

S.4 PHYSICS REVISION SCENARIO QUESTIONS

Item One

Tom works as a cook at a school, where he usually makes tea for students in the morning using firewood. One morning, he needed to prepare 50 litres of milk for breakfast but decided against it because he wasn't sure if he had enough firewood for the task. As a result, the students ended up not having breakfast, which led to a protest at school. The school management stepped in and blamed the cook for the students' behaviour which seemed unfair according to Tom.

Hint:

- Density of milk = 1030kgm^{-3}
- Room temperature = 25°C
- Specific heat capacity of milk = $3930\text{Jkg}^{-1}\text{K}^{-1}$
- Boiling point of milk = 100.5°C
- Available pieces of wood = 80
- Amount of heat produced by each piece of wood = 152808.225J

Task:

Using your knowledge of physics, determine whether it was fair for the school management to blame Tom for what happened.

Item Two

Mary is a new mother who gave birth to a boy child in a certain village last month. When the doctor was discharging Mary from the hospital, she advised her to bathe the baby with water at temperatures ranging from 35°C to 40°C to avoid skin burn of the new born child. On arrival at home, she requested the maid to boil 2 litres of water up to 70°C after which she mixed the hot water with 3 litres of cold water at 15°C in a basin of mass 3kg.

Hint:

- Specific heat capacity of water = $4200\text{Jkg}^{-1}\text{K}^{-1}$
- Specific heat capacity of the material of the basin = $400\text{Jkg}^{-1}\text{K}^{-1}$
- Take 1 litre of water = 1kg

Task

Using your knowledge on heat capacity, help Mary to know if the water has cooled to the required temperature as directed by the doctor.

Item Three

Students at a particular school were tasked with choosing between cooking pots with specific heat capacities of $600\text{Jkg}^{-1}\text{K}^{-1}$ and $900\text{Jkg}^{-1}\text{K}^{-1}$ for cooking. However, they couldn't reach a consensus on which pot is preferable.

Task

Using your knowledge of physics:

- a) Assist the students in making an informed decision.

- b) Help them determine the quantity of heat required to raise the temperature of 5 liters of water in the cooking pot you chose above by 25°C .

Item Four

In a certain referral hospital, a nurse on internship had to inject medicine into a patient's vein. The medicine was in powdered form and had to be mixed with 100cm^3 of water at a temperature of 75°C . To attain this temperature, water had to be heated using an electrical heater rated 1500W . The doctor instructed the nurse that the patient must receive the medicine within 20s

Hint:

- Specific heat capacity of water = $4200\text{Jkg}^{-1}\text{K}^{-1}$
- Initial temperature of water = 20°C
- Density of water = 1gcm^{-3}

Task:

As a learner of Physics, help the nurse to find out if the patient will receive the medication on time.

Item Five

A home owner bought an electric heater designed to supply 200kJ of heat per minute. One morning, he needed to prepare 3kg of water for tea in a sauce pan of mass 2kg and a specific heat capacity of $900\text{Jkg}^{-1}\text{K}^{-1}$ at 24°C . He realized he had only 4 minutes to catch the bus to work and wasn't sure if he would have his tea ready in time. He has approached you for help.

Hint:

- Boiling point of water = 100°C

Task

Using your knowledge of physics, help the home owner determine if he would be able to have the tea ready in time or not.

Item Six

Your sister leaves home for work at $7:20\text{ a.m.}$ and as a must carries tea in a flask. One morning, she needed to prepare the tea she carries but remembered that the only water she had in the house was 5 litres in a sauce pan of 0.2kg in a deep freezer. On removing the sauce pan from the deep freezer, she realized that all the water had turned into a block of ice. It was $7:00\text{a.m}$ and she was worried about leaving home late, but decided to heat the sauce pan containing the block of ice with her heater rated 4.22kW , until all the ice turned into water and the water boiled ready for tea.

Hint:

- Specific heat capacity of the saucepan = $900\text{Jkg}^{-1}\text{K}^{-1}$
- Specific heat capacity of water = $4200\text{Jkg}^{-1}\text{K}^{-1}$
- Specific latent heat of fusion of ice = 336000Jkg^{-1}
- Density of water = 1000kgm^{-3}
- Boiling point of water = 100°C
- Temperature of ice in the saucepan = 0°C

Task:

- a) Determine how long it took your sister to boil the tea.
- b) Explain whether or not your sister was able to leave home for work at 7:20a.m.

Item Seven

A tourist visited a certain Hotel in Kampala where he decided to reside for the whole period he was to stay in Uganda. While at the Hotel, he complained that the room he was sleeping in was hot during day time and therefore, he could always over sweat. The food was always served late and the tea served was at a temperature of 85°C , yet he only takes tea at a maximum temperature of 30°C . The Hotel attendant was advised to buy a cooking appliance that makes cooking faster at a high boiling point of water greater than 100°C and also use small pieces of ice at 0°C to cool down the tea to the required temperature.

Hint:

- Capacity of tea-cup = 14 litres
- Density of tea = 1000kgm^{-3}
- Specific heat capacity of tea = $4200\text{Jkg}^{-1}\text{K}^{-1}$
- Specific latent heat of fusion of ice, $l_f = 334000\text{Jkg}^{-1}$
- Ignore the heat absorbed by the tea cup

Task:

As a Physics learner, help the hotel attendant to;

- (a) Understand the electrical appliance he should buy and how it makes cooking faster.
- (b) Determine the mass of ice needed to reduce the temperature of the tea
- (c) Understand the possible cause of hotness in the room during the day and suggest possible solutions too this challenge
- (d) Explain to the tourist how sweating regulates the body temperature