13. A | 14. A | 15. C |
| 16. C | 17. C | | | |
| 22. (a) | (i) -10°C to 110°C | (ii) $2\text{ mm}/^{\circ}\text{C}$ | | |
| | (b) (ii) $4\text{ mm}/^{\circ}\text{C}$ | | | |
| 23. (b) | 1.29°C | | | |
| 24. (b) | (i) 2 mm; (ii) 198 mm (iii) $2\text{ mm}/^{\circ}\text{C}$ | | | |