Chapter 6 - Work, Power and Energy

I. One mark questions (PART – A):

1. Define Scalar or dot product of two vectors. (K)
2. If $\vec{A}.\vec{B} = 0$, then what is the angle between $\vec{A}$ and $\vec{B}$? (S)
3. If $\vec{A}.\vec{B} = AB$, then what is the angle between $\vec{A}$ and $\vec{B}$? (S)
4. Mention expression for work done by a force in vector form (U)
5. Define work done by the force (K)
6. When does the work done by a force is zero ? (S)
7. Define work-energy theorem (K)
8. Mention the dimensions of the work done (S)
9. Is work a scalar or vector? (S)
10. Express joule in calorie. (K)
11. What is the nature of the work done by frictional force? (A)
12. What does the area under 'force – displacement' curve represent? (S)
13. Define potential energy ? (K)
14. Can potential energy of on object be negative? (S)
15. Write expression for the potential energy stored in a spring (K)
16. What is elastic collision? (K)
17. What is the value of one-horse-power in watt? (S)
18. What is kinetic energy? (U)
19. What is spring force? (K)
20. Write the S.I unit of spring constant. (U)
21. Whether the spring force is conservative or non-conservative ? (U)
22. What is the energy associated with 1 kg of mass. (S)
23. Define power (K)
24. What does area under the graph of force against displacement graph represent (K)
25. State principle of Conservation of energy. (K)
26. Define Power.(K)
27. Write the SI unit of power. (U)
28. Write the dimension of power.(U)
29. Express joule in kilowatt hour (S)
30. Give an example for zero work (U)

Two mark questions (PART – B):

1. Find the cosine of the angle between the vectors $\vec{A} = 2\hat{i} - 4\hat{j} - 5\hat{k}$ and $\vec{B} = 2\hat{i} + 2\hat{j} - 4\hat{k}$.(S)
2. Define work done by the force. What is value of work done by the centripetal force? Explain. (K)
3. State any two conditions under which a force does no work.(U)
4. How do you represent graphically work done by a variable force and by a constant force? (S)
5. What is non conservative force ? Give an example. (U)
6. What is conservative force? Give an example. (U)
7. Mention the expression for the work done by a spring force. (K)
8. Mention the two types of Mechanical energies. (U)
9. What is power? Show that power is equal to the product of force and velocity. (K)
10. Distinguish between elastic and inelastic collision (U)
11. What is elastic collision? Give an example. (U)
12. What is inelastic collision? Give an example (K&U)
13. What is perfectly inelastic collision? Give an example.

14. Find the magnitude of a vector $\vec{A} = 0\hat{i} + 3\hat{j} + 4\hat{k}$ (S)

Three mark questions (PART – C):

1. Prove work –energy theorem for a constant force. (K)
2. What is meant by collision? Distinguish between elastic and inelastic collision.(U)
3. Derive expression for kinetic energy (K)
4. Calculate the work done by a man in carrying a load of 100 kg over his head through a distance of 10m in a vertically upward direction. (S)
5. When does work done is i) + ve ii) –ve iii) zero (A)
6. Distinguish between conservative force and non-conservative force. (U)
7. Convert one kilowatt hour into joules (S)
8. Explain graphically the work done by a variable force.(K&S)
9. Draw a graph showing the variation of kinetic energy and potential energy with displacement of a loaded spring.(S)

Five mark questions (PART – D):

1. *State law of conservation of mechanical energy and illustrate the same in case of a freely falling body.(U)*
2. *Derive an expression for potential energy of stretched spring.(K)*
3. *State Work- energy theorem .Prove it in case of a variable force.(S)*
4. *Obtain the expression for loss in K.E. during an inelastic collision.(K)*
5. *Obtain the expression for final velocities of two bodies in one dimensional elastic collision.(K)*

Five mark questions-numericals. (PART – D):

1. A pump on the ground floor of a building can pump up water to fill a tank of volume $30m^3$ in 15 min. If the tank is 40m above the ground, and the efficiency of the pump is 30%, how much electric power is (Ans: 43.557kW)

2. A bullet of mass 50gm moving with a velocity of 400m/s strickes a wall and goes out from the other side with a velocity of 100m/s. Calculate the work done in passing through the wall. (Ans3750 J)
3. A pump on the ground floor of a building can pump up water to fill a tank of volume $40m^3$ in 20 minutes. If the tank 30m above the ground and the efficiency of the pump is 60%, How much electric power is consumed by the pump? Given density of water =1000 kg/m^3 and acceleration due to gravity =$9.8m/s^2$.(Ans 16.33kwatt)
4. A pilot of an aero plane fires a shot weighing 0.1kg with a vertical of 300ms-1. Calculate the total energy of the shot when it is at a height of 500m above the ground.(Ans 4990 J)

5. A pump is required to lift 600kg of water per minute from 920m deep well and ejects it with a speed of $10ms^{-1}$. What will be the power of pump required ? (Ans 92.5 kJ.)
6. A constant force of 3.5 N accelerates a stationary body of mass 20 kg through a displacement of 3.5 m. Find the work done. (Ans :12.25 J)
7. A bob of a simple pendulum is released from a horizontal position. What is the speed with when the bob crosses the mean position if 20% of its initial energy lost in air resistance ($g=9.8m/s^2$) (Ans :4.85 m/s)
8. A person pushes a trunk on railway platform. He applies a force of 150N over a distance of 10m. Thereafter he gets progressively tired and his applied Force reduces linearly with distance to

100N. The total distance through which truck has moved is 20m. Plot F-S graph and also calculate work done by that person. (Ans : 4000J)

9. A man weighing 48kg carries a bag of 2kg. He climbs to the top of building 100m all in 5 minute. Calculate the work done by the man and his power in watts and in horse power.
(Ans : 163.3 W& 0.218 H P)

10. A variable force given by F=x +8 acts on a particle. Calculate the work done by the force during the displacement of the particle from x=1m to x=3m.(Ans : 20 J)

11. From what height should a body of mass 40kg fall in order to have same kinetic energy as a body of mass 1.96kg travelling at $12ms^{-1}$. (Ans: h= 0.36m)

12. A rain drop of mass 1kg falling from a height 1km hits the ground at a speed $50ms^{-1}$.Calculate the work done by the gravitational force and (ii) work done by the unknown resistive force.
(Ans : 9.8 J & 8.55 J)

13. A railway engine of mass 60.3 tones is running at a speed of $12ms^{-1}$. What is the additional power must is develop in order to increase its speed to $18ms^{-1}$ in 5 secs? (Ans= 434.13×10^3 W)

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