ALLIANCE GIRLS HIGH SCHOOL MOCK 2017
PHYSICS PAPER 1

Answer all the questions in this section in the spaces provided.

1. Draw a section of the main scale and full Vernier scale that would give a reading of 3.07 cm . **(1 mark)**

2. **Figure 1** shows a burette partly filled with a liquid. The liquid was initially at the level shown. If the 400 *drops* of the liquid each of volume 0.015 cm^3 was removed from the burette, mark the new level of liquid in the burette. **(1 mark)**

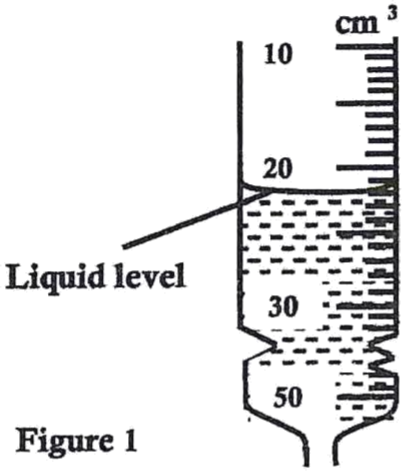

Figure 1

3. A block of metal of mass $150g$ at 100°C is dropped into a lagged calorimeter of heat capacity $45JK^{-1}$ containing $100g$ of water at 25°C. The temperature of the resulting mixture is 34°C. Determine the specific heat capacity of the metal block. **(3 marks)**
(*Take specific heat capacity of water as* $4{,}200\ J/kgK$)

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4. An object is placed on water and it floats. Write an equation connecting all the forces acting on the body. **(1 mark)**

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5. **Figure 2** shows a 150 g mass tied on a string and whirled in a vertical circle of radius 30 cm with a uniform speed. At the lowest position of the circle the tension is 9.5 N. Calculate speed v of the mass. **(3 marks)**

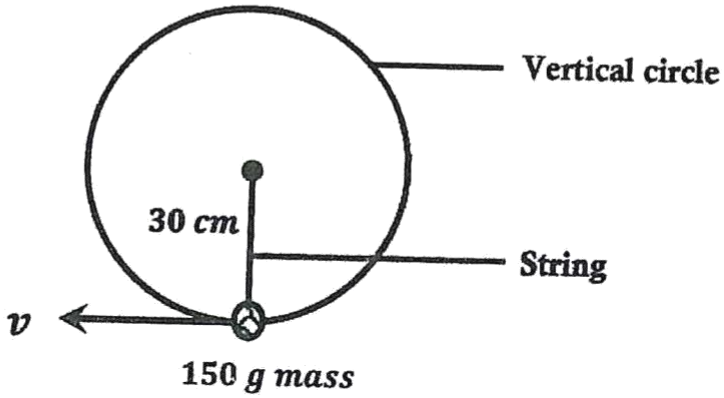

Figure 2

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6. **Figure 3** shows two systems of spring arrangements A and B. The springs are identical and have a spring constant K.

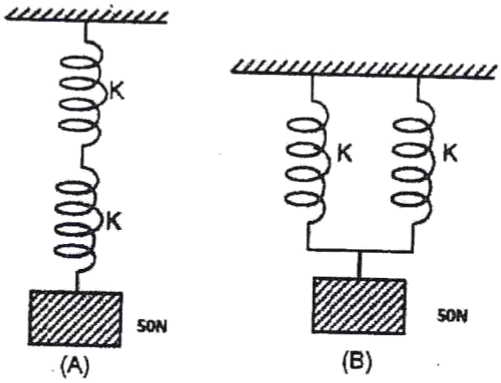

Figure 3

(a) State with a reason which system of springs is stiffer. **(2 marks)**

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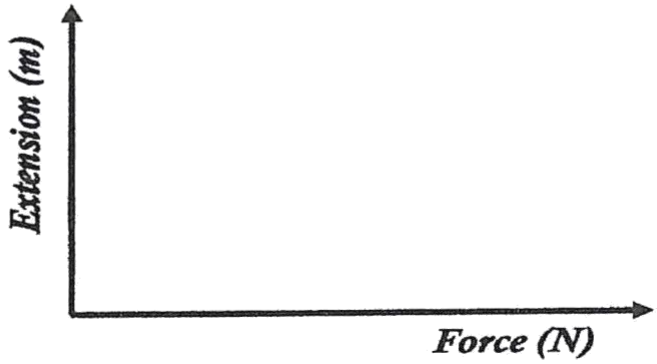
(b) On the axes provided, sketch the graphs of systems A and B assuming that the springs obey Hooke's law. **(1 mark)**



(c) Determine the value of K if the extension in system B was $2.5cm$. **(2 marks)**

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7. A piece of paper is wrapped round the joint of a rod partly made of iron and partly wood so that some of the paper is over the iron rod and the other part over the wooden rod as shown in **Figure 4**.

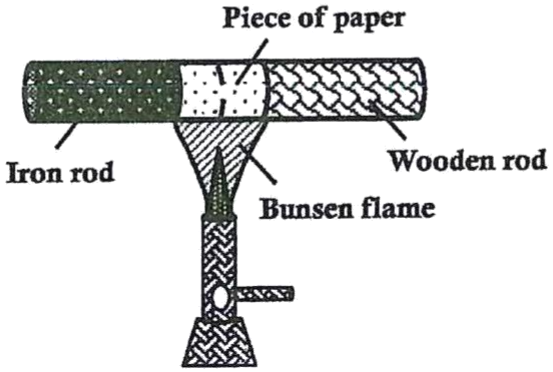

Figure 4

When a bunsen flame is passed over the paper several times it is observed that the paper gets charred or blacked on the region covering the wooden rod while the one covering the iron rod does not. Explain this observation made. **(2 marks)**

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8. A metre rule of mass $50g$ is balanced by masses of $25g$ and $15g$ suspended from its ends. Find the position of its pivot from $25g$ mass. **(3 marks)**

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Figure 5 shows a Bunsen burner which is used for heating substances in a laboratory. Use the information given to answer Questions **9** and **10** below.

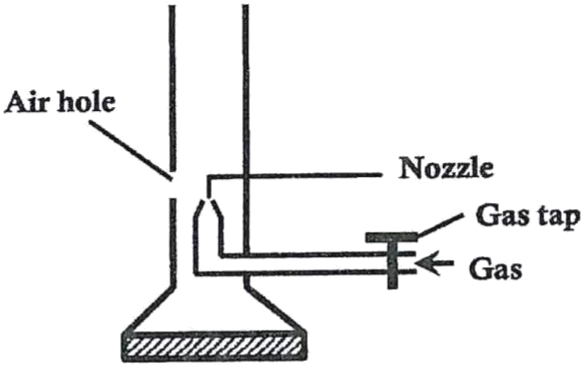

Figure 5

9. Explain the principle working of a Bunsen burner. **(2 marks)**

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10. Give a reason why the Bunsen burner in **Figure 5** has a wide base. **(1 mark)**

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11. Water rises up in capillary tubes but mercury, which is also a liquid, falls in capillary tubes to a level below the outside surface as shown in **Figure 6**. Explain this observation. **(2 marks)**

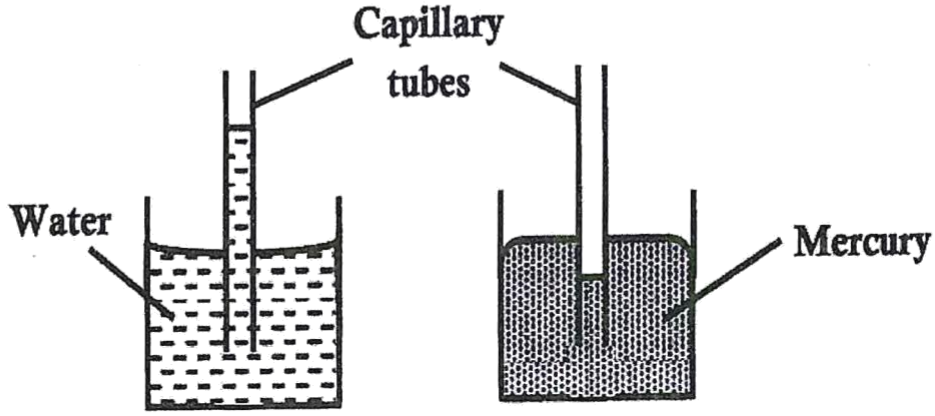

Figure 6

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12. State the molecular difference between a real gas and an ideal gas. **(1 mark)**

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SECTION B (55 Marks)

Answer all the questions in this section in the spaces provided.

13. (a) **Figure 7** shows a car braking system. The brake fluid is an oily liquid.

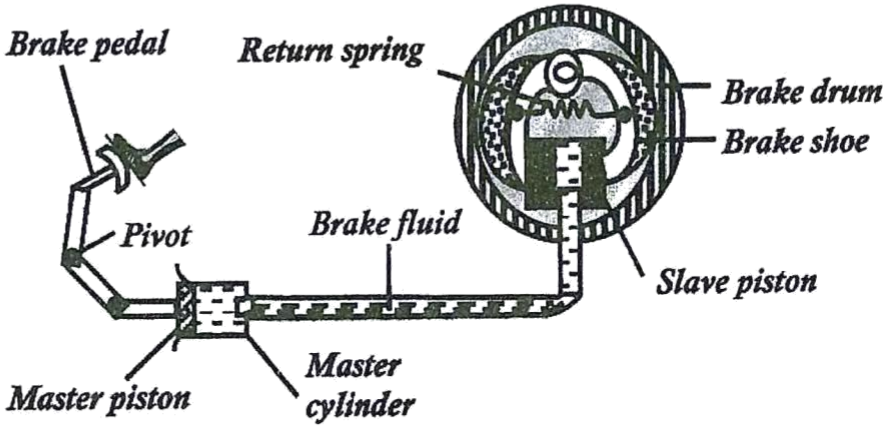

Figure 7

(i) State the principle by which a car braking system works. **(1 mark)**

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(ii) State one property of the brake fluid used in this system. **(1 mark)**

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(iii) The cross-sectional area of the master piston is 5.0 cm^2. A force of 1540 N is applied to the master piston. Calculate the force exerted on each slave piston by the brake fluid given that the cross-sectional area of each slave piston is 7.2 cm^2. **(3 marks)**

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(b) A diver is 15 m below the surface of water in a dam as shown in **Figure 8**.

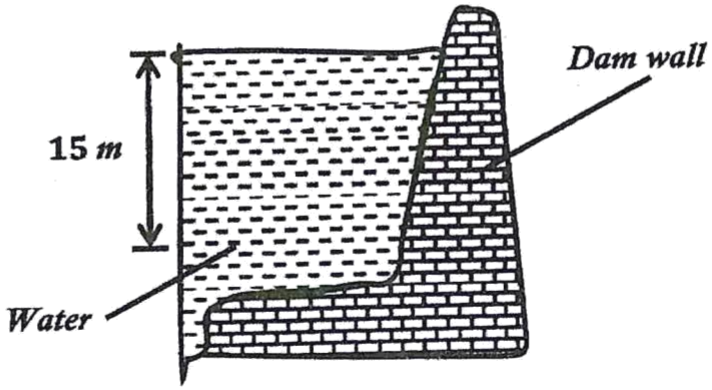

Figure 8

If the density of water is 1,000 kgm^{-3} and gravity is 10 Nkg^{-1}, determine:

(i) The total pressure acting on the diver given that the atmospheric pressure at this place is $1.0 \times 10^5\ N/m^2$. **(3 marks)**

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(ii) Dam walls are made wider at the bottom than at the top. Explain. **(1 mark)**

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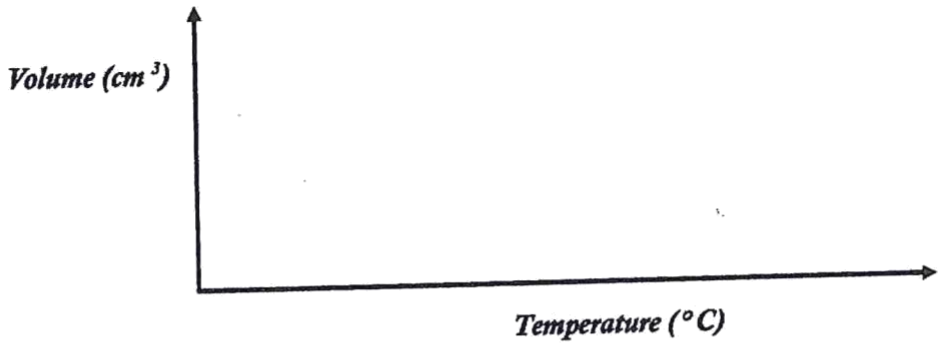
(c) Water in a measuring cylinder is placed in a refrigerator and allowed to cool from about 15°C to 0°C. Assuming the water does not freeze, sketch on the axes provided the graph of Volume of water against temperature. **(1 mark)**



(d) **Figure 9** shows a column of air trapped by mercury thread 5 cm long. If the atmospheric pressure is 750 $mmHg$, determine the length of air column when the tube horizontal. **(3 marks)**

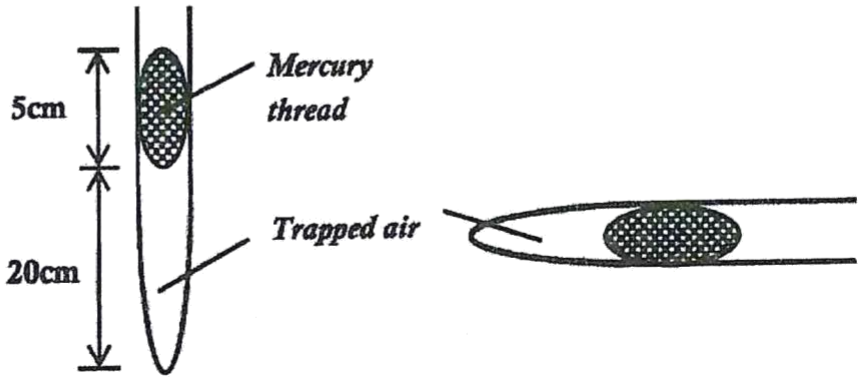


Figure 9

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14. (a) **Figure 10** shows a car of mass m moving along a curved part of the road with a constant speed.

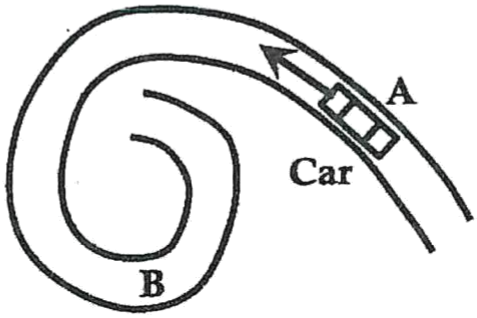

Figure 10

Explain why the car is more likely to skid at point B of the road if the speed is not changed. **(2 marks)**

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(b) A particle **P** tied to a string is moving in a horizontal circle about O as shown in **Figure 11**. Particle **P** moves with a constant speed v.

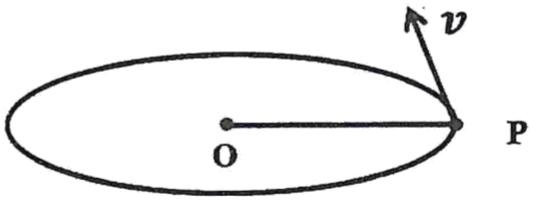

Figure 11

(i) State what provides the centripetal force. **(1 mark)**

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(ii) Use an arrow to indicate the direction in which the net force **F** acting on **P** will act. **(1 mark)**

(iii) Give a reason why particle **P** above experiences centripetal acceleration even though it is moving with a constant speed v. **(1 mark)**

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(c) **Figure 12** shows two masses 0.2 kg and 0.4 kg connected by a string through a hole on a smooth horizontal surface.

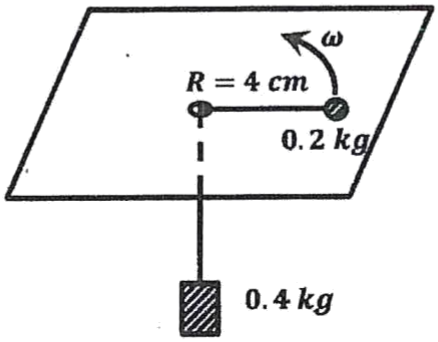

Figure 12

The 0.2 kg mass rotates in a horizontal circle of radius 4 cm. Calculate the angular velocity of the mass when the system is in equilibrium. (Take acceleration due gravity, $g = 10\ m/s^2$) **(3 marks)**

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(d) A jet starts from rest with a uniform acceleration of 500 m/s^2. How long does it take to cover a distance of 40 km? **(3 marks)**

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15. (a) A horizontal force of 50 N is applied on a wooden block of mass 2.5 kg placed on a horizontal surface. Given that the coefficient of kinetic friction between the surface and the block is 0.5, determine the acceleration of the block. **(3 marks)**

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(b) **Figure 13** shows a graph of velocity against time for a ball bearing released at the surface of viscous liquid.

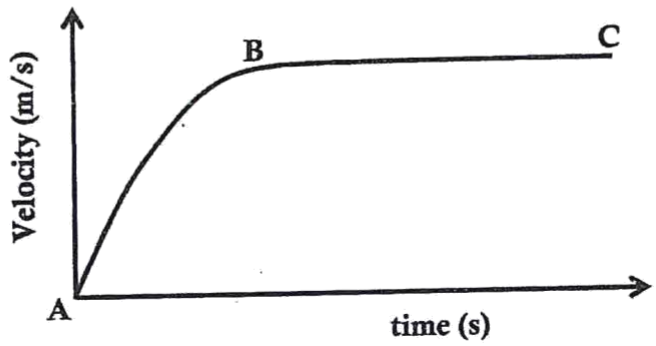

Figure 13

(i) Write an expression/equation connecting all the forces acting on the ball bearing for parts:

I. AB **(1 mark)**

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II. BC **(1 mark)**

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(ii) Indicate on the graph the terminal velocity v_t of the ball bearing. **(1 mark)**

(c) **Figure 14** shows a pulley system being used to lift a load of 150 N by applying an effort of 60 N.

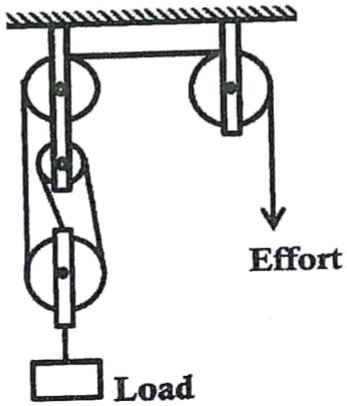

Figure 14

(i) State the velocity ratio of the pulley system. **(1 mark)**

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(ii) Calculate the efficiency of the pulley system. **(4 marks)**

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(d) Show that the velocity ratio of a wheel and axle machine whose cross-section is shown in **Figure 15** is given by $V.R. = \frac{R}{r}$ where **R** is the radius of the wheel while **r** is the radius of the axle. **(2 marks)**

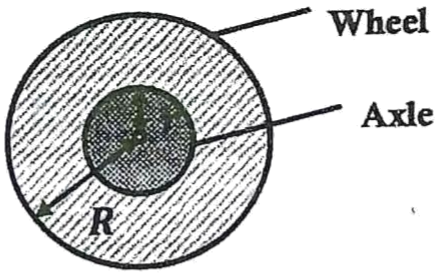

Figure 15

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16. (a) Define the term "***specific latent heat of fusion***" of a material. **(1 mark)**

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(b) A metal bar of mass 30 g and specific heat capacity 880 J/kgK is placed in a small furnace. **Figure 16** shows how the temperature of the metal bar varies with time t in seconds.

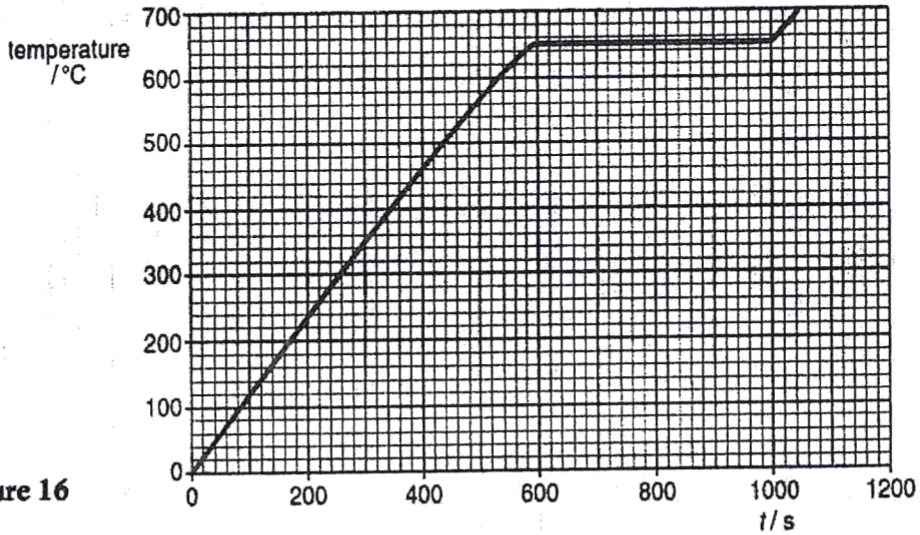

Figure 16

(i) State what happens to the bar between $t = 600\ s$ and $1000\ s$. **(1 mark)**

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(ii) Calculate the energy supplied to the bar between $t = 0\ s$ and $600\ s$. **(3 marks)**

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(iii) Between $t = 600\ s$ and $1000\ s$ the furnace supplies 30 *joules* of energy per second to the bar. Calculate the specific latent heat of fusion of the metal bar. **(3 marks)**

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17. (a) State *Archimedes' principle*. **(1 mark)**

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(b) The system in **Figure 17** below is in equilibrium.

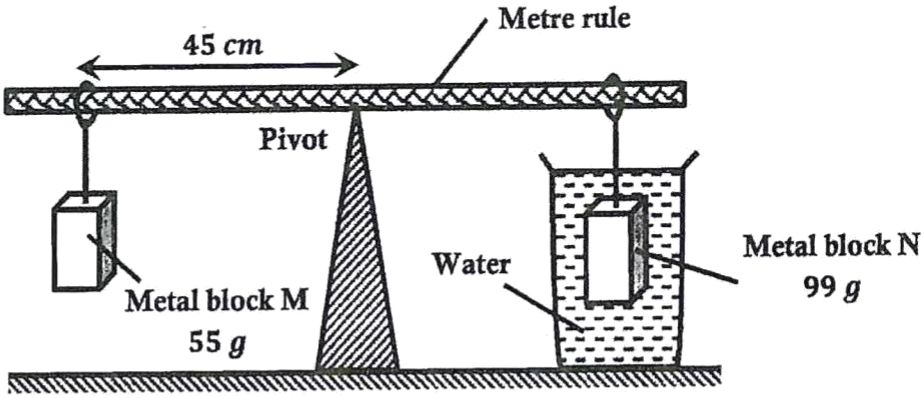

Figure 17

(i) When the temperature of the water is raised the system is observed to tilt to the right, state the reason for this observation. **(2 marks)**

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(ii) Calculate the apparent loss of weight of the metal block N given the dimensions of the block are $2cm \times 2cm \times 6cm$. **(3 marks)**

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(iii)Determine the apparent weight of the metal block N. **(2 marks)**

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(iv)How far is the metal block N from the pivot? **(2 marks)**

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