

Sound, Calorimetry, Radioactivity (Numericals)
Assignment Sheet

1. A pendulum has a frequency of 5 vibrations per second. An observer starts the pendulum and fires a gun simultaneously. He hears the echo from a cliff after 8 vibrations of the pendulum. If the velocity of sound in air is 340ms^{-1} , what is the distance between the cliff and the observer ?
[ICSE 2003]

2. A student performs the following experiment in order to calculate specific latent heat of fusion of ice. He takes a calorimeter of mass 5.0g containing 50g of water at 30°C . Into this calorimeter he adds 5g of dry ice at 0°C . When all the ice melts the final temperature recorded by him is 20°C .
 - (a) What is the total quantity of water in the calorimeter at 20°C .
 - (b) What quantities of heat are released by water and calorimeter in attaining the temperature of 20°C ?
 - (c) What is the total amount of heat gained by the ice ?
 - (d) Calculate the value of latent heat of fusion of ice from the above calculations.
[Take S.H.C. of water = $4.2\text{Jg}^{-1}\text{C}^{-1}$ and S.H.C. of copper = $0.4\text{Jg}^{-1}\text{C}^{-1}$]
[ICSE 2003]

3. The wavelength of the waves produced on the surface of water is 20cm. If the velocity is 24ms^{-1} , Calculate :
 - (i) The number of waves produced in one second,
 - (ii) The time required to produce one wave.
[ICSE 2004]

4. 10,125 J of heat energy boil off 4.5g of water at 100°C to steam at 100°C . Find the specific latent heat of steam.
[ICSE 2004]

5. A radar is able to detect the reflected waves from an enemy aeroplane, after a time interval of 0.02 milli second. If the velocity of the waves is $3 \times 10^8 \text{ms}^{-1}$, calculate the distance of the plane from the radar.**[ICSE 2005]**

6. Water falls from a height of 50m. Calculate the rise in temperature of water when it strikes the bottom. [$g = 10\text{ms}^{-2}$, specific heat capacity of water = $4200\text{Jkg}^{-1}\text{C}^{-1}$]
[ICSE 2005]

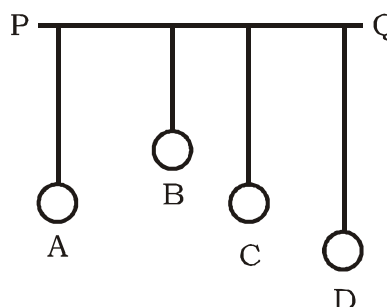
7. Calculate the amount of heat released when 5.0g of water at 20°C is changed to ice at 0°C .
Sp. heat capacity of water = $4.2\text{Jg}^{-1}\text{C}^{-1}$ and
Sp. latent heat of fusion of ice = 336Jg^{-1} .
[ICSE 2005]

8. A piece of iron of mass 2kg has a thermal capacity of 966 Jg^{-1} .
(a) How much heat is needed to warm it by 15°C ?
(b) What is its specific heat capacity in S.I. units ? **[ICSE 2006]**
9. A man standing in front of a vertical cliff fires a gun. He hears the echo after 3s. On moving closer to the cliff by 82.5m, he fires again this time, he hears echo after 2.5s. Calculate :
(i) The distance of the cliff from the initial position of the man.
(ii) The velocity of sound. **[ICSE 2007]**
10. Some hot water was added to three times its mass of cold water at 10°C and the resulting temperature was found to be 20°C . What was the temperature of the hot water ? **[ICSE 2007]**
11. A radar sends a signal to an aeroplane at a distance 45km away with a speed of $3 \times 10^8 \text{ ms}^{-1}$. After how long is the signal received back from the aeroplane? **[ICSE 2008]**
12. A piece of ice of mass 40g is dropped into 200g of water at 50°C . Calculate the final temperature if Specific heat capacity of water = $4200 \text{ Jkg}^{-1} \text{ }^\circ\text{C}^{-1}$, specific latent heat of fusion of ice = $336 \times 10^3 \text{ J kg}^{-1}$. **[ICSE 2008]**
13. Calculate the minimum distance at which a person should stand in front of a reflecting surface so that he can hear a distant echo.
[Take speed of sound in air = 350 ms^{-1}] **[ICSE 2009]**
14. An ultrasonic wave is sent from a ship towards the bottom of the sea. It is found that the time interval between the sending and receiving of the wave is 1.5s. Calculate the depth of the sea if the velocity of sound in sea water is 1400 ms^{-1} . **[ICSE 2009]**
15. 40 g of water at 60°C is poured into a vessel containing 50g of water at 20°C . The final temperature recorded is 30°C . Calculate the thermal capacity of the vessel.
[Take specific heat capacity of water as $4.2 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$] **[ICSE 2009]**
16. Calculate the amount of ice which is required to cool 150g of water contained in a vessel of mass 100g at 30°C , such that the final temperature of the mixture is 5°C . [Take specific heat capacity of material of vessel as $0.4 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$, specific latent heat of fusion of ice = 336 Jg^{-1} , specific heat capacity of water = $4.2 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$] **[ICSE 2009]**
17. (i) A man stands at a distance of 68 m from a cliff and fires a gun. After what time interval will he hear the echo, if he speed of sound in air is 340 ms^{-1} ?
(ii) If the man had been standing at a distance of 12 m from the cliff would he have heard a clear echo ? **[ICSE 2010]**

18. 50 g of ice at 0°C is added to 300g of a liquid at 30°C . What will be the final temperature of the mixture when all the ice has melted? The specific heat capacity of the liquid is $2.65 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$ while that of water is $4.2 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$. Specific latent heat of fusion of ice = 336 Jg^{-1} . **[ICSE 2010]**
19. (i) Three musical instruments give out notes at the frequencies listed below. Flute : 400Hz; Guitar : 200Hz; Trumpet : 500Hz. Which one of these has the highest pitch?
(ii) With which of the following frequencies does a tuning fork of 256 Hz resonate? 288 Hz, 314Hz, 333Hz, 512 Hz. **[ICSE 2011]**
20. A man standing 25 m away from a wall produces a sound and receives the reflected sound.
(i) Calculate the time after which he receives the reflected sound if the speed of sound in air is 350 ms^{-1} .
(ii) Will the man be able to hear a distinct echo? Give a reason for your answer. **[ICSE 2011]**
21. 200 g of hot water at 80°C is added to 300g of cold water at 10°C . Calculate the final temperature of the mixture of the mixture of water. Consider the heat taken by the container to be negligible. [specific heat capacity of water is $4200 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$] **[ICSE 2011]**
22. 250 g of water at 30°C is present in a copper vessel of mass 50g. Calculate the mass of ice required to bring down the temperature of the vessel and its contents to 5°C .
Specific latent heat of fusion of ice = $336 \times 10^3 \text{ J kg}^{-1}$
Specific heat capacity of copper vessel = $400 \text{ J kg}^{-1}\text{ }^{\circ}\text{C}^{-1}$
Specific heat capacity of water = $4200 \text{ J kg}^{-1}\text{ }^{\circ}\text{C}^{-1}$. **[ICSE 2011]**
23. (i) A man standing between two cliffs produces a sound and hears two successive echoes at intervals of 3 s and 4 s respectively. Calculate the distance between the two cliffs.
The speed of sound in the air is 330 ms^{-1} .
(ii) Why will an echo not be heard when the distance between the source of sound and the reflecting surface is 10 m? **[ICSE 2012]**
24. A hot solid of mass 60 g at 100°C is placed in 150g of water at 20°C . The final steady temperature recorded is 25°C . Calculate the specific heat capacity of the solid. [Specific heat capacity of water = $4200 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$] **[ICSE 2012]**
25. 40 g of ice at 0°C is used to bring down the temperature of a certain mass of water at 60°C to 10°C . Find the mass of water used.
[Specific heat capacity of water = $4200 \text{ J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$]
[Specific latent heat of fusion of ice = $336 \times 10^3 \text{ J kg}^{-1}$] **[ICSE 2012]**

26. A sound made on surface of lake takes 3sec to reach a boatman. How much time will it take to reach a diver inside the water at same depth
Velocity of sound in air = 330ms^{-1}
Velocity of sound in water = 1450ms^{-1} **[ICSE 2013]**
27. How much heat energy is released when 5g of water at 20°C changes to ice at 0°C .
[SHC of water = $4.2\text{ Jg}^{-1}\text{ }^\circ\text{C}^{-1}$]
[SLH of fusion of ice = 336 Jg^{-1}] **[ICSE 2013]**
28. A radioactive nucleus undergoes a series of decays according to the sequence
 $X \xrightarrow{\beta} X_1 \xrightarrow{\alpha} X_2 \xrightarrow{\alpha} X_3$
If the mass number & atomic number of X_3 are 172 & 69 respectively, what is the mass number & atomic number of X. **[ICSE 2013]**
29. An observer stands at a certain distance away from a cliff & produces a loud sound. He hears the echo of sound after 1.8 seconds. Calculate the distance between the cliff and observer if the velocity of sound in air is 340ms^{-1} . **[ICSE 2013]**
30. A certain amount of heat Q will warm 1g of material X by 3°C & 1g of material Y by 4°C . Which material has higher specific heat capacity. **[ICSE 2013]**
31. A Calorimeter of mass 50g & SHC $0.42\text{ Jg}^{-1}\text{ }^\circ\text{C}^{-1}$ contains some mass of water at 20°C . A metal piece of 20g at 100°C is dropped into the calorimeter. After stirring, the final temperature of the mixture is 22°C . Find the mass of water used in calorimeter.
[SHC of metal piece = $0.3\text{ Jg}^{-1}\text{ }^\circ\text{C}^{-1}$]
[SHC of water = $4.2\text{ Jg}^{-1}\text{ }^\circ\text{C}^{-1}$] **[ICSE 2013]**
32. 50 g of metal piece at 27°C requires 2400 J of heat energy so as to attain a temperature of 327°C . Calculate the specific heat capacity of the metal. **[ICSE 2014]**
33. 50 g of metal piece at 27°C requires 2400 J of heat energy so as to attain a temperature of 327°C . Calculate the specific heat capacity of the metal. **[ICSE 2014]**
34. Heat energy is supplied at a constant rate to 100g of ice at 0°C . The ice is converted into water at 0°C in 2 minutes. How much time will be required to raise the temperature of water from 0°C to 20°C ? [Given : sp. heat capacity of water = $4.2\text{ J g}^{-1}\text{ }^\circ\text{C}^{-1}$, sp. latent heat of ice = 336 J g^{-1}]. **[ICSE 2014]**

35. Specific heat capacity of substance A is $3.8 \text{ J g}^{-1}\text{K}^{-1}$ whereas the Specific heat capacity of Substance B is $0.4 \text{ J g}^{-1} \text{ K}^{-1}$.
 (i) Which of the two is a good conductor of heat?
 (ii) How is one led to the above conclusion? **[ICSE 2014]**
36. If substances A and B are liquids then which one would be more useful in car radiators? **[ICSE 2014]**
37. A radar sends a signal to an aircraft at a distance of 30 km away and receives it back after 2×10^{-4} seconds. What is the speed of the signal? **[ICSE 2014]**
38. Heat energy is supplied at a constant rate to 100g of ice at 0°C . The ice is converted into water at 0°C in 2 minutes. How much time will be required to raise the temperature of water from 0°C to 20°C ?
**[Given : sp. heat capacity of water = $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$,
 sp. latent heat of ice = 336 J g^{-1}].** **[ICSE 2014]**
39. A person standing between two vertical cliffs and 480 m from the nearest cliff shouts. He hears the first echo after 3s and the second echo 2s later.
Calculate:
 (i) The speed of sound.
 (ii) The distance of the other cliff from the person. **[ICSE 2015]**
40. A refrigerator converts 100g of water at 20°C to ice at -10°C in 35 minutes. Calculate the average rate of heat extraction in terms of watts.
**[Given : Specific heat capacity of ice = $2.1 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$
 Specific heat capacity of water = $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$
 Specific Latent heat of fusion of ice = 336 J g^{-1}]** **[ICSE 2015]**
41. A person standing between two vertical cliffs and 480 m from the nearest cliff shouts. He hears the first echo after 3s and the second echo 2s later.
Calculate :
 (i) The speed of sound.
 (ii) The distance of the other cliff from the person. **[ICSE 2015]**
42. In the diagram below, A, B, C, D are four pendulums suspended from the same elastic string PQ. The length of A and C are equal to each other while the length of pendulum B is smaller than that of D. Pendulum A is set into a mode of vibrations. **[ICSE 2015]**



43. A refrigerator converts 100g of water at 20°C to ice at -10°C in 35 minutes. Calculate the average rate of heat extraction in terms of watts.
Given : Specific heat capacity of ice = $2.1 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$
 Specific heat capacity of water = $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$
 Specific Latent heat of fusion of ice = 336 J g^{-1} . **[ICSE 2015]**
44. Calculate the mass of ice required to lower the temperature of 300 g of water 40°C to water at 0°C . (Specific latent heat of ice = 336 J/g , Specific heat capacity of water = $4.2 \text{ J/g}^{\circ}\text{C}$) **[ICSE 2016]**
45. An element ${}_Z\text{S}^A$ decays to ${}_{85}\text{R}^{222}$ after emitting 2 α particles and 1 β particle. Find the atomic number and atomic mass of the element S. **[ICSE 2016]**
46. Some ice is heated at a constant rate, and its temperature is recorded after every few seconds, till steam is formed at 100°C . Draw a temperature time graph to represent the change. Label the two phase changes in your graph. **[ICSE 2016]**
47. A copper vessel of mass 100 g contains 150 g of water at 50°C . How much ice is needed to cool it to 5°C ?
Given : Specific heat capacity of copper = $0.4 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$
 Specific heat capacity of water = $4.2 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$
 Specific latent heat of fusion of ice = 336 Jg^{-1} **[ICSE 2016]**
48. A solid of mass 50 g at 150°C is placed in 100 g of water at 11°C , when the final temperature recorded is 20°C . Find the specific heat capacity of the solid. (Specific heat capacity of water = $4.2 \text{ J/g}^{\circ}\text{C}$) **[ICSE 2017]**
49. You have a choice of three metals A, B and C, of specific heat capacities $900 \text{ Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$, $380 \text{ Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$ and $460 \text{ Jkg}^{-1}\text{ }^{\circ}\text{C}^{-1}$ respectively, to make a calorimeter. Which material will you select? Justify your answer. **[ICSE 2017]**
50. Calculate the mass of ice needed to cool 150g of water contained in a calorimeter of mass 50g at 32°C such that the final temperature is 5°C .
 Specific heat capacity of calorimeter = $0.4 \text{ J/g}^{\circ}\text{C}$
 Specific heat capacity of water = $4.2 \text{ J/g}^{\circ}\text{C}$
 Latent heat capacity of ice = 330 J/g **[ICSE 2017]**

