INDIAN SCHOOL AL WADI AL KABIR

Class: IX	Department: SCIENCE 2020-2021 SUBJECT-PHYSICS	Date of submission: 14.02.2021
Worksheet No:7 **WITH ANSWERS**	**Topic: WORK AND ENERGY**	**Note:** **A4 FILE FORMAT [PORTFOLIO]**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS

1. Which one of the following is not the unit of energy?
   (a) joule (b) newton meter
   (c) kilowatt (d) kilowatt hour
2. The work done on an object does not depend upon the
   (a) displacement (b) force applied
   (c) angle between force and displacement (d) initial velocity of the object
3. Water stored in a dam possesses
   (a) no energy (b) electrical energy
   (c) kinetic energy (d) potential energy
4. 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
5. If speed of a car becomes 2 times, its kinetic energy becomes
   (a) 4 times (b) 8 times
   (c) 16 times (d) 12 times
6. 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
7. Commercial unit of energy is
   (a) joule (b) kWh
   (c) watt (d) newton
8. When a body like earth is moving in a circular path the work done in that case is zero because:
   (a) Centripetal force acts in the direction of motion of the body
   (b) Centripetal force acts along the radius of circular path
   (c) Gravitational force acts perpendicular to the radius of circular path
   (d) Centripetal force acts perpendicular to the radius of circular path
9. 1 Ws = _____
   (a) 10 joules
   (b) 1 joule
   (c) 3.6×10^6 J
   (d) 2 joules
10. In case of negative work the angle between the force and displacement is
    (a) 0° (b) 45°
    (c) 90° (d) 180°

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: A spring has potential energy, both when it is compressed or stretched.
    Reason: In compressing or stretching, work is done on the spring against the restoring force.
12. Assertion: A winded toy car, when placed on floor, starts moving.
    Reason: Toy car has kinetic energy stored in it which facilitates its motion.
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. Write an expression for the work done when a force is acting on an object in the direction of displacement.
17. Identify energy possessed by
    i. Rolling stone
    ii. Stretched rubber band
18. State the law of conservation of energy
19. A coolie is walking on a railway platform with a load of 30kg on his head. How much work is done by coolie?
20. At what rate is electrical energy consumed in a 60W bulb?

TWO MARKS TYPE QUESTIONS

21. Under what conditions is work said to be done?
22. The momentum of a bullet of mass 20 g fired from a gun is 10 kg m/s. What will be the kinetic energy of this bullet in kJ?
23. A man of mass 50 kg jumps to a height of 1 m. Find his potential energy at the highest point. ($g = 10\ m/s^2$)
24. Define power, what is its SI unit?
25. Derive a relationship between kinetic energy and linear momentum.

THREE MARKS TYPE QUESTIONS

26. A body is thrown vertically upwards with a speed u. When does

(a) its potential energy becomes maximum.
(b) Kinetic energy becomes maximum

27. 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
28. Find the ratio of powers of the following two persons
    (a) Person A does a work of 100J in 5 seconds
    (b) Person B does a work of 200J in 6 seconds

FIVE MARKS TYPE QUESTIONS

29. (a) Define Kinetic energy and derive the expression for Kinetic energy
    b) A man weighing 70kg carries a weight of 10 kg to the top of the tower 100m high. Calculate the work done.
30. (a) Define potential energy. Derive equation for gravitational potential energy
    (c) 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

PREVIOUS YEAR BOARD QUESTIONS

31. Define 1J of work CBSE 2012
32. An electric heater is rated 1500W. How much energy does it use in 10 hours? CBSE 2011
33. Differentiate between kW and kWh CBSE 2013
34. 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

QN NO	ANSWER	MARKS
1.	(c) kilowatt	1
2.	(d) initial velocity of the object	1
3.	(d) potential energy	1
4.	(a) 36×10^5 J	1
5.	(a) 4 times	1
6.	(a) increases	1
7.	(b) kWh	1
8.	(b) Centripetal force acts along the radius of circular path	1
9.	(b) 1 joule	1
10.	(d) 180°	1
11.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
12.	(c) Assertion (A) is true but reason (R) is false.	1
13.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
14.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
15.	(d) Assertion (A) is false but reason (R) is true.	1
16.	Work done, W= F×s	
17.	i. kinetic energy ii. potential energy	

18.	The law of conservation of energy states that energy can only be converted from one form into another, it can neither be created nor destroyed. The total energy before and after the transformation remains the same.	1
19.	Zero because angle between force and displacement is 90^0	1
20.	In a 60W bulb, 60J of energy is consumed in each second	1
21.	• A force should act on an object • The object must be displaced	2
22.	**The mass of bullet is 20 g or 0.02 kg.** **The momentum of the bullet is 10 kg · m/s** **The kinetic energy of a body in terms of its momentum is given as:** $\mathbf{KE = \frac{p^2}{2m}}$ $\mathbf{KE = \frac{10 \times 10}{2 \times 0.02}}$ $\mathbf{2500\ J = 2.5\ kJ}$	2
23.	m= 50 kg h = 1m Ep = mgh Ep = 50 X 10 X 1 Ep = 500J Therefore, potential energy is 500J	2
24.	Power is the rate of doing work. SI unit- watt	2
25.	$K.E = 1/2mv^2$ $v^2 = 2K.E/m \ldots\ldots\ldots Eqn(2)$ *From Eqn (1)* $p^2 = (mv)^2 = m^2v^2 \ldots\ldots\ldots Eqn(3)$ *By plugging in the values of v^2 of Eqn(2) in Eqn (3)* $p^2 = m^2(2K.E/m)$ $p^2 = 2mK.E$ $K.E = p^2/2m$	2
26.	a. At the highest point of journey ,the potential energy is maximum b. At the point from where body is thrown the kinetic energy is maximum	3
27.	(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	3
28.	$\frac{P_A}{P_B} = \frac{W_A/t_A}{W_B/t_B} = \frac{W_A}{t_A} \times \frac{t_B}{W_B} = \frac{100}{5} \times \frac{6}{200} = \frac{3}{5}$	3
29	The energy possessed by a body by virtue of its motion is called kinetic energy. <u>Equation for kinetic energy</u> Consider an object of mass, m moving with a uniform velocity,	5

	u. It displaced through a distance, s when a constant force F acts on it in the direction of its displacement Then work done, $W = F \times s$ …….(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 $\mathbf{E_k= \frac{1}{2} m v^2}$ iii. Work done= (mass of man+mass of weight)×g×h =(70+10)×9.8×100=78400J	
30	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 $\boldsymbol{E_p = mgh}$	

	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 $h = \frac{250}{mg} = \frac{250}{(5)(10)} = 5\ m$	5
31.	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.	2
32.	Power= Energy/Time Energy= Power × time = 1500W × 10h =15000Wh= 15kWh	2
33	kW is the unit of power and kWh is the unit of energy	1
34	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	2

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