Important Questions for Class 11 Physics Chapter 5: Class 11 Physics Chapter 5, "Work, Energy, and Power," focuses on the fundamental concepts of energy and its transformations. Key topics include the definition of work, the work-energy theorem, kinetic and potential energy, and the law of conservation of energy.

The chapter also covers the concepts of power, including its formula and units, and how energy is transferred in mechanical systems. Important questions often include derivations of key formulas, applications of the work-energy theorem, calculating work done in various scenarios, and problems involving the conservation of mechanical energy. The chapter forms the foundation for understanding energy dynamics in physics.

Important Questions for Class 11 Physics Chapter 5 Overview

Chapter 5 of Class 11 Physics, Work, Energy, and Power, is fundamental for understanding the basic principles of mechanics. Key topics include the concepts of work, energy, and power, and their interrelationships. Important questions from this chapter often cover work done by a force, kinetic and potential energy, the work-energy theorem, and conservation of energy.

These concepts are critical not only for exams but also for practical applications in real-world physics problems. Mastery of these topics is essential for solving problems related to motion, energy transformations, and efficiency, which are foundational for higher studies in physics and engineering.

Important Questions for Class 11 Physics Chapter 5 Work, Energy and Power

Below is the Important Questions for Class 11 Physics Chapter 5 Work, Energy and Power -

1. If two bodies stick together after collision, will the collision be elastic or inelastic?

Ans: If two bodies stick together after the collision the collision will be an inelastic collision.

2. When an air bubble rises in water, what happens to its potential energy?

Ans: When an air bubble rises in water, the potential energy of the air bubble decreases because work is done by upthrust on the bubble.

3. A spring is kept compressed by pressing its ends together lightly. It is then placed in a strong acid and released. What happens to its stored potential energy?

Ans: When Spring is kept compressed by pressing its ends together lightly and further placed in strong acid and released, the loss in potential energy appears as kinetic energy of the molecules of the acid.

4. Define the triple point of water.

Ans: Triple point of water indicates the values of pressure and temperature at which water co-exists in equilibrium in all the three states of matter.

5. State Dulong and Petit law.

Ans: According to Dulong and Petit law, the specific heat of all the solids is constant at room temperature and is equal to 3R.

6. Why are the clock pendulums made of invar, a material of low value of coefficient of linear expansion?

Ans: The clock pendulums are made of Inver as it has a low value of α (coefficient of linear expansion) i.e., for a small change in temperature, there won't be much change in the length of the pendulum.

7. Why is mercury used in making thermometers?

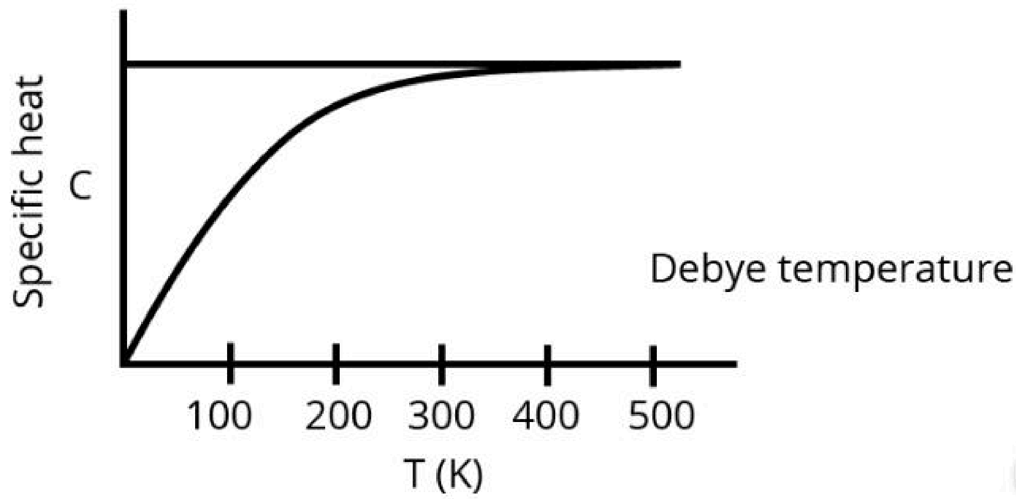
Ans: Mercury is used in making thermometers as it has a wide and useful temperature range and has a uniform rate of expansion.

8. How would a thermometer be different if glass expanded more with increasing temperature than mercury?

Ans: If glass expanded more with increasing temperature than mercury, the scale of the thermometer would be upside down.

9. Show the variation of specific heat at constant pressure with temperature.

Ans: Here is the required variation:



10. Two thermometers are constructed in the same way except that one has a spherical bulb and the other an elongated cylindrical bulb. Which one will respond quickly to temperature change?

Ans: The thermometer with a cylindrical bulb will respond quickly to temperature changes as the surface area of the cylindrical bulb is greater than that of a spherical bulb.

11. A body constrained to move along the z-axis of a coordinate system is subject to a constant force F given by $F = -\hat{i} + 2\hat{j} + 3\hat{k}\, N$. Where $\hat{i}, \hat{j}, \hat{k}$ are unit vectors along the x, y and z axis of the system respectively. What is the work done by this force in moving the body a distance of 4 m along the z axis?

Ans: Force exerted on the body is $F = -\hat{i} + 2\hat{j} + 3\hat{k}\, N$.

Displacement, $s = 4\hat{k}\ m$

Work done, $W = F.s$

$= \left(-\hat{i} + 2\hat{j} + 3\hat{k}\right).\left(4\hat{k}\right)$

$= 12\ J$

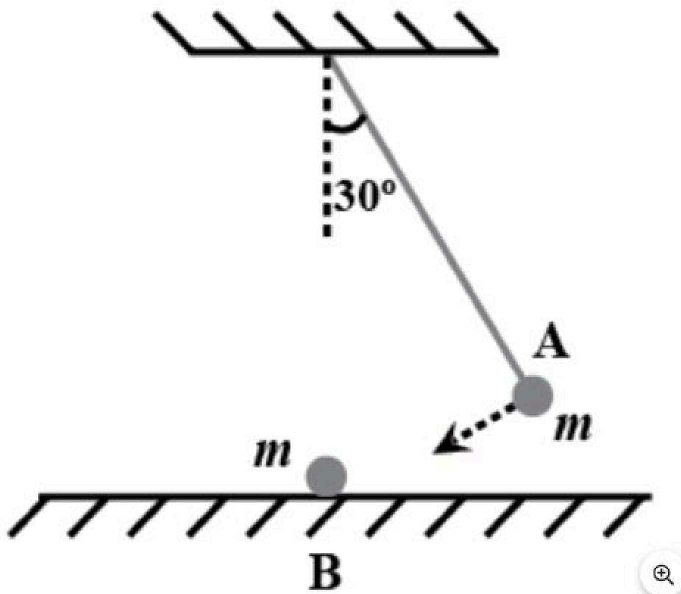
Thus, $12\ J$ of work is done by the force on the body.

12. A molecule in a gas container hits a horizontal wall with speed and angle 30° with the normal, and rebounds with the same speed. Is momentum conserved in the collision? Is the collision elastic or inelastic?

Ans. The collision is elastic, really. Whether the collision is inelastic or elastic, the gas molecule's momentum is conserved. The gas molecule travels at 200 m/s, collides with the container's stationary wall, and then bounces back at the same speed. This demonstrates that the wall's rebound velocity stays at zero.

As a result, during the impact, the molecule's whole kinetic energy is preserved. An elastic collision is exemplified by the above collision.

13. The bob A of a pendulum released from 30° to the vertical hits another bob B of the same mass at rest on a table as shown in Fig. 6.15. How high does the bob A rise after the collision? Neglect the size of the bobs and assume the collision to be elastic.



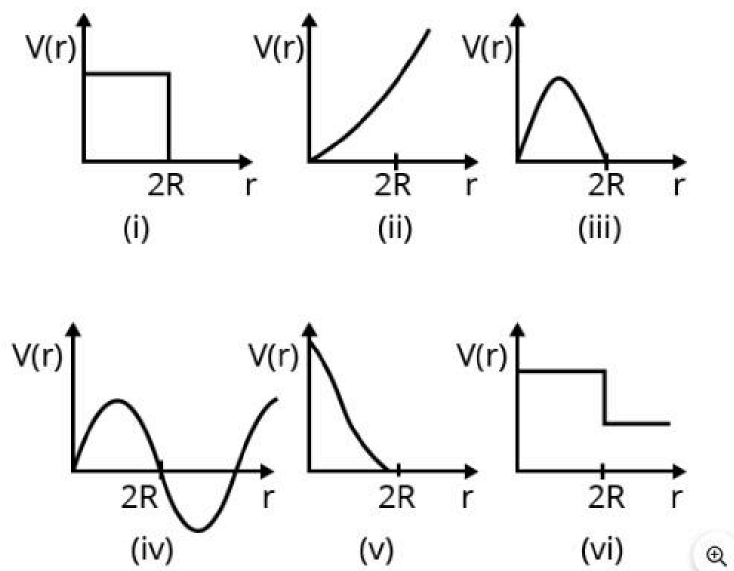
Ans. Bob A refuses to get up. When two equal masses collide elastically, one of which is stationary and the other is moving with some velocity, the stationary mass gains the same velocity while the moving mass instantly stops moving after the contact.

In this case, the travelling mass completely transfers its momentum to the stationary mass. Therefore, when bob A of mass m collides with bob B of equal mass, bob A will come to rest, and bob B will travel at the same speed as bob A at the moment of impact.

14. A trolley of mass 300 kg carrying a sandbag of 25 kg is moving uniformly with a speed of 27 km/h on a frictionless track. After a while, sand starts leaking out of a hole on the floor of the trolley at the rate of 0.05 kg/s. What is the speed of the trolley after the entire sand bag is empty?

Ans: The sand bag is placed on a trolley that is moving with a uniform speed of $27\ km/h$. The external forces acting on the system of the sandbag and the trolley is zero. As the leaking action does not produce any external force on the system, the sand starts leaking from the bag with no change in the velocity of the trolley. This is in accordance with Newton's first law of motion. Thus, the speed of the trolley will remain $27\ km/h$.

15. Which of the following potential energy curves in Fig. 6.18 cannot possibly describe the elastic collision of two billiard balls? Here r is the distance between centres of the balls.



Ans: The elastic collision of two pool balls cannot be described by (i), (ii), (iii), (iv), and (vi) based on the figure provided in the question. We are aware that the distance between two masses in a system is inversely proportional to its potential energy.

Here, as the two balls get closer to one another, the system's potential energy will diminish. When the two balls come into contact with one another, or at r = 2R, where R is the radius of each pool ball, it will become zero (i.e., V(r) = 0). These two requirements are not met by the potential energy curves shown in figures (i), (ii), (iii), (iv), and (vi). The elastic collisions between them are therefore not described by them.

Short Answer Questions

1. A body is moving along Z – axis of a co – ordinate system is subjected to a constant force F is given by $\vec{F} = -\hat{i} + 2\hat{j} + 3\hat{k} N$. Where $\hat{i}, \hat{j}, \hat{k}$ are unit vector along the x, y and z – axis of the system respectively. What is the work done by this force in moving the body a distance of 4m along the Z – axis?

Ans: Force exerted on the body is,

$F = -\hat{i} + 2\hat{j} + 3\hat{k} N$.

Displacement, $s = 4\hat{k}\ m$

Work done, $W = F.s$

$= \left(-\hat{i} + 2\hat{j} + 3\hat{k}\right).\left(4\hat{k}\right)$

$= 12\ J$

Thus, $12\ J$ of work is done by the force on the body.

2. A ball is dropped from the height h_1 and if re-bounces to a height h_2. Find the value of coefficient of restitution.

Ans: As the ball drops from height h_1,

Velocity of approach will be $v_1 = \sqrt{2gh_1}$

And the ball rebounds to height h_2.

Therefore, velocity of separation is $v_2 = \sqrt{2gh_2}$

Coefficient of restitution is given by:

Coefficient of restitution is given by:

$$e = \frac{v_2}{v_1} = \frac{\sqrt{2gh_2}}{\sqrt{2gh_1}}$$

$$\Rightarrow e = \sqrt{\frac{h_2}{h_1}}$$

3. State and prove work energy theorem analytically.

Ans: The work-energy theorem states that work done by force acting on a body is equal to the change produced in its kinetic energy.

If $\vec{F}$ force is applied to move an object through a distance $d\vec{s}$.

Then $dw = \vec{F}.d\vec{s}$

$$F = m\vec{a}$$

$$dw = m\vec{a}.d\vec{s}$$

$$dw = m\frac{d\vec{v}}{dt}.d\vec{s}$$

$$dw = m\frac{d\vec{s}}{dt}.d\vec{v}$$

$$\Rightarrow dw = mv.d\vec{v}$$

On integrating,

$$\sum dw = W = \int_u^v mv.d\vec{v}$$

$$W = m\left|\frac{v}{2}\right|_u^v$$

$$\Rightarrow W = \frac{mv^2}{2} - \frac{mu^2}{2}$$

Hence $W \ = \ K_f \ \ K_i$ Where K_f and K_i are final and initial kinetic energy.

4. An object of mass 0.4kg moving with a velocity of 4m/s collides with another object of mass 0.6kg moving in the same direction with a velocity of 2m/s. If the collision is perfectly inelastic, what is the loss of K.E. due to impact?

Ans: In the above question it is given that:

$m_1 \ = \ 0.4kg$,

$u_1 \ = \ 4m/s$,

$m_2 \ = \ 0.6kg$ And

$u_2 \ = \ 2m/s$.

Total K.E. before collision is given by:

$K_i = \frac{1}{2}m_1{u_1}^2 + \frac{1}{2}m_2{u_2}^2$

$$\Rightarrow K_i = \frac{1}{2}(0.4)(4)^2 + \frac{1}{2}(0.6)(2)^2$$

$\Rightarrow K_i = 4.4J$

Since collision is perfectly inelastic,

$v = \frac{m_1u_1 + m_2u_2}{m_1 + m_2} = 2.8m/s$

Total K.E. after collision is given by:

$K_i = \frac{1}{2}m_1{u_1}^2 + \frac{1}{2}m_2{u_2}^2$

$$\Rightarrow K_i = \frac{1}{2}(0.4)(4)^2 + \frac{1}{2}(0.6)(2)^2$$

$\Rightarrow K_i = 4.4J$

Since collision is perfectly inelastic,

$v = \frac{m_1u_1 + m_2u_2}{m_1 + m_2} = 2.8m/s$

Total K.E. after collision is given by:

$K_f = \frac{1}{2}(m_1 + m_2)v^2$

$\Rightarrow K_f = \frac{1}{2}(0.4 + 0.6)\,2.8^2$

$\Rightarrow K_f = 3.92J$

Thus, loss in K.E. will be:

$\Delta K = K_i - K_f$

$\Rightarrow \Delta K = 4.4 - 3.92 = 0.48J$

5. Why does the density of solid/liquid decreases with rise in temperature?

Ans: Consider P to be Density of solid/liquid at temperature T.

$$P_1 = Density\ of\ solid/liquid\ at\ Temperature\ T + \Delta T.$$

As, $Density = \frac{Mass}{Volume}$

$$P = \frac{M}{V} \text{ ...... (1)}$$

$$P_1 = \frac{M}{V_1} \qquad \text{...... (2)}$$

$$V_1 = Volume\ of\ solid\ at\ temperature\ T\ +\ \Delta T$$

$$V\ = Volume\ of\ solid\ at\ temperature\ T$$

As on increasing the temperature, solids/liquids expand, that is their volume increases, so by equation 1) & 2) Density is inversely proportional to volumes. Therefore, if the volume increases on increasing the temperature, Density will decrease.

6. Two bodies at different temperatures $\mathbf{T_1}$, and $\mathbf{T_2}$ are brought in thermal contact do not necessarily settle down to the mean temperature of $\mathbf{T_1}$ and $\mathbf{T_2}$. Why?

Ans: When two bodies at different temperatures $\mathbf{T_1}$ and $\mathbf{T_2}$ are in thermal contact. They do not always settle at their mean temperature because the thermal capacities of two bodies may not always be equal.

7. The resistance of certain platinum resistance thermometer is found to be $2.56\ \Omega$ at $0^\circ C$ and $3.56\ \Omega$ at $1000^\circ C$. When the thermometer is immersed in a given liquid, its resistance is observed to $5.06\ \Omega$. Determine the temperature of liquid?

Ans: In the above question it is given that:

$$R_o\ = Resistance\text{at } 0^\circ C = 2.56\Omega$$

$$R_t\ = Resistance\ at\ temperature\ T\ =\ 1000^\circ\text{C is } 3.56\ \Omega$$

$$R_t\ = Resistance\ at\ unknown\ temperature\ t;$$

$$R_t\ =\ 5.06\Omega$$

As $t = \frac{R_t - R_0}{R_{100} - R_0} \times 100$

$$\Rightarrow t = \frac{5.06-2.56}{3.56-2.56} \times 100 = 250^\circ C$$

8. A ball is dropped on a floor from a height of 2cm. After the collision, it rises up to a height of 1.5m. Assuming that 40% of mechanical energy lost goes to thermal energy into the ball. Calculate the rise in temperature of the ball in the collision. Specific heat capacity of the ball is 800J/k. Take $g = 10m/s^2$.

Ans: In the above question it is given that:

$Initial\ height = h_1 = 2m$

$Final\ height = h_2 = 1.5m$

$Since\ potential\ energy = mechanical\ energy\ for\ a\ body\ at\ rest\ as\ K.E = 0$

$Mechanical\ energy\ lost = |mg(h_1 - h_2)|$

$= |1 \times 10(105 - 2)| = 5J$

Now $(mechanical\ energy\ lost) \times 40$

$\frac{40}{100} \times 5 = Cm\Delta T$

$\Rightarrow \frac{40}{100} \times 5 = 800 \times 1 \times \Delta T$

Therefore,

$\Delta T = \frac{100 \times 800}{40 \times 5} = 2.5 \times 10^{-3}\ {}^oC$, which is the required rise in temperature.

9. A thermometer has wrong calibration. It reads the melting point of ice as 10^0C. It reads 60^0C in place of 50^0C. What is the temperature of boiling point of water on the scale?

Ans: In the above question it is given that:

Lower fixed point on the wrong scale is 10^0C.

Let $n = no.\ divisions\ between\ upper\ and\ lower\ fixed\ points\ on\ this\ scale.$

If $Q = reading\ on\ this\ scale$, then

$\frac{C-0}{100} = \frac{Q-(-10)}{n}$

Now, $C = Incorrect\ Reading = 60^0C$

$Q = Correct\ Reading = 50^0C$

So,

$\frac{50-0}{100} = \frac{60-(-10)}{n}$

$\frac{50}{100} = \frac{70}{n}$

$n = 140$

Now,

$\frac{C-0}{100} = \frac{Q-(-10)}{n}$

On the Celsius scale, Boiling point of water is 100^0C

So,

$\frac{100-0}{100} = \frac{Q+10}{140}$

$Q = 130^0C$, which is the temperature of boiling point of water on this scale.

10. Write the advantages and disadvantages of platinum resistance thermometer.

Ans: Advantages of Platinum Resistance thermometer are as follows:

1. High accuracy of measurement
2. Measurements of temperature can be made over a wide range of temperature i.e., from $260^0 C\ to\ 1200^0 C$.

Disadvantages of Platinum Resistance thermometer are as follows:

1. High Cost
2. Requires additional equipment such as bridge circuit, Power supply etc.

11. If the volume of block of metal changes by 0.12% when it is heated through 200C. What is the co-efficient of linear expansion of the metal?

Ans: The co-efficient of cubical expansion y of the metal is given by:

$Y = \frac{1}{V} \times \frac{\Delta V}{\Delta T}$

$\Rightarrow Y = \frac{\Delta V}{V} \times \frac{1}{\Delta T}$

Here, $\frac{\Delta V}{V} = \frac{0.12}{100}$

$\Delta T = 20^0 C$

$Y = \frac{0.12}{100} \times \frac{1}{20}$

$\Rightarrow Y = 6 \times 10^{-5} / {}^0 C$

$\therefore$ Co-efficient of linear expansion of the metal is:

$\alpha = \frac{Y}{3} = \frac{6 \times 10^{-5}}{3} = 2 \times 10^{-5} / {}^0 C$

Benefits of Using Important Questions for Class 11 Physics Chapter 5

Using important questions for Class 11 Physics Chapter 5 (Work, Energy, and Power) offers several benefits for students:

Focused Preparation: Important questions typically cover key concepts and frequently tested topics, ensuring that students focus on the most relevant material for exams. This helps in maximizing the study time.

Better Understanding: Practicing these questions helps students understand the practical application of theoretical concepts like work, kinetic energy, potential energy, conservation of energy, and power. This solidifies their grasp on the subject.

Improved Problem-Solving Skills: Many important questions require students to apply formulas and concepts in different scenarios. This enhances problem-solving abilities and prepares them for both theoretical and numerical questions in exams.

Boosts Exam Confidence: Regularly practicing important questions boosts confidence as students become familiar with the exam pattern and types of questions they may encounter, reducing exam anxiety.

Time Management: Important questions can help students learn how to allocate time efficiently during exams. By practicing various types of questions, they get a better sense of how much time to spend on each question, which is essential for managing exam duration.

Better Exam Performance: By practicing important questions, students identify common pitfalls and tricky areas within the chapter. This leads to better performance by avoiding common mistakes and ensuring a deeper understanding of the material.