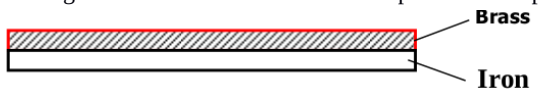
6. THERMAL EXPANSION.

1. Define temperature and give its **SI** unit
2. Distinguish between **heat** and **temperature**
3. Convert **-40.3 °C** to Kelvin

EXPANSION IN SOLIDS

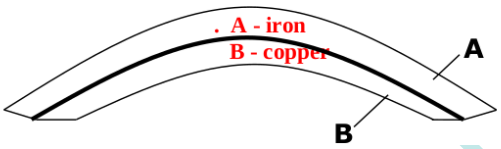
1. State and explain **two** application of expansion and contraction of solids
2. State **two** quantities on which expansion on heating of a metal depends.
3. In a ball and ring experiment, the ball goes through the rings at room temperature. When it is heated it does not go through the ring, but when left on the ring for some time, it goes through. Explain this observation.
4. State the reason why electricity transmission cables are left sagging between the posts.
5. Give a reason why a concrete beam reinforced with steel does not crack when subjected to changes in temperature.
6. Explain why a glass container with thick glass walls is more likely to crack than one with a thin wall when a very hot liquid is poured into them.
7. In an attempt to prepare a cup of tea, a student placed boiling water into a glass tumbler. The glass tumbler broke into pieces. Explain this observation.
8. A piece of iron is heated. Explain what happens to its density.
9. The diagram below shows a bimetallic strip at room temperature



Sketch a diagram to show the appearance of the bimetallic strip when heated.

10. The figure below shows a bimetallic strip made of copper and iron at room temperature.

If copper expands more than Iron, identify **A** and **B** in the bimetallic strip if it is placed in a refrigerator whose temperature is (-70 ^{0}C)



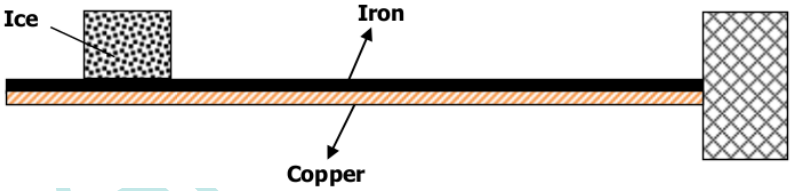
11. Figure below shows a bimetallic strip at room temperature.

Draw the shape of the strip:

(i) When it is heated to **80 ^{0}C**.

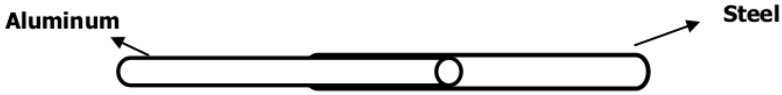
(ii) When it is cooled to **-10 ^{0}C**.

12. A cube of ice rests on a bimetallic strip at room temperature. The strip is made of iron and copper



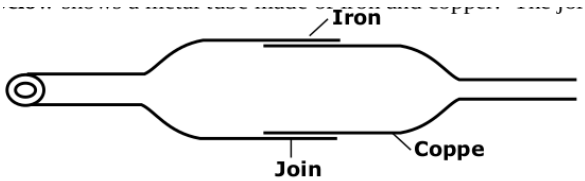
State and explain what happens to the bimetallic strip.

13. The figure below shows an aluminum tube tightly stuck in a steel tube.



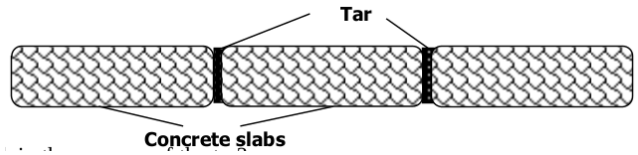
Explain how the two tubes can be separated by applying a temperature change at the junction given that aluminium expands more than steel for the same temperature rise.

14. The diagram **below** shows a metal tube made of iron and copper. The joint is tight at room temperature.



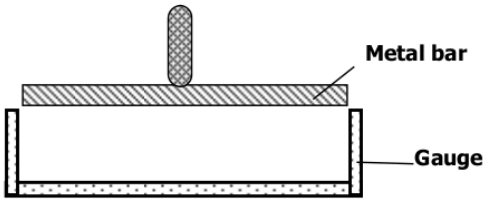
Explain how you would separate the two by changing the temperature given that copper expands more than iron for some change in temperature.

15. The figure below shows concrete road made of concrete slabs and gaps filled with tar.



State and explain the purpose of the tar?

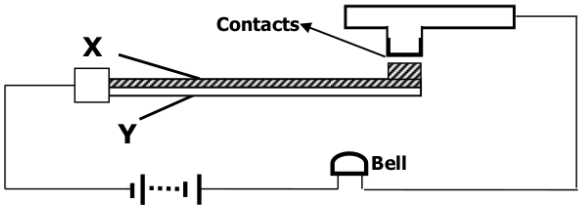
16. The figure below shows a metal bar that fits exactly in to the gauge at room temp. The metal bar is heated and then fitted into the gauge.



State and explain the observations made.

17. State and explain **two** application of expansion and contraction of solids

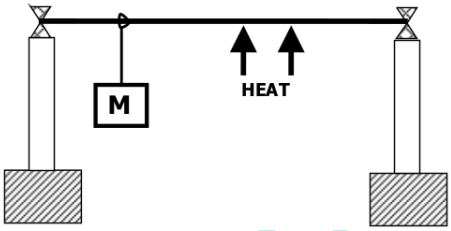
18. The diagram below shows a model of fire alarm based on bimetallic strip. The strip is made of brass and iron.



(I) Label the metal **X** and **Y**

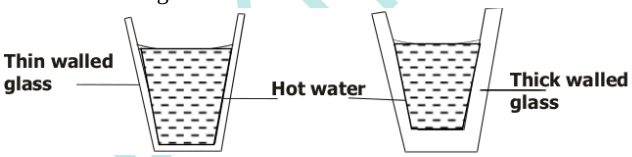
(ii) Describe how the fire alarm works.

19. The mass M was suspended from a tight copper wire using a rider as shown .The copper wire was then heated.



State and **explain** what was observed on the position of M as the wire was heated for sometime.

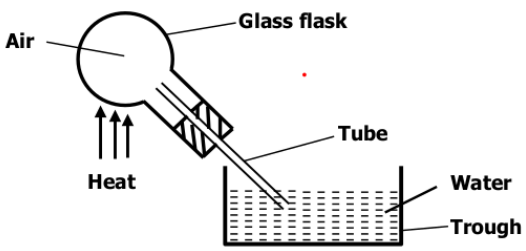
20. Figure below shows two glasses of different thickness.



Hot water was poured in both glasses. What is likely to be observed and why?

EXPANSION IN LIQUIDS AND GASES

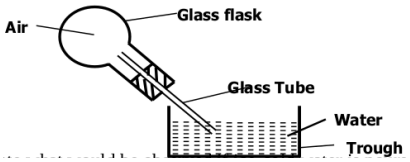
1. State one application of expansion in gases
2. When a thermometer is immersed in ice cold water, the mercury thread is observed to rise before dropping steadily in the capillary tube. Explain.
3. A bottle of soda always has a space between the cap and the top of the liquid. Explain
4. In the set up shown below, it is observed that the level of the water in the tube initially rises before starting to drop. Explain this observation
5. The diagram below shows a flask fitted with a glass tube dipped into a beaker containing water at room temperature. The cork fixing the glass tube is tight.



(i) State what would be observed if the flask is heated.

(ii) Give a reason for the observation in (i) above.

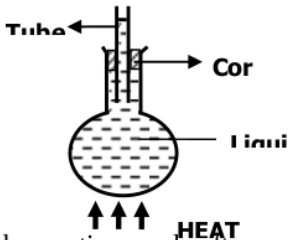
6. The diagram below shows a flask fitted with a glass tube dipped into a beaker containing water at room temperature. The cork fixing the glass tube is tight.



i) State with reason what would be observed if ice-cold water is poured onto the flask

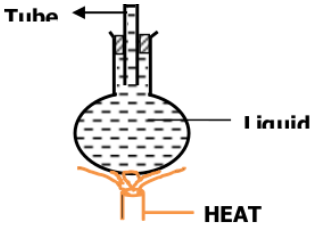
(ii) Give a reason for the observation in (i) above.

7. The figure below shows a set up used to study expansion of liquids



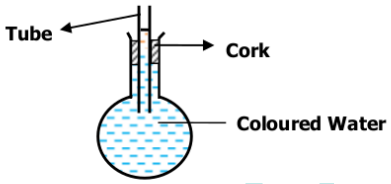
State and explain the observation made after some time

8. The system in the figure below is a set up which can be used to illustrate expansion of liquids.



State one way of modifying the apparatus so that the rise in level for a particular temperature change is increased

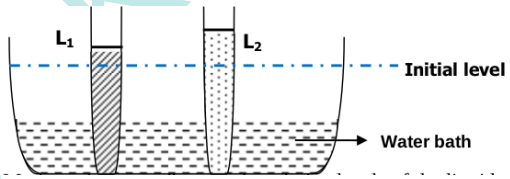
9. A round – bottom flask is filled with coloured water as shown in the diagram below.



When the flask is placed in ice cold water the level on water rose and then fell.

Explain this observation.

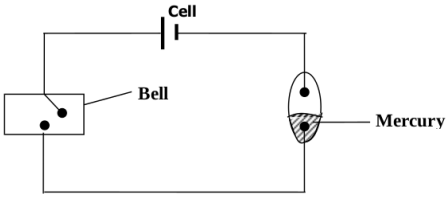
10. The figure below shows the levels attained by two liquids $\mathbf{L_1}$ and $\mathbf{L_2}$ after the temperature has been raised. The liquids were initially at the same levels as shown. The tubes are identical and closed at the lower end



(i) Mark on the same diagram the relative levels of the liquids when the temperature is lowered below the initial value

(ii) Give a reason for your answer

11. The diagram below shows circuit of a fire alarm. When fire breaks it rings the bell to alert people that there is fire. Name two properties of mercury that makes it suitable to be used.



ANOMALOUS BEHAVIOUR

1. Give any two evidence of the unusual expansion of water.
2. Describe ONE advantage and ONE Disadvantage of anomalous behavior of water.
3. State one biological importance of anomalous expansion of water
4. Aquatic animals are observed to survive in frozen ponds. Explain this observation.
5. A certain substance contracts when heated at a certain temperature and expands when cooled at the same temperature.

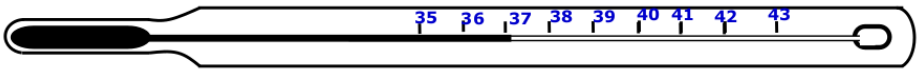
(i) Name the substance

(ii) State **one** disadvantage of this behaviour.

6. State why it is necessary to leave an air space in a closed glass bottle of water when it is to be kept in a refrigerator.
7. Explain why water in a pond may freeze on the surface only but not deep inside the pond.
8. Explain why fish can survive under water when the surface is already frozen.
9. Sketch the graph of volume against temperature of water between $0\ ^0$c to $10\ ^0$c
10. Sketch the graph of density against temperature of water between $0\ ^0$c to $10\ ^0$c .
11. Sketch a graph of **mass per unit volume** of water against **temperature** from **-5 ^{0}C** to **10 ^{0}C**.
12. Sketch a graph of **volume** of water against **temperature** from **-5 ^{0}C** to **10 ^{0}C**.
13. State and explain one factor that enhances accuracy in a thermometer.

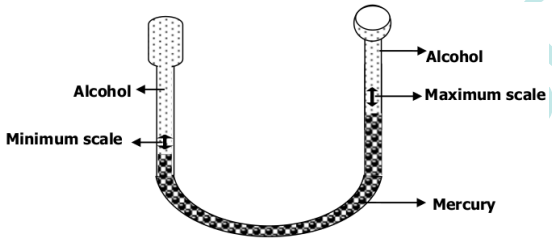
THERMOMETERS

1. Explain how sensitivity of clinical thermometer can be improved.
2. Explain the function of the following features in a thermometer.
   - **(a)** Capillary bore
   - **(b)** Thick Stem
   - **(c)** Thin Bulb
3. State the two special feature of a clinical thermometer.
4. Why is it that boiling is not used for sterilization of clinical thermometer.
5. The figure below shows a thermometer used by a doctor to determine the temperature of a patient. Why is it difficult to work with this thermometer?

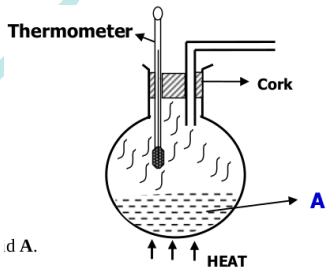


6. The Figure below shows a clinical thermometer which is not graduated.

   (i) Name the parts indicated with letters: **X** and **Y.**
   (ii) What is the function of the part labelled **Y**.
   (iii) State the appropriate scale range in degrees Celsius of the thermometer.
7. Why must the tube of the thermometer be made of thin glass?
8. The figure shows a six's maximum and minimum thermometer.



   (i) State the thermometric liquid of the thermometer.
   (ii) State any one feature which makes the thermometers suitable for its function.
9. State the reason for thin walled bulb in a liquid in glass thermometer.
10. Explain how the thin bore in a liquid-in-glass thermometer improves sensitivity of the thermometer.
11. Explain the purpose of the constriction in a clinical thermometer.
12. State three properties of a good thermometric liquid
13. State two advantage of mercury over alcohol as a thermometric liquid.
14. Why is it that boiling is not used for sterilization of clinical thermometer?
15. Temperature scale in clinical thermometer ranges from **35 ^{0}C** to **43 ^{0}C.** Explain.
16. A mercury thermometer can be modified to measure small changes in temperature. State one possible modification
17. A clinical thermometer needs to be an **accurate maximum** thermometer. Explain briefly how these two basic requirements are achieved
18. The diagram below shows an arrangement used to determine the upper fixed point of ungraduated thermometer.



d **A**.

   (i) Name liquid **A**.
   (ii) Why is the bulb of thermometer not dipped in liquid A.
19. When calibrating a liquid in glass thermometer, it is normally not advisable to dip the bulb in boiling water when getting the upper fixed point. Explain why it is so.
20. An uncalibrated thermometer is placed first in melting ice then in boiling water. The lengths of the liquid column are **22 mm** and **79 mm** respectively. What temperature in **^{0}C** would correspond to a length of **63 mm**? **ANS 71.93 ^{0} C**
21. When making the fixed points on a thermometer it is observed that at **0 ^{0}C** the mercury thread is of length **2 cm** and **8cm** at **100 ^{0}C**. What temperature would correspond to a length of **6 cm**. **ANS 66.67 ^{0} C**
22. A faulty mercury thermometer reads **40 °C** and **120 °C** when placed in pure melting ice and steam from boiling water respectively. Determine the actual temperature when this thermometer reads **50 °C**. **ANS 12.5 ^{0} C**