Work, Energy and Power

1. **Assertion (A):** Work done by conservative force along closed path is zero.
   Reason (R): When an object is moved along closed path beginning and ending are at same point its displacement is zero.
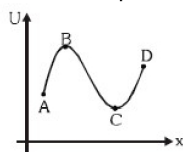   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** A body with negative energy cannot have linear momentum.
   Reason (R): Magnitude of linear momentum can be negative.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. **Assertion (A):** The potential energy of a particle varies with distance x as shown in the graph. The force acting on the particle is zero at point B and C.

   Reason (R): The slope of the U–x curve is zero at point B and C.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** When a non–conservative force is involved in a system, it may dissipate energy.
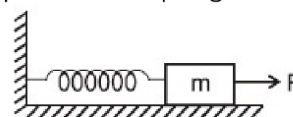   **Reason (R):** The work done by a non–conservative force is always negative.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** The sum of potential and kinetic energy for a system of moving objects is conserved only when no net external force acts on the objects
   Reason (R): If no nonconservative force acts on a system of objects, the work done by external forces on a system of objects is equal to change in potential energy plus change in kinetic energy of the system.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** One end of ideal massless spring is connected to fixed vertical wall and other end to a block of mass m initially at rest on smooth horizontal surface. The spring is initially in natural length. Now a horizontal force F acts on block as shown. Then the maximum extension in spring is equal to maximum compression in spring.

   Reason (R): To compress and to expand an ideal unstretched spring by equal amount, different work is to be done on spring.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7. **Assertion (A):** An athlete accelerates from rest to its maximum speed due to friction between his shoes and track.
   Reason (R): Positive work done by frictional force increases the kinetic energy of athlete.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

8. **Assertion (A):** Net work done by all the internal force of a system is independent of choice of reference frame.
Reason (R): Value of force is independent of choice of reference frame.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** Work done by a force is always same in all inertial frame of references.
Reason (R): Work is an invariant physical quantity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** Total energy is negative for a bounded system.
Reason (R): Potential energy of a bound system is negative and its magnitude is more than kinetic energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Work done by frictional force may be sometimes path independent.
Reason (R): Frictional force is a non-conservative force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** Work done is positive when force acts in the direction of displacement.
Reason (R): Work done by frictional force can not be positive.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** The work done by a non-conservative force is always negative.
Reason (R): When a non-conservative force is involved in a system, it always dissipates energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** A particle is rotated in a vertical circle with the help of a string. Work done by tension in the string on particle is zero.
Reason (R): Tension is always perpendicular to instantaneous velocity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** Two balls of different masses are thrown vertically upwards with same speed. They will pass through their point of projection in the downward direction with the same speed in absence of air resistance.
Reason (R): In absence of air resistance, the mechanical energy of a projectile is conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** The work done by external agent in bringing (slowly) a body down from the top to the base along a frictionless inclined plane is the same as the work done by external agent in slowly bringing it down along the vertical side.
Reason (R): The gravitational force on the body along the inclined plane is the same as that along the vertical side.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** A particle is projected vertically upwards then as it ascends, its kinetic energy decreases uniformly with distance.
Reason (R): Its speed decreases uniformly with time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** Work done by all external forces on a system of particles is equal to change in kinetic energy of the system.
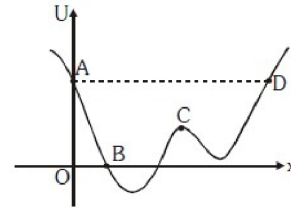**Reason (R):** Work done by a force has different dimensions from kinetic energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** Magnitude of linear momentum cannot be negative.
Reason (R): A body with negative energy cannot have linear momentum.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** For an object in a conservative force field moving along x−axis, the potential energy of the system is shown in figure. The speed of the object will be same at points A and D.

Reason (R): For internal conservative forces, work done by internal forces is equal to minus of change in potential energy i.e. $W_{int} = -\Delta U$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** If in a round trip work done by a force is zero then force is conservative.
Reason (R): Work done by conservative force field is independent of path.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** Karnam Malleshwari famous Indian weight lifter lifts a weight up and returns it to same initial position along the same path. Net work done by muscles of weight lifter is positive.
Reason (R): Net displacement of weight is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** The mechanical energy of earth–moon system remains same when a heavenly body passes nearby the earth–moon system.
Reason (R): Force exerted by heavenly body on the earth–moon system is non-conservative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** A body cannot have kinetic energy without having linear momentum but it can have momentum without having mechanical energy.
Reason (R): Linear momentum and energy have same dimensions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** A spring has potential energy, both when it is compressed or elongated.
Reason (R): In compressing or stretching, work is done on the spring against the restoring force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** There is no term like instantaneous work similar to instantaneous velocity.
Reason (R): For work to be done, the force must act for a displacement.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** A man of mass m, standing on a frictionless surface pushes a wall and acquires a velocity v_0. The work done by the wall on the man is non-zero.
Reason (R): Work done by all the forces is equal to change in kinetic energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Power delivered by all forces acting on a particle moving in a uniform circular motion is always zero.
Reason (R): Work done by all forces acting on a particle moving in a uniform circular motion is zero as KE remains constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** Comets move around the sun in elliptical orbits. The gravitational force on the comet due to sun is not normal to the comet's velocity but the work done by the gravitation force over every complete orbit of the comet is zero.

Reason (R): Gravitational force is a conservative force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** Work done by or against force of friction in moving a body in any round trip is always zero.

Reason (R): Frictional force is a conservative force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** No work is done when an electron completes a circular or an elliptical orbit around the stationary nucleus of an atom.
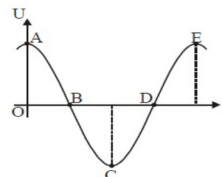
Reason (R): Electrostatic force is a conservative force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** A man carrying a load on his head and walking with uniform velocity on a street does not work against gravity.

Reason (R): When a body moves with uniform velocity, work done by all forces on this body is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** The potential energy of a particle varies with distance x as shown in figure.

The force acting on the particle is zero at points C and E.

Reason (R): Conservative force f(x) associated with potential energy U(x) is related with U(x) as $F = -\dfrac{dU(x)}{dx}$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** The kinetic energy of a particle continuously increases with time if the resultant force on the particle must be at an angle less than 90° to the velocity at all instants.

Reason (R): The work done by the external forces on a system equals to change in total energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** The work done by the net force on a particle during non-uniform circular motion is not equal to zero.

Reason (R): In case of non-uniform circular motion net force and elementary displacement are not perpendicular to each other.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

36. **Assertion (A):** Kinetic energy of a system can be increased without applying any external force on the system.

**Reason (R):** If external forces are absent then work done by internal forces is equal to change in kinetic energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

37. **Assertion (A):** If a spring is compressed, energy is stored in spring and when it is elongated, energy is released.

Reason (R): Work done by spring force is equal to change in potential energy of the spring.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

38. **Assertion (A):** Work done by gravitational force on a block for moving P to A and Q to A are equal.
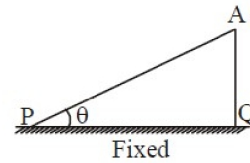
Reason (R): Potential energy is defined for gravitational force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

39. **Assertion (A):** Frictional forces are conservative forces.

Reason (R): Potential energy can be associated with frictional forces.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	4	1	3	1	4	3	2	4	1	4	3	4	1	1	3	2	4	3	1
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	
Ans.	4	2	4	3	1	1	4	1	1	4	1	2	1	2	1	1	3	2	4	