	INDIAN SCHOOL AL WADI AL KABIR	
Class: IX	**DEPARTMENT OF SCIENCE -2021-22** **SUBJECT: PHYSICS**	DATE OF COMPLETION: 13.12.2021
WORKSHEET NO:4 WITH ANSWERS	**TOPIC: WORK AND ENERGY**	**A4 FILE FORMAT (PORTFOLIO)**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS

1. If 1 newton of force displaces a body by 1m, the work done is
   (a) 10J (b) 5J (c)1J (d) Depends on time
2. On tripling the speed of motion of a body, the change in K.E is
   (a)9 times (b) 8 times (c) 4 times (d) 2 times
3. A mass is moving 5m/s with speed of along the x-direction on a smooth surface, when a force of 5 N acts on it along the y-axis. The work done by the force is
   (a) 25J (b)10 J (c) Depends on time (d) zero
4. An electric bulb of 60W burns for 5 hours a day. The cost of electricity involved in a month of 30 days at Rs 3.00 per unit is
   (a) 270 (b)27 (c)2.70 (d) 2700
5. When a body falls freely towards the earth, then its total energy
   (a)increases (b) decreases (c) remains constant (d) first increases and then decreases
6. A battery lights a bulb. The sequence of energy transfer in the process is
   (a)electrical energy to heat and light
   (b) chemical energy to electrical energy and then to heat and light
   (c) chemical energy to heat and light
   (d) chemical energy to light
7. If a force of F newton moves a body with constant speed v, the power delivered by it is
   (a) F/v (b) Fv (c)F^2v (d)v/F
8. The number of joules contained in 1 kWh is
   (a) 36×10^5 J (b) 3.6×10^7 J
   (c) 36×10^8 J (d) 3.7×10^7 J
9. Which one of the following is not the unit of energy?
   (a) joule (b) newton metre
   (c) kilowatt (d) kilowatt hour
10. When a coil spring is compressed, the work is done on the spring. The potential energy
    (a) increases (b) decreases
    (c) disappears (d) remains unchanged

ASSERTION AND REASONING

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.
(e) Both Assertion and Reason are false.

11. Assertion: Stretched bow has potential energy
    Reason: Catapult has kinetic energy
12. Assertion: Work done by an athlete completing a round of a field is zero
    Reason: The displacement of a body returning back to the initial position is zero
13. Assertion: A kinetic energy of a body is quadrupled, when its velocity is doubled.
    Reason: Kinetic energy is proportional to square of velocity.
14. Assertion: No work is done when a woman carrying a load on her head, walks on a level road with a uniform velocity.
    Reason: No work is done if force is perpendicular to the direction of displacement
15. Assertion: Work done by friction on a body sliding down an inclined plane is positive.
    Reason: Work done is greater than zero, if angle between force and displacement is acute or both are in same direction.

ONE MARK TYPE QUESTIONS

16. State the unit of work.
17. Identify energy possessed by
    i. Rolling stone
    ii. Stretched rubber band
18. A coolie is walking on a railway platform with a load of 30kg on his head. How much work is done by coolie?
19. A 2m high person is holding a 25kg trunk on his head and standing at a roadways bus-terminus. How much work is done by the person?
20. A bag of wheat is dropped from a height h. What energy conversion takes place as it reaches the ground?

TWO MARKS TYPE QUESTIONS

21. Two balls of masses m each are raised to height h and 2h respectively. What will be the ratio of their potential energies?
22. At what speed a body of mass 1kg will have a kinetic energy of 1J?
23. A horse of mass 250kg and a dog of mass 30 kg are running at the same speed. Which of the two possesses more kinetic energy? How?

THREE MARKS TYPE QUESTIONS

24. A man of mass 60kg runs up a flight of 30 steps in 40s. If each step is 20cm high, calculate his power.
25. An electric bulb of 100W works for 4hours a day. Calculate the units of energy consumed in 15 days.
26. Give an example for
    (a) Force acting in the direction of displacement

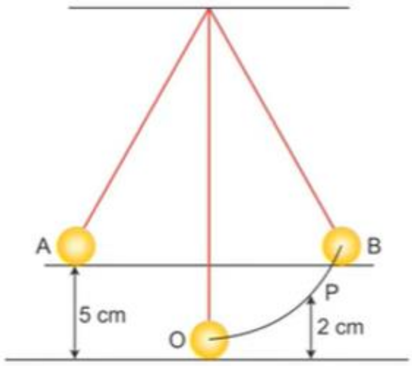
(b) Force acting against the direction of displacement
(c) Force acting perpendicular to the direction of displacement

FIVE MARKS TYPE QUESTIONS

27. (a) Define Kinetic energy and derive the expression for Kinetic energy
(b) The masses of scooter and bike are in the ratio of 2:3, but both are moving with the same speed of 108km/h. Compute the ratio of their kinetic energy
28. (a) Define potential energy. Derive equation for gravitational potential energy
(a) A 5kg ball is thrown upwards with a speed of 10m/s (g=10m/s).
    i) Calculate the maximum height attained by it
    ii) Find the potential energy when it reaches the highest point

CASE STUDY QUESTIONS

29. The following table shows that a simple pendulum consisting of a bob of mass 100gm. Initially the bob of the pendulum is at rest at 'O'. It is then displaced to one side at A. The height of 'A' above 'O' is 5cm. (Take $g=10m/s^2$)



i. What is the value of potential energy of bob at 'A' and where does it come from?
(a) 0.05J (b) 0.5J (c) 0.0005J (d)50J
ii. What is the value of total energy of the bob at position A?
(a) 1J (b) 0.05J (c) 5J (d) 50J
iii. What is the value of kinetic energy of the bob at mean position 'O'?
(a) 10J (b)5 J (c) 0.05J (d) 50J
iv. What is the value of kinetic energy and potential energy of the bob at the position 'P' whose height above 'P' whose height above 'O' is 2cm?
(a) P.E=0.2J and K.E=0.3J (b) P.E=2.0J and K.E =3.0J
(c)P.E = 0.002J and K.E=0.003J (d) P.E =0.02 J and K.E =0.03J
v. What is kinetic energy?
(a) Energy acquired due to motion
(b) Energy acquired due to rest
(c) Sum of potential and mechanical energy
(d) It is the energy stored inside a body

PREVIOUS YEAR BOARD QUESTIONS

30. Define 1J of work CBSE 2012
31. An electric heater is rated 1500W. How much energy does it use in 10 hours? CBSE 2011
32. Differentiate between kW and kWh CBSE 2013

33. A force acting on a 10 kg mass changes its velocity from 54km/h to 90k/h. Calculate the work done by the force CBSE 2016

ANSWERS

1.	(c)1J
2.	(a)9 times (K.E αv^2) v--->3v, K.E--->9K.E
3.	(d) zero (as force and displacement are perpendicular)
4.	(b)27 Cost of electricity = P× t× cost per kW = 0.06kW × (5×30) ×3= Rs27
5.	(c) remains constant
6.	(b) chemical energy to electrical energy and then to heat and light
7.	(b) Fv
8.	(a) 36×10^5 J
9.	(c) kilowatt
10.	(a) increases
11.	(c) Assertion (A) is true but reason (R) is false.
12.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
13.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
14.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
15.	(d) Assertion (A) is false but reason (R) is true.
16.	The SI unit of work is joule
17.	i. kinetic energy ii. potential energy
18.	Zero because angle between force and displacement is 90^0
19.	Zero, because there is no displacement
20.	The energy of wheat bag changes from potential energy to kinetic energy
21.	Both the bodies have same mass. Potential energy of bodies: ∴ (PE)1=mgh and (PE)2=mg(2h) ⇒ (PE)1:(PE)2=1:2
22.	We know that K.E = 1/2 m v^2 Replace K.E i.e kinetic energy by 1 J and mass (m) by 1 kg (given in the question) 1 = 1/2× 1 × v^2 2 = v^2 (take 2 to the other side) v = √2 m/s v = 1.414 m/s
23.	Kinetic energy is directly proportional to mass. Since mass of a horse (250kg) is greater than that of a dog (30kg), the horse has greater kinetic energy for the same speed.
24.	Given m=60kg,t=40s, h=30×20cm =(30×20/100)m Power= W/t=mgh /t=(60×10×30×0.2)/40 = 90W
25.	Given P=100W, t=4 hours

	Energy =Power$\times$ time=P$\times$(no: of days) $\times$(no: of hours) =100$\times$15$\times$4=6000Wh =6kWh=6 units
26.	(a) Horizontal force applied on a table to displace it (b) Frictional force acting on a box which is being shifted (c) Gravitational pull of earth on moon
27.	The energy possessed by a body by virtue of its motion is called kinetic energy. Equation for kinetic energy Consider an object of mass, m moving with a uniform velocity, u. It displaced through a distance, s when a constant force F acts on it in the direction of its displacement Then work done, W = F × s ………….(1) Velocity changes from u to v. Let a be the acceleration produced. $v^2-u^2 = 2as$ ……………..(2) $s = \frac{v^2 - u^2}{2a}$ …………….. (3) We know, F = ma …………….(4) Substituting equations (4) and (3) in (1) Work done by the force , F is $W= ma \times \frac{(v^2 - u^2)}{2a}$ $W=\frac{1}{2}m(v^2 - u^2)$ …………………………….(5) Work done = Change in Kinetic Energy If the object is starting from its stationary position , that is, u=0, then $W= \frac{1}{2} m v^2$ ………………(6) Thus, the kinetic energy possessed by an object of mass, m and moving with a uniform velocity, v is **$E_k= \frac{1}{2} m v^2$** ii) Kinetic energy α Mass of body Let mass of scooter=m_s=2m Mass of bike =m_b=3m Kinetic energy of scooter/Kinetic energy of bike= m_s/m_b= 2m/3m=2:3
28.	The potential energy of an object is the energy possessed by the object due to its position or shape. Equation for Potential energy Consider an object of mass *m* is raised to a height *h* from the ground, the force required to raise the object is equal to the weight of the object . *Force,F = mg* *Work done = Force × displacement* *or W = mg × h = mgh* Potential energy gained by the object **$E_p = mgh$**

	Given, mass of the ball, $m = 5\ kg$ Speed of the ball, $v = 10\ m/s$ (a) Initial kinetic energy of the ball, $E_k = \frac{1}{2}mv^2 = \frac{1}{2}(5)(10)^2 = 250\ J$ When the ball reaches the highest point, its kinetic energy becomes zero and the entire kinetic energy is converted into its potential energy. $\therefore E_p = 250\ J$ (b) If h is the maximum height attained by the ball, $E_p = mgh$ or $mgh = 250\ J$ or $h = \frac{250}{mg} = \frac{250}{(5)(10)} = 5\ m$
29.	i. The work done in raising the bob through a height of 5 cm (against the gravitational attraction) gets stored in the bob in the form of its potential energy. PE=mgh =0.1×10×0.05=0.05J ii. At position A, PE = 0.05 J, KE = 0 So, Total energy = 0.05 J iii. At mean position, potential energy is zero, hence KE at O = 0.05 J iv. PE at P = mgh = 0.1 x 10 x 2 x 10^{-2} = 0.02 J K.E = Total energy – PE = 0.05 – 0.02 = 0.03 J v. (a) Energy acquired due to motion
30.	1 joule is the amount of work done when a force of 1 N displaces an object through 1 metre in the direction of the force applied.
31.	Power= Energy/Time Energy= Power × time = 1500W × 10h =15000Wh= 15kWh
32.	kW is the unit of power and kWh is the unit of energy
33.	m=10kg, u=54km/h, v=90km/h u=15m/s, v=25m/s Work done of an object =change in kinetic energy Work done=1/2m(v^2-u^2) W=5(25^2–15^2) W=5(625–225) =5×400=2000 Work done W=2kJ

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