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Specific Heat Capacity and Latent Heat

Q1.

Calculate the amount of heat that is needed to heat water of mass 10 kg from 30 °C to its boiling point. [Specific heat capacity of water is 4 200 J kg^{-1}]

Q2.

An immersion heater is rated at 1 500 W. Calculate the time taken for water of 5 kg to reach its boiling point if the initial temperature of water is 28 °C. [Specific heat capacity of water = 4 200 J kg^{-1}]

Q3.

500 g of metal block at 120 °C is dipped in 200 g of water at 30 °C. The final temperature of the mixture is 50 °C. Find the specific heat capacity of the metal block. [Specific heat capacity of water = 4 200 J $kg^{-1}{}^{o}C^{-1}$]

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Q4.

A block of metal Q with a mass of 0.5 kg is heated up until its temperature increases by 80°C. The metal block is placed onto a block of ice. The mass of the melted ice that change to water is 100 g. Calculate the specific heat capacity of metal Q. [Specific latent heat of fusion of ice = 3.36×10^5 Jkg^{-1}]

Q5.

A liquid with a mass of 0.2 kg is cooled at its freezing point. The total heat energy released for this change of phase is 16000 J. What is the specific latent heat of fusion of the liquid?

Q6.

The specific latent heat of fusion of solid X IS $1.5X10^5$ Jkg^{-1}. If the solid is heated with a 2000 W heater at its melting point, what is the mass of the liquid produced in 2 minutes?

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Q7.

500g of ethanol is heated with an immersion heater rated 2000 W at boiling point 78 °C. Find the time taken to change all the ethanol to gas. [Specific latent heat of vaporization of ethanol = 8.55×10^5 J kg^{-1}]

Q8.

A block of metal Q with a mass of 0.5 kg is heated up until its temperature increases by 80 °C. The metal block is placed onto a block of ice. The mass of melted ice that change to water is 100 g. Calculate the specific heat capacity of metal Q. [Specific latent heat of fusion of ice = 3.36×10^5 J kg^{-1}]

Q9.

A piece of metal is dropped from a 40 storey building of height 80 m. Assuming that all the energy of the metal is converted to heat, what is the rise in temperature of the metal when it hits the ground? [Specific heat capacity of metal = 250 J $kg^{-1}{}^{o}C^{-1}$]

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Q10.

Figure 1 shows two identical iron blocks, A and B of the same mass. They have the same initial temperature of 70 °C. Blocks A and B are then transferred into beakers P and Q respectively. Beaker P contains 300 g of oil and beaker Q contains 300 g of water.

The initial temperature of the water and oil in each beaker is 30 °C.

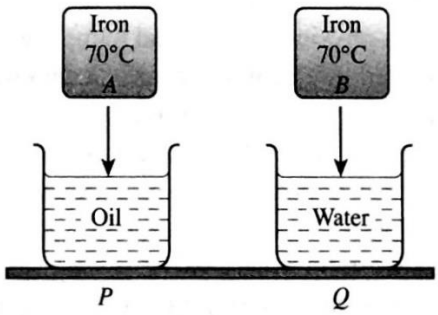

Figure 1

[Specific heat capacity of oil = 2400 J kg^{-1} $°C^{-1}$; specific heat capacity of iron = 450 J kg^{-1} $°C^{-1}$; specific heat capacity of water = 4200 J kg^{-1} $°C^{-1}$]

a) i) Which of the two beakers will have a higher temperature at the end of the experiment?
   ii) Give a reason why there is a difference in temperature in both beakers.

b) i) Calculate the rise in temperature of the water in beaker P if the mass of the iron block is 200g.
   ii) Calculate the rise in temperature of the water in beaker Q.
   iii) State one assumption which you have made in your calculation in b)i).

Q11.

The figure shows the temperature-time graph for a substance, Q of mass 1kg, being heated using a 2500 W heater. Based on the graph, determine

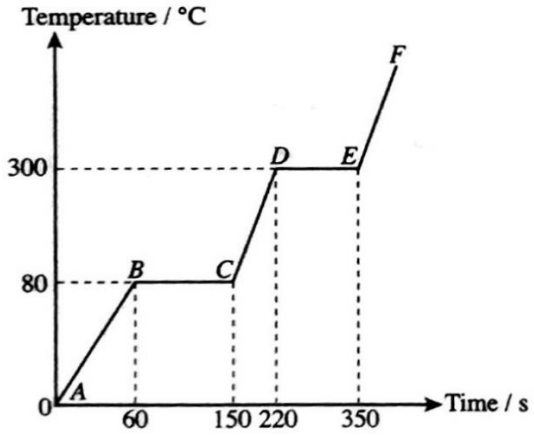

Figure 2

a) the specific heat capacity of substance Q in solid state
b) the specific heat capacity of substance Q in liquid state
c) the specific latent heat of fusion of substance Q
d) the specific latent heat of vaporization of substance Q

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Q12.

The diagrams show the direction of sea breeze and land breeze during the day and during the night respectively.

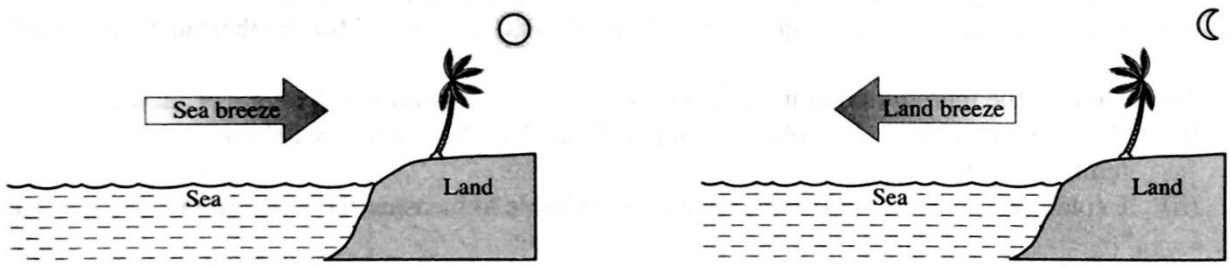

Figure 3

a) i) What is the meaning of specific heat capacity?

ii) Using both diagrams compare the direction of the wind in day time and night time. Based on your observation, state the common characteristics of the two situations. Use there characteristics to construct a physics concept and name the concept.

b) Explain why water is normally used as a cooling agent in a car engine.

c) You are assigned to produce an ideal kettle which saves gas for the purpose of boiling water. Using the appropriate physic concepts, suggest and explain the modifications required.

d) An aluminium pan and a copper pan of mass 300 g respectively are heated with 2000 J of heat energy. Calculate the temperature rise in the aluminium pan and the copper pan. Which pan is more suitable to be used as a cooking pan? Give a reason for your answer.
[Specific heat capacity of aluminium = 900 J kg^{-1} $^oC^{-1}$; specific heat capacity of coper = 390 J kg^{-1} $^oC^{-1}$]