IIT & AIIMS Foundation Course

EXERCISE

Multiple Choice Questions

1. No work is done when
(a) a nail is plugged into a wooden board
(b) a box is pushed along a horizontal floor(c) there is no component of force parallel to the direction of motion
(d) there is no component of force normal to the direction of force

2. 1 kW h is equal to
(a) $3.6\,J$ (b) $3.6\,KJ$
(c) $3.6\,MJ$ (d) $36\,J$

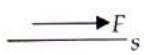
3. A body of mass 1 kg has a kinetic energy of $1J$ when its speed is
(a) $0.45ms^{-1}$ (b) $1\,ms^{-1}$
(c) $1.4ms^{-1}$ (d) $4.4\,ms^{-1}$

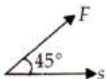
4. The unit of work is joule. The other physical quantity that has same unit is
(a) Power (b) Velocity
(c) Energy (d) Force

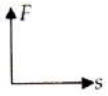
5. In which case work is not done
(a) a girl swimming in a pond
(b) windmill lifting water from a well
(c) a standing man holding a suit case in his hand
(d) a sail boat moving in the direction of wind.

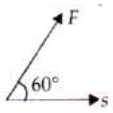
6. An electric motor creates a tension of 4500 N in hoisting a cable and reels it at a rate of $2m^{s-1}$. The power of the motor is
(a) 25 $25kW$ (b) $9kW$
(c) $225kW$ (d) $90kW$

7. In which of the following cases is work done maximum

(a) 

(b) 

(c) 

(d) 

8. The work done by a weight of 1 kg mass when it moves up through 1 m is
(a) $10\,J$ (b) $-10\,J$
(c) $0.1J$ (d) $-0.1J$

9. A man carries a suitcase in his hand climbs up the stairs. The work done by the man is
(a) Positive (b) negative
(c) zero (d) none of the above

10. A total of 4900 joules were consumed in lifting a 50 kg mass. The mass was raised to a height of
(a) 10 m (b) 960 m
(c) 98 m (d) 245,000 m

11. The work done in holding 15 kg suitcase while waiting for a bus for 45 minutes is
(a) $675\,J$ (b) $40500\,J$
(c) $4500\,J$ (d) zero

12. If Rahul has done the same amount of work in less time compared to Rohan then
(a) Rahul has more power
(b) Rohan has more power
(c) both Rahul and Rohan have equal power
(d) Rahul has more energy than Rohan

13. Which of the following is not an example of potential energy?
(a) water stored in a dam
(b) a stretched bow and arrow system
(c) a dog chasing a hare
(d) a stone lying on the top of a roof

14. Chlorophyll in plants converts light energy into
(a) heat energy (b) chemical energy
(c) mechanical energy (d) electric energy

15. In a factory due to a sudden strike the work usually done in a day took a longer time. Then
(a) power increases (b) power decreases
(c) energy increases (d) energy decreases

16. When the momentum of a body is increased by 100%, its K.E. increases by
(a) 100% (b) 200%
(c) 300% (d) 400%

17. A person pulls a body on a horizontal surface by applying a force of 5.0 N at an angle of 30° with the horizontal. Find the work done by this force in displacing the body through 2.0 m.
(a) $5\sqrt{3}\ J$ (b) $6\sqrt{2}\ J$
(c) $7\sqrt{3}\ J$ (d) $4\sqrt{3}\ J$

18. A certain household consumes 250 units of electric energy in a month. The energy consumed in mega joule is
(a) $900\,MJ$ (b) $750\,KJ$
(c) $2250\,MJ$ (d) $1750\,KJ$

19. The power of a pump which takes 10 s to lift 100 kg of water tank situated at a height of 20 m is
(a) $2\times10^{4}\,W$ (b) $2\times10^{3}\,W$
(c) $200W$ (d) $1kW$

20. When the speed of a particle is doubled, the ratio of its kinetic energy to its momentum
(a) remains the same
(b) gets doubled
(c) becomes half
(d) becomes four times

21. When you compress a coil spring you do work on it. The elastic potential energy
(a) increases (b) decreases
(c) disappears
(d) remains unchanged

22. An iron sphere of mass 30 kg has the same diameter as an aluminum sphere whose mass is 10.5 kg. The spheres are dropped simultaneously from a cliff. When they are 10 m from the ground, they have the same
(a) acceleration (b) momentum
(c) potential energy (d) kinetic energy

23. Two boys A and B lift 100 bricks through the same height in 5 minutes and 6 minutes respectively.
(a) A has more power than B
(b) B has more power than A
(c) both have same power
(d) none of the above

24. A rocket rises up vertically. What happens to its potential energy?
(a) it increases
(b) it initially increases then decreases
(c) it initially decreases then increases
(d) it increases, till it becomes maximum

25. 1 watt is equal to
(a) $J\,s^{-1}$ (b) $J\,s$
(c) $J\,s^{-2}$ (d) $N\,s^{-2}$

26. In an electric flashlight the chemical energy of the cell is
(a) converted into heat energy only
(b) converted into light energy only
(c) converted first into light and then heat energy
(d) converted first into heat and then light energy

27. The speed of a particle is doubled. Its kinetic energy
(a) remains the same
(b) becomes two times
(c) becomes half
(d) becomes four times

28. A body of mass 2 kg is projected vertically upwards with a speed of 3 ms^{-1}. The maximum gravitational potential energy of the body is
(a) $18\,J$ (b) $4.5\,J$
(c) $9\,J$ (d) $2.25\,J$

29. A student carries a bag weighing 5 kg from the ground floor to his class on the first floor that is 2 m high. The work done by the boy is
(a) $1\,J$ (b) $10\,J$
(c) $100\,J$ (d) $1000\,J$

30. An engine develops a power of 10 kW. How much time will it take to lift a mass of 200 kg to a height of 40 m? $(g = 10\,m\,s^{-2})$
(a) $4\,s$ (b) $5\,s$
(c) $8\,s$ (d) $10\,s$

31. When a force retards the motion of a body, The work done is
(a) positive (b) zero
(c) negative (d) undefined

32. The work done is zero if
(a) The body shows displacement in the opposite direction of the force applied.
(b) The body shows displacement in the same direction as that of the force applied.
(c) The body shows a displacement in perpendicular direction to the force applied.
(d) The body moves obliquely to the direction of the force applied.

33. A nail becomes hot when hammered in a plank
(a) the potential energy of hammer changes into heat energy
(b) the kinetic energy of the hammer changes into heat energy
(c) the force of friction changes into heat energy
(d) none of the above

34. What should be the angle between the force and displacement for maximum work?
(a) 0° (b) 30°
(c) 60° (d) 90°

35. Two bodies have their masses $m_1 / m_2 = 3$ and their kinetic energies $\frac{K.E_1}{K.E_2} = \frac{1}{3}$ The ratio their velocities are
(a) 1 : 1 (b) 1 : 2
(c) 1 : 3 (d) 2 : 3

36. A locomotive exerts a force of 7500 N and Pulls a train by 1.5 km. The work done by the locomotive in mega joule is
(a) 12.25 MJ (b) 11.25 MJ

(c) 10.75 MJ (d) 11.50 MJ

37. An object of mass m is moving with a constant velocity v. The work done on the object to bring it to rest is

(a) $m\upsilon^2$ (b) $\frac{1}{2}m\upsilon^2$

(c) $m\upsilon$ (d) $\frac{m^2\upsilon}{2}$

38. If force and displacement of the particle (in direction of force) are doubled. Work should be

(a) doubled (b) 4 times

(c) halved (d) 1/4 times

39. Which of the following statements is correct regarding the relation between centripetal force and radius of the circular path?

(a) The work done by the centripetal force increases if the radius of the path is increased

(b) The work done by the centripetal force decreases by decreasing the radius

(c) The work done by the centripetal force increases by decreasing the radius

(d) The work done is always zero

40. A body rolls down on an inclined plane, it has

(a) only kinetic energy

(b) only potential energy

(c) both kinetic energy and potential energy

(d) neither kinetic energy nor potential energy

41. In which of the following case is the potential energy of a spring minimum?

(a) When it is compressed

(b) When it is extended

(c) When it is at its natural length

(d) When it is at its natural length but is kept at a height h above the ground

42. The work done by the weight of a 1 kg mass while it moves up through 1 m is

(a) $9.8\,J$ (b) $-9.8\,J$

(c) $\frac{1}{9.8}J$ (d) $-\frac{1}{9.8}J$

43. A photocell converts light energy into

(a) photon energy (b) electrical energy

(c) magnetic energy (d) heat energy

44. A particle of mass 100 g moves at a speed of $1 m\,s^{-1}$. Its kinetic energy

(a) $50\,J$ (b) $5\,J$

(c) $0.5\,J$ (d) $0.05\,J$

45. A uniform force of 4 N acts on a body of mass 8 kg for a distance of 2.0 m. The K.E. acquired by the body is

(a) $8\,J$ (b) $64\,J$

(c) $4\,J$ (d) $16\,J$

46. A car weighing 500 kg working against resistance of 500 N, accelerates from rest to $20 m\,s^{-1}$ in 100 m.

(a) $1.0\times10^5\,J$

(b) $1.5\times10^5\,J$

(c) 1.05 x 105 $1.05\times10^5\,J$ J

(d) Data is insufficient

47. A man of weight 60 kg wt. takes a body of Mass 15 kg at a height 10 m on a building in 3 minutes.

The efficiency of man is

(a) 10% (b) 20%

(c) 30% (d) 40%

48. A boy has four options to move a body through 3 m as indicated. In which case is maximum work done?

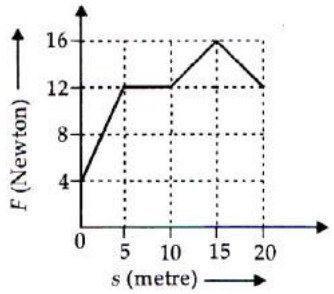
(a) Push over an inclined plane

(b) lift vertically upwards

(c) Push over smooth rollers

(d) Push on a plane horizontal surface

49. Figure shows the frictional force versus displacement for a particle in motion. The loss of kinetic energy (work done against friction) in travelling over $s = 0$ to $s = 20$ m will be



(a) $18\,J$ (b) $160\,J$

(c) $240\,J$ (d) $24\,J$

50. A boy pulls up a bucket of water from a well 80 m deep. If the mass of the bucket along with water is 20 kg, the amount of work done by he boy is

(a) 16, 0000 J (b) 20, 000 J

(c) 16,000 J (d) 20, 0000 J

51. Work done is always

(a) scalar quantity (b) vector quantity

(c) positive (d) negative

52. A hammer of mass 1 kg falls freely on a nail from a height of 1 m. The kinetic energy of hammer, just before hitting the nail is $[g = 10 m s^{-2}]$

(a) $1\,J$ (b) $5\,J$ (c) $10\,J$ (d) $4\,J$

53. An object of mass 1 kg has a potential energy of 1 joule relative to the ground when it is at a height of
(a) 0.102 m (b) 1 m
(c) 9.8 m (d) 32 m

54. A 1 kg mass has a kinetic energy of 1 joule when its speed is
(a) $0.45 ms^{-1}$ (b) $1 ms^{-1}$
(c) $1.4 ms^{-1}$ (d) $4.4 ms^{-1}$

55. A body is allowed to roll down a hill/ it will have
(a) only K.E. (b) only RE
(c) both (a) and (b) (d) data is insufficient

56. An object of mass 40 kg is raised to a height of 8 m above the ground. The gain in potential energy by the object $(g = 10 ms^{-2})$
(a) $200 J$ (b) $3200 J$
(c) $1500 J$ (d) $1000 J$

57. The speed of a motor bike decreases by 4 times Its kinetic energy will decrease by
(a) four times (b) eight times
(c) sixteen times (d) thirty two times

58. Energy possessed by a body on account of its motion is called
(a) mechanical energy (b) potential energy
(c) kinetic energy (d) magnetic energy

59. A stone is placed on the .top of a building of height h. Its potential energy is directly proportional to its
(a) mass
(b) height
(c) acceleration due to gravity
(d) all the above

60. When the speed of a particle is increased 3 times, its kinetic energy
(a) increases 3 times (b) remains same
(c) increases 9 times (d) decreases to 1/3

61. In which case work is done
(a) a green plant carrying out photosynthesis
(b) a porter standing at a place and carry heavy load on his head
(c) drying of food grains in sun
(d) a trolley rolling down a slope

62. The work done by an electric drill rated 50 W in 30 s is
(a) $1200 J$ (b) $600 J$
(c) $900 J$ (d) $1500 J$

63. A stone is thrown up vertically. What happens to its P.E. during its motion during its upward journey?
(a) Decreases
(b) Increase till it becomes maximum
(c) First decreases and then increases
(d) First increases and then decreases

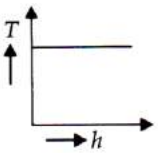
64. A body falling from a height of 10 m rebounds from a hard floor. It loses 20% of energy in the impact. What is the height to which it would rise after the impact?
(a) $7 m$ (b) $5 m$
(c) $8 m$ (d) $6 m$

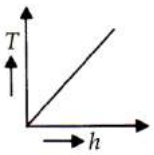
65. A lorry and a car with the same kinetic energy are brought to rest by the application of brakes which provide equal retarding forces. Which of them will come to rest in a shorter distance?
(a) Lorry (b) Car
(c) Both will stop at the same distance
(d) None of these

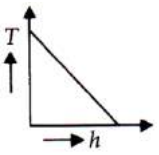
66. The units N s are equivalent to
(a) J (b) $kg\, m\, s^{-1}$
(c) $kg\, m\, s^{-2}$ (d) $N\, m\, s^{-1}$

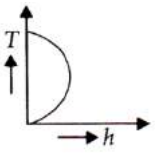
67. One kilowatt is approximately equal to
(a) 1.30 h.p (b) 1.56 h.p
(c) 2.50 h.p (d) 1.83 h.p

68. Which of the following graph best represents the total energy (T) of a freely falling body and its height (h) above the ground?

(a) 

(b) 

(c) 

(d) 

69. Watt sec represents the unit of
(a) energy (b) power
(c) force (d) none of these

70. When the time taken to complete a given amount of work increases, then
(a) power increases
(b) energy increases
(c) power decreases
(d) energy decreases

71. The momentum of a body is doubled. What is the percentage increase in kinetic energy?
(a) 500% (b) 300%
(c) 200% (d) 600%

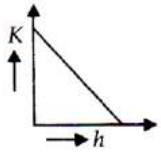
72. In a hydroelectric dam the potential energy of water directly changes to
(a) electric energy only
(b) kinetic energy only
(c) first kinetic energy and then electric energy
(d) first electric energy and then kinetic energy

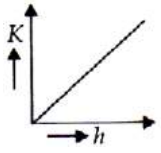
73. If a body is raised through height h on the surface of earth and the energy spent is E, then for the same amount of energy the body on the' surface of moon will rise through the height of
(a) $2h$ (b) $6h$
(c) $4h$ (d) $12h$

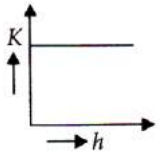
74. Asha lift a doll from the floor and places it on a table. If the weight of the doll is known, what else does one need to know in order to calculate the work Asha has done on the doll?
(a) The time required (b) Mass of the ball
(c) Height of the table
(d) Cost of the doll or the table

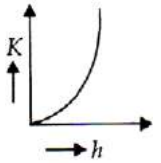
75. The moon revolves around the earth because the earth exerts a radial force on the moon. Does the earth perform work on the moon?
(a) No
(b) Yes, always
(c) Yes, sometimes
(d) cannot be decided

76. Which of the following graph best represents the kinetic energy (K.E) of a freely falling body and its height h above the ground?

(a) 

(b) 

(c) 

(d) 

77. One joule work is said to be done when a force of one Newton acts through a distance of
(a) $1cm$ (b) $1mm$
(c) $1m$ (d) $1km$

78. A rocket rises up in the air due to the force generated by the fuel. The work done by the
(a) fuel is negative work and that of force of gravity is positive work
(b) fuel is positive work and that of force of gravity is negative work
(c) both fuel and force of gravity do positive work
(d) both fuel and force of gravity do negative work.

79. A ball is thrown upward from a point, reaches to the highest point Q
(a) kinetic energy at P is equal to kinetic energy Q
(b) potential energy at P is equal to kinetic energy at Q
(c) kinetic energy at P equal to potential energy at Q
(d) potential energy at P is equal to potential energy at Q

80. A boy lifts a book of known weight from the surface of a table and then keeps it back. To calculate the work done, he needs to know
(a) the mass of the book
(b) the height
(c) the cost of the book
(d) the time taken by him

81. A steam engine has an efficiency of 20%. It is given an energy of 1000 cal. per minute. What is the actual work done by it in joule and in calories?
(a) $100cal, 800J$ (b) $200cal, 873J$
(c) $10cal, 80J$ (d) $100cal, 100J$

82. A stretched spring possesses
(a) kinetic energy
(b) elastic potential energy
(c) electrical energy
(d) magnetic energy

83. The mass of a ball A is twice the mass of another ball B. The ball A moves at half the speed of the ball B. The ratio of the kinetic energy of A to that of B is
(a) $\frac{3}{2}$ (b) $\frac{1}{2}$
(c) $\frac{5}{2}$ (d) $\frac{4}{2}$

84. The kinetic energy of an object of mass m, moving with a velocity of $5ms^{-1}$ is $25J$. If the velocity is increased by three times, the kinetic energy is
(a) $100J$ (b) $225J$
(c) $400J$ (d) $180J$

85. A rocket of mass $3\times10^{6}kg$ takes off from a launching pad and acquires a vertical velocity

of 1 kms^{-1} at an altitude of 25 km. The potential energy of the rocket is $(g = 10 ms^{-2})$

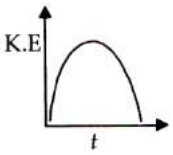
(a) $7.5 \times 10^{11} J$

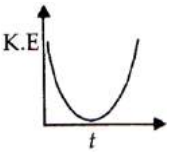
(b) $2.5 \times 10^{11} J$

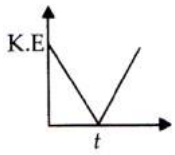
(c) $7.5 \times 10^{10} J$

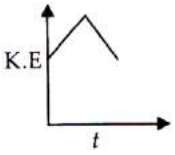
(d) $5.5 \times 10^{11} J$

86. A cricket ball is projected vertically upward such that it returns back to the thrower. The Variation in kinetic energy with time is best represented by

(a) 

(b) 

(c) 

(d) 

87. The work done by a body is directly proportional to

(a) force acting on the body

(b) displacement produced in the body

(c) mass of the body

(d) both (a) and (b)

88. A large box is taken to a height of 8 m, when energy spent is $64,000 J$. The mass of the box is $(g = 10 ms^{-2})$

(a) 400 kg (b) 800 kg

(c) 700 kg (d) 1600 kg

89. Which one of the following is not the measure of energy

(a) kWh (b) erg

(c) Ws (d) Js

90. An aeroplane flying at a height of 20,000 m at a speed of 300 km h^{-1} has

(a) only potential energy

(b) only kinetic energy

(c) both, potential and kinetic energy

(d) none of the above

FILL IN THE BLANKS

1. A stone is tied to a string and whirled in a circular path. The work done by the stone is

2. When a torch is switched on, the..... energy of the batteries is converted into heat energy and then light energy.

3. Water stored in an overhead tank possesses ..... energy.

4. The negative work means that the..... opposes the motion of the body.

5. When a body moves in a circular path, work done on it is .....

6. Kilowatt hour is the unit of.....

7. Power is a..... quantity.

8. 1 hp is equal to..... kW.

9. A body can have.....without momentum.

10. 1 kg mass has a K.E. of 1 J when its speed is

11. Efficiency is the ratio of output power to the

12. 1 erg is..... joule.

13. Heat energy is present in a body in the form of..... of constituent particles.

14. A compressed spring has..... potential energy than the potential energy which it has at the natural length.

15. Chemical energy of petrol or diesel is transformed in to..... energy to run automobiles.

16. If velocity of a body is twice of previous velocity, then kinetic energy will become ..... times.

17. If the K.E. of a body is increased by 300%, its momentum will increase by .....

18. If the angle between force F and displacement is 60°, then the work done is ..... If you apply 1 J of energy to lift a book 0.5 kg, it will rise up to ..... m

TRUE OR FALSE

1. When a body falls, its kinetic energy remains constant.

2. Work and energy have different units.

3. The potential energy of a spring increases when it is extended and decreases when it is compressed.

4. When negative work is done by external forces on a system, the energy of the system decreases.

5. When an aeroplane takes off, the work done by its weight is positive.

6. In an electromagnet, electric energy changes in to magnetic energy.

7. One kilowatt hour is commonly referred as one unit of electricity.

8. Kinetic energy is the energy possessed by a body by virtue of its position.

9. A rubber band has more potential energy when wrapped around a packet than when it was lying unused.

10. Energy can neither be created, nor be transferred.

11. A force does no work, if it produces no motion.

12. The unit of work is watt.

13. When a body falls on the ground and stops, The principle of conservation of energy is violated.

14. Energy stored in the spring of a watch is Kinetic energy.

15. Work done by centripetal force is zero.

16. When an arrow is released from a bow, potential energy changes in the kinetic energy.

17. In order to get maximum work, the angle between force and displacement should be 90°.

18. Work done by a force depends upon how fast work is done.

Matrix Match Type

In this section each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in Column-I have to be matched with statements (p, a, r, s) in Column-II.

1.

Column-I	**Column-II**
(A) Kinetic energy	(p) mgh
(B) Power	(q) $\frac{1}{2}m\upsilon^2$
(C) Potential energy	(r) $m\upsilon$
(D) Momentum	(s) W/t

2.

Column-I	**Column-II**
(A) Potential energy to sound energy	(p) A cracker bursts
(B) Chemical energy to heat, light and sound energy	(q) A duster falling from a table.
(C) Kinetic energy to sound energy	(r) A container filled with marbles is shaken.
(D) Kinetic energy to heat energy	(s) Rubbing of hands

3.

Column-I	**Column-II**
(A) Joule	(p) Power
(B) Watt	(q) 1 h.p
(C) $1KW\,h$	(r) Energy
(D) $746W$	(s) $3.6\times10^6\,J$

4.

Column-I	**Column-II**
(A) Mass of 1 kg, pulled through 1 m horizontally, force applied 8 N	(p) Work done $=0$
(B) Suitcase on head, person moves upstairs	(q)Workdone$=mgh\,J$
(C) No component of force in the direction of motion	(r) $Fs\cos\theta$
(D) Work done	(s) Work done$=8]$

5.

Column I	**Column II**
(A) Force	(p) $kg\,m^2s^{-2}$
(B) Work	(q) $kg\,m\,s^{-2}$
(C) Momentum	(r) $kg\,m^2s^{-3}$
(D) Power	(s) $kg\,m\,s^{-2}$

ASSERTION & REASON QUESTIONS

Directions: In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(c) If assertion is true but reason is false

(d) If assertion is false but reason is true.

1. **Assertion:** A crane P lifts a car up to a certain height in 1 min. Another crane Q lifts the same car up to 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.

2. **Assertion:** The kinetic energy, with any reference, must be positive.

Reason: It is because, in the expression for kinetic energy, the velocity appears with power 2 and mass is a scalar quantity.

3. **Assertion:** The rate of doing work is called power.

Reason: Power is a scalar quantity.

4. **Assertion:** Two bodies of equal masses moves with the uniform velocities υ and 3υ respectively.
Reason: The ratio of their kinetic energy be 1 : 4.

5. **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.

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.

7. **Assertion:** The kinetic energy of a body is quadrupled, when its velocity is doubled.
Reason: Kinetic energy is proportional to square of velocity.

8. **Assertion:** Graph between potential energy of a spring versus the extension or compression of the spring is a straight line.
Reason: Potential energy of a stretched or compressed spring, is directly proportional to square of extension or compression.

9. **Assertion:** The work done during a round trip is always zero.
Reason: No force is required to move a body in its round trip.

10. **Assertion:** The change in kinetic energy of a particle is equal to the work done on it by the net force.
Reason: Change in kinetic energy of particle is equal to the work done only in case of a system of one particle.

11. **Assertion:** Soft steel can be made red hot by continued hammering on it, but hard steel cannot.
Reason: Energy transfer in case of soft Iron is large as in hard steel.

12. **Assertion:** When the force retards the motion of a body, the work done is zero.
Reason: Work done depends on angle between force and displacement.

13. **Assertion:** The power of a pump which raises 100 kg of water in 10 sec to a height of 100 m is 10 kW.
Reason: The practical unit of power is horse power.

14. **Assertion:** A light body and heavy body have same momentum. Then they also have same kinetic energy.
Reason: Kinetic energy depend on mass of the body.

15. **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.