MT EDUCARE LTD.

ICSE X SUBJECT : **PHYSICS**

Sound, Calorimetry, Radioactivity (Numericals)

Assignment Sheet

STEP UP ANSWERSHEET

26. Given, depth i.e., distance is same.

$$\therefore \quad s = \frac{d}{t}$$

$$\Rightarrow \quad 330 = \frac{d}{3}$$

$$\Rightarrow \quad d = 990\text{m}$$

Now for the diver inside water

$$s = \frac{d}{t}$$

$$t = \frac{990}{1,450}$$

$$\therefore \quad t = 0.682 \text{ sec.}$$ **[ICSE 2013]**

27. Heat energy required $= mc\Delta t + mL$

$= 5 \times 4.2 \times 20 + 5 \times 336$

$= 420 + 1,680 = 2,100$ J **[ICSE 2013]**

28. Mass number of X = 180

Atomic number of X = 72 **[ICSE 2013]**

29. We know $s = \frac{d}{t}$

$$\Rightarrow \quad d = s \times t$$

$$\Rightarrow \quad d = 340 \times \frac{1.8}{2}$$

$$\therefore \quad d = 306 \text{ m.}$$ **[ICSE 2013]**

30. Specific heat capacity, $c = \frac{\text{Heat taken}}{\text{Mass} \times \text{Rise in temperature}}$

$$\therefore \quad c_X = \frac{Q}{1 \times 3} \text{ and } c_Y = \frac{Q}{1 \times 4}$$

$$\therefore \quad c_X > c_Y$$

Hence, X has higher specific heat capacity. **[ICSE 2013]**

31. Heat given = Heat Taken.

Let mass of water used be m, then

$mc\Delta T = m'c'\Delta t + m'c_1\Delta t$

$$\Rightarrow \quad 20 \times 0.3 \times (100 - 22) = 50 \times 0.42 \times (22 - 20) + m \times 4.2 \times (22 - 20)$$

$$\Rightarrow \quad 468 = 42 + 8.4\, m$$

$\Rightarrow \quad 8.4\, m = 426$

$\therefore \quad m = 50.71$ gm. **[ICSE 2013]**

32. **(32 and 33 Same Answer)**

Given, $m = 50\text{g or } \frac{50}{1000}\text{kg}$

$Q = 2400\text{J}$

$T_1 = 27°\text{C}$

$T_2 = 327°\text{C}$

$Q = mc\Delta t$

$$c = \frac{Q}{m\Delta t}$$

$$= \frac{2400}{\frac{50}{1000}\times(327-27)}$$

$$= \frac{2400}{\frac{5}{100}\times 300}$$

$$= \frac{2400}{15} = 160 \text{ Jkg}^{-1}\text{ K}^{-1}$$ **[ICSE 2014]**

34. **(34 and 38 same answer)**

$m_{ice} = 100 \text{ g} = 0.1 \text{ kg}.$

Heat energy required to raise the temperature of water from 0°C to 20°C, (Q)

$= mc\Delta t$

$= 0.1 \text{ kg} \times 4200 \text{ J/kg/°C} \times 20°\text{C}$

$= 420 \times 20 = 8400 \text{ J}$

Heat energy required for conversion of ice into water at 0°C = mL

$= 0.1 \text{ kg} \times 336000 \text{ J/kg}$

$= 33600$ J W

Power, $P = \frac{W}{t}$

$$P = \frac{33600}{120}$$

$$= \frac{3360}{12} = 280 \text{ W}$$

$P \times t = Q$

$$t = \frac{Q}{P}$$

$$= \frac{8400}{280} = 30\text{sec.}$$ **[ICSE 2014]**

35. Specific heat capacity of A is 3.8 J/g/K.
Specific heat capacity of B is 0.4 J/g/K.
(i) 'B' is a good conductor of heat.

(ii) The specific heat capacity of B is lower than A. This means that less heat is required to raise the temperature of lg of B by 1K than the heat required for A. **[ICSE 2014]**

36. 'A' will be preferred as it absorbs large amount of heat energy without raising its own temperature much as its specific heat capacity is high. **[ICSE 2014]**

37. (i) An important property of such type of a waves is that they travel undeviated through long distances.

(ii) Speed, $v = \frac{2d}{t}$

$\Rightarrow \quad v = \frac{2 \times 30 \times 10^3}{2 \times 10^{-4}}$

$\Rightarrow \quad v = \frac{30 \times 10^3}{10^{-4}}$

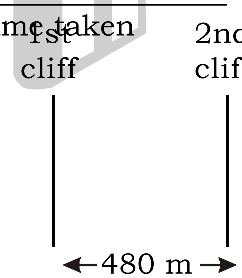
$\Rightarrow \quad v = 3 \times 10^4 \times 10^4$

$\therefore$ Speed of the signal, $v = 3 \times 10^8$ m/s **[ICSE 2014]**

38. **(Same as 34 Answer)** **[ICSE 2014]**

39. The first echo is heard from the nearest cliff.
The total distance travelled by sound to reach the first cliff and then come back = 2 × 480 m = 960 m, Time taken = 3 seconds

(i) Speed of sound = $\frac{\text{Total distance travelled}}{\text{Time taken}} = \frac{960}{3}$ = 320 m/s



(ii) Time taken for the second echo = (3 + 2) seconds = 5 seconds
Distance of the second cliff from the observer

$= \frac{(\text{speed} \times \text{time})}{2} = \frac{(320 \times 5)}{2}$ = 800 m **[ICSE 2015]**

40. Heat lost by water when the refrigerator converts 100 g of water at 20°C to water at 0°C

= mass of water × specific heat capacity of water × fall in temperature

= 100 × 4.2 × (20 – 0) = 8400J

Heat energy extracted to convert 100 g of water at 0° C to be ice at 0°C

= mass of ice × specific latent heat of fusion of ice = 100 × 336 = 33600 J

Heat energy extracted to convert 100 g of ice at 0°C to ice at –10°C

= mass of ice × specific heat capacity of ice × fall in temperature

= 100 × 2.1 × [0 – (– 10)] = 100 × 2.1 × 10 = 2100 J

Total heat extracted = 8400 + 33600 + 2100 = 44100 J

Let the averae rate of extraction of heat be P watts.

Energy extracted by the refrigerator in t seconds = P × t

Thus,

P × t = 44100 J

P × 35 × 60 = 44100 (since 35 minutes = 35 × 60 seconds)

y $P = \frac{44100}{35 \times 60}$ = 21 watts **[ICSE 2015]**

*41.

42. (i) **Force vibration** are executed by the pendulums B and D.
(ii) Pendulum C is in a state of resonance with Pendulum A. Also they are in the same phase.
(iii) This is because the time period of pendulum B is different from that of C (since length of the pendulums B and C are different).

[ICSE 2015]

43. **(Same as 40 Answer)**

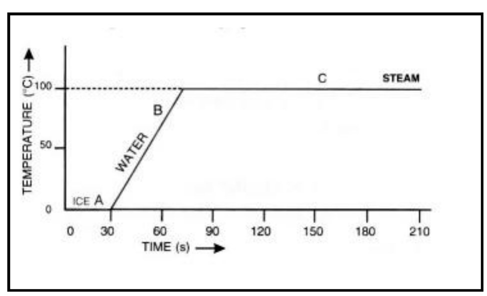
44. Given : mass of water = 300 g, fall in temperature = (40 – 0) °C = 40°C.
Let mass of ice required = mg
Heat lost by water = Heat gained by ice
i.e., mass of water x specific heat capacity of water x fall in temperature
= mass of ice x specific latent heat of ice
or 300 × 4.2 × 40 = m × 336

∴ $m = \frac{300 \times 4.2 \times 40}{336}$ = 150 g **[ICSE 2016]**

45. Due to emission of 2 α-particles and 1 β-particle from ${}^{A}_{Z}S$, the atomic number Z has decreased by 4 and increased by 1 (i.e., net decreased by 3), while mass number A has decreased by 8 to form ${}^{222}_{85}R$.

∴ Z – 3 = 85 and A – 8 = 222 i.e. Z = 88 and A = 230 **[ICSE 2016]**

46. The temperature-time graph is shown below.
In Fig., A – Phase change from 0°C ice to 0°C water
C – Phase change from 100°C water to 100°C steam
[ICSE 2016]



47. Let m g ice is needed
Heat is lost by copper vessel and water when their temperature fall from 50°C to 5°C.
Therefore total heat lost = mass of copper vessel × specific heat capacity of copper × fall in temperature + mass of water × specific heat capacity of water × fall in temperature

= $100 \times 0.4 \times (50 - 5) + 150 \times 4.2 \times (50 - 5)$

= $1800 + 28350 = 30150$ J ...(i)

Heat is gained by the ice in melting at 0°C and then in increase in its temperature from 0°C to 5°C.

Therefore total heat gained = mass of ice × specific latent heat of ice + mass of melted ice × specific heat capacity of water × rise in temperature

= $m \times 336 + m \times 4.2 \times (5 - 0)$

= $336\,m + 21\,m = 357\,m$ J ....(ii)

By the principle of calorimetry,

total heat gained = total heat lost

or $357\,m = 30150$

$$\therefore \quad m = \frac{30150}{357} = 84.45 \text{ g}$$ **[ICSE 2016]**

48. Mass of solid m_1 = 50 g, temperature of solid t_1 = 150°C, mass of water m_2= 100 g, temperature of water t_2 = 10°C, temperature of mixture t = 20°C

Heat lost by the solid $Q_1 = m_1c_1\,(t_1 - t)$

$= 50 \times c_1 \times (150 - 20) = 6500\, c_1$J

Heat gained by water $= m_2 \times c_2 \times (t - t_2)$

$= 100 \times 4.2 \times (20 - 11) = 3780$J

If there is no loss of heat, by the principle of calorimetry Heat lost by the solid = Heat gained by water

or $6500\, c_1 = 3780$

$$\therefore \quad c_1 = \frac{3780}{6500} = 0.582 \text{ J g}^{-1}\, {}^\circ\text{C}^{-1}$$

[ICSE 2017]

49. For calorimeter, metal B will be used.

Reason : Its specific heat capacity is lowest, so it will take least heat from its contents to acquire the temperature of contents.

[ICSE 2017]

50. Given, mass of water m_1 = 150 g, mass of calorimeter m_2 = 50 g, temperature of water t_1 = 32°C, final temperature t = 5°C.

Let m be the mass of ice added

Heat given by calorimeter $Q_1 = m_2c_2 \times (t_1 - t)$

$= 50 \times 0.4 \times (32 - 5) = 540$ J

Heat given by water $Q_2 = m_1 \times c_1 \times (t_1 - t)$

$= 150 \times 4.2 \times (32 - 5) = 17010$J

Heat taken by ice to melt at 0°C = $mL = m \times 330 = 330$ m J

and heat taken by iced water to raise its temperature to 5°C

$= m \times 4.2 \times (5 - 0) = 21$ m J

∴ Total heat taken by ice $= 330\,m + 21\,m = 351\,m$ J

By principle of calorimetry, if there is no loss of heat,

$351\,m = 540 + 17010$

$$m = \frac{17550}{351} = 50 \text{ g}$$ **[ICSE 2017]**

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