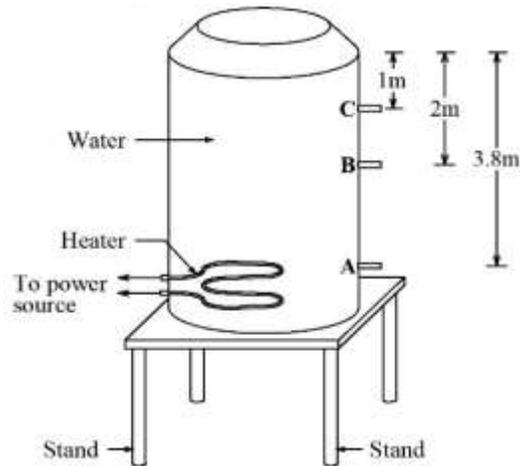# S.2 REVISION QUESTION

Item One

A certain home owner intends to put up a metallic water tank fitted with an electrical heater which supplies heat energy as shown in the figure below.

The home owner found out that the heater was fitted at the lower part of the tank but he did not understand why it was done like that.

Task

As a learner of Physics;

a) Explain to the home owner why the electrical heater was fitted at the position shown above and how eventually all the water gets hot.

b) Determine the value of pressure exerted by water at each of the levels A, B and C.

c) Suggest with reason, the best position for the water outlet pipe on the tank.

Hint: Density of water = 1000 kgm^{-3}

Acceleration due to gravity on Earth = 10 ms^{-2}.

Item Two

In an attempt to test for the purity of a stone that was suspected to be gold, a certain student was tasked to carry out a scientific investigation on the stone which was 6.5cm^3 in the laboratory. He however didn't know the mass of the stone and neither had a beam balance nor a spring balance. Fortunately, on his table was a set of apparatus that included a knife edge, two pieces of thread, a known mass of 50g, a well calibrated meter rule and a rectangular wooden block but did not know how to use them to accomplish the task.

Task

a) As a learner of Physics help the student carry out an experiment to determine the un known mass of the stone using the available apparatus.

b) If in carrying out the experiment, the following results were obtained;

- Distance from the pivot/knife edge to the point of suspension of the 50g mass, $d_1 = 25$ cm

- Distance from the pivot/knife edge to the point of suspension of the stone, $d_2 = 10$ cm

Determine the mass of the stone.
c) Using your answer in b) above, help the student confirm if the stone was made of pure gold or not.
   Hint: Density of pure gold = 19.3gcm^{-3}

Item Three

James and Jonah are siblings living in a mountainous village. One day, their mother asked them to go down to the river to fetch water for washing their dirty blankets. They left home barefooted each with their own jerry can. On their way, it started to rain, making the ground slippery and hard to walk on. This caused them to struggle to reach the river because they didn't understand what was happening and how to overcome it. While they were collecting water, Jonah accidentally dropped her jerry can, and it was swept away by the fast-moving river, which was flowing due North with a force of 120N. At the same time, the wind blew the jerry can Eastwards with a force of 50N. Confused about how to stop the jerry can, they couldn't catch it, so they used John's jerry can to collect water instead. When they began washing the blankets with just water (plain cold water), they noticed that the dirt was taking a long time to come out, and they wondered how to make the washing easier.

Support Diagram
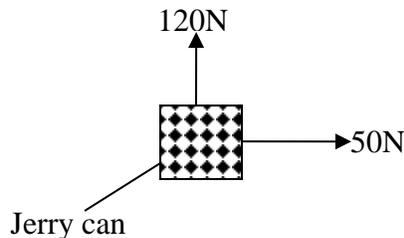
Task

Using your knowledge of Physics, help Jonah and James understand why;
a) They struggled to walk steadily on the wet ground, and how they can overcome this challenge.
b) The dirt on their blankets was hard to wash out, and what they can do to make cleaning easier.
c) Determine the resultant force they needed to apply to stop the jerry can from being carried away.

Item Four

A woman needed to attend a wedding ceremony in a nearby village, but on the day of the wedding, it rained heavily. This made the path from her house to the reception muddy and difficult to walk on. Since she didn't have enough money for a taxi or boda boda, her only option was to walk. She had two kinds of shoes; **Type A** and **Type B** and wasn't sure which one of the two would be a better option to wear on this muddy road.

Additionally, the maximum pressure required for a smooth movement on this road is 70,500Nm^{-2} but she has no idea about how to confirm this with her two kinds of shoes.

Hint: Acceleration due to gravity on Earth = 10 ms^{-2}
Total area of contact of **Type A** shoes with the ground = 45 cm^2

Total area of contact of **Type B** shoes with the ground $= 100 \text{ cm}^2$
Mass of the woman $= 70\text{kg}$

Task

Using your knowledge of Physics;

a) Help the woman determine the type of shoes she would put on to ensure a smooth movement to the reception.

b)

Item Five

At a certain beverage factory, workers were tasked to load crates of soda onto a sales truck. However, they quickly became tired and needed an easy way to do the job. Fortunately, they found a long rope and a 6m long flat plank of wood but could not figure out how to use them to simplify the work.

Hint: Height of the cargo area of the truck from the ground $= 3\text{m}$

Task:

As a student of Physics;

a) (i) Advise the workers on the type of simple machine they would design using the available materials. Explain how this machine would be used.

(ii) Determine whether an effort of 66.7N would be enough to pull a crate of soda of 10kg onto the truck if the machine designed in a) above is 60% efficient.

b) After successfully loading the crates, the truck's gear system responsible for causing motion and designed to work at an efficiency of not less than 80% broke down. The following gear system was available for replacement.
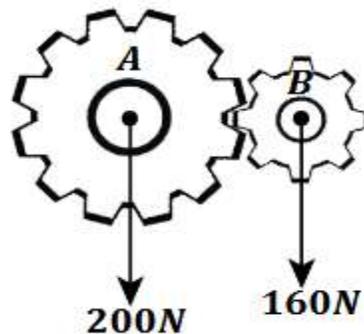
Determine whether the above gear system would make the truck move or not.

Hint: Gear **A** is a driven gear

Gear **B** is the driving gear.

END