INDIAN SCHOOL AL WADI AL KABIR		
Class: IX	**DEPARTMENT OF SCIENCE -2022-23** **SUBJECT: PHYSICS**	DATE OF COMPLETION: FEB. 2023
WORKSHEET NO:5 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 a 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

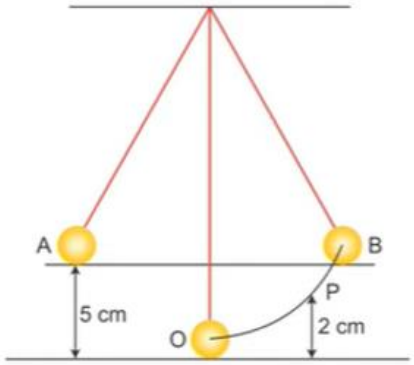
24. A man of mass 60kg runs up a flight of 30 steps in 40s. If each step is 20cm high, calculate his power.
25. An electric bulb of 100W works for 4hours a day. Calculate the units of energy consumed in 15 days.
26. Give an example for
    (a) Force acting in the direction of displacement
    (b) Force 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× time=P×(no: of days) ×(no: of hours) =100×15×4=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, $W = F \times s$ …….(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 **$E_k= \frac{1}{2} m v^2$**

	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. <u>Equation for Potential energy</u> 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

PREVIOUS YEAR BOARD QUESTIONS CONTINUATION

34. What is the work to be done to increase the velocity of a car from 30 km/h to 60 km/h. If mass of the car is 1500 kg.

Solution: Mass of car, m = 1500 kg. Initial velocity, u = 30 km/h = 8.33 m/s. Final velocity, v = 60 km/h = 16.67 m/s.
Work done = change in K.E = 750 x 208.5 =$_=$ 156375 J. 5 J

35. A body of mass 10 kg is kept at a height 10 m from the ground, when it is released after sometime its kinetic energy becomes 450 J. What will be the potential energy of the body at the instant ?[g = 10m/s^2]

Solution: At a height of 10 m.

E = 0+mgh =10 × 10 × 10 = 1000 J.

After sometime the kinetic energy is 450 J.

E = 450 + U

1000 = 450 + U or U = 1000 – 450$\Rightarrow$ U = 550 J.

36. If the stone is thrown up vertically and return to ground, its potential energy is maximum.

a. during the upward journey b. at the maximum height c. during the return journey d. at the bottom

[b]

(b) Potential energy = mgh Potential energy is maximum when h is maximum.

37. Two bodies of masses 1 kg and 5 kg are dropped gently from the top of a tower. At a point 20 cm from the ground, both the bodies will have the same:

a. Momentum b. Kinetic energy c. Velocity d. Total energy

(c) Velocity of fall is independent of the mass of the falling body.

38. Which of the following is a scalar quantity?

a. Displacement b. momentum c. Acceleration d. Work

[d]Work

39. A body of mass 10 kg is dropped to the ground from a height of 10 metres. The work done by the gravitational force is:

a. – 490 Joules b. + 490 Joules c. – 980 Joules d. + 980 Joules

(d) As the body moves in the direction of force therefore work done by gravitational force will be positive. W Fs mgh J

40. A man pushes a wall and fails to displace it. He does a. negative work b. positive but not maximum work c. no work at all d. maximum work

(c) No displacement is there.

41. Which of the following is not the unit of power? a. J/s b. Watt c. kJ/h d. kWh

[d]

42. A weight lifter lifts 240 kg from the ground to a height of 2.5 m in 3 seconds his average power is: a. 1960 W b. 19.6 W c. 1.96 W d. 196 W

(a) 1960 W

43. A raised hummer possess : a. kinetic energy only b. gravitational potential energy c. electrical energy d. sound energy

[b]

44. The value of g on moon 1/6th of the value of g on the earth. A man can jump 1.5 m high on the earth. On moon he can jump up to a height of:

a. 9 m b. 7.5 m c. 6 m d. 4.5 m

26. (a) $v^2 = u^2 + 2gh$

$\Rightarrow \quad \frac{h_m}{h_e} = \frac{g_e}{g_m}$

$\Rightarrow \quad h_m = h_e \times \frac{g}{\frac{1}{6}g} \quad 1.5 \quad 6 = 9m$

45. The potential energy of a freely falling object decreases continuously. What happens to the loss of potential energy?

46. The kinetic energy of an object is K. If its velocity is doubled than its kinetic energy will be: a. K b. 2K c. 2 K d. 4K

(d) $K \cdot E = \frac{1}{2}mv^2$

$(K \cdot E)_{New} = 4(K \cdot E) \Rightarrow v_{New} = 2v$

ASSERTION AND REASONING

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
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(d) Assertion (A) is false but reason (R) is true.

Q.1. Assertion : Work done by or against gravitational force in moving a body from one point to another is independent of the actual path followed between the two points.
Reason : Gravitational forces are conservative forces.

Answer: (c)

Q.2. Assertion : The work done during a round trip is not zero.
Reason : No force is required to move a body in its round trip.

Answer: (d)

Q.3. Assertion : Work done by the gravitational force through a certain distance is constant irrespective of the fact that the body has a uniform or accelerated motion.
Reason : Gravitational force is a conservative force.

Answer: (b)

Q.4. Assertion : The kinetic energy, with any reference, must be positive.
Reason : In the expression for kinetic energy, the velocity appears with power 2 and mass is a scalar quantity.

Answer: (a)

Q.5. Assertion : A crane P lifts a car upto a certain height in 1 min. Another crane Q lifts the same car upto the same height in 2 min. Then crane P consumes two times more fuel than crane Q.
Reason : Crane P supplies two times more power than crane Q.

Answer: (a)

Q.6. Assertion : According to law of conservation of mechanical energy, change in potential energy is equal and opposite to the change in kinetic energy.
Reason : Mechanical energy is not a conserved quantity.

Answer: (c)

Q.7. Assertion : A winded toy car, when placed on floor, starts moving.
Reason : Toy car has kinetic energy stored in it which facilitates its motion.

Answer: (c)

Q.8.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.

Answer: (a)

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