CBSE

WORK AND ENERGY WS 1

Class 09 - Science

Section A

1. **Assertion (A):** 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. **[1]**

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

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

2. **Assertion (A):** When the force retards the motion of a body, the work done is negative. **[1]**

   Reason (R): Work done depends on the angle between force and displacement.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

3. **Assertion (A):** 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. **[1]**

   Reason (R): Gravitational forces are conservative forces.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

4. **Assertion (A):** A spring has potential energy, both when it is compressed or stretched. **[1]**

   Reason (R): In compressing or stretching, work is done on the spring against the restoring force.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

5. **Assertion (A):** No work is done when a woman carrying a load on her head, walks on a level road with a uniform velocity. **[1]**

   Reason (R): No work is done if force is perpendicular to the direction of displacement.

   a) Both A and R are true and R is the correct explanation of A.
   b) Both A and R are true but R is not the correct explanation of A.
   c) A is true but R is false.
   d) A is false but R is true.

6. Match the following columns with the correct response. **[1]**

Column A	Column B

(1) Kinetic energy	(A) Energy due to position
(2) Potential energy	(B) The rate of doing work
(3) Work	(C) Force displaces an object in the direction of force
(4) Power	(D) Energy due to motion

a) 1-B, 2-D, 3-A, 4-C
b) 1-C, 2-B, 3-D, 4-A
c) 1-D, 2-A, 3-C, 4-B
d) 1-A, 2-C, 3-B, 4-D

Section B

7. Match the following Column A with Column B: **[2]**

Column A	Column B
(a) Positive work done	(i) The force acts opposite to the direction of displacement
(b) Zero work done	(ii) The energy required to do 1 joule of work
(c) Negative work done	(iii) A force acts at right angles to the direction of motion of the body
(d) 1 joule energy	(iv) The force is in the direction of displacement

8. Iceberg floats in sea. Why? **[2]**
9. A girl having a mass of 35 kg sits on a trolley of mass 5 kg. The trolley is given an initial velocity of 4 ms^{-1} by applying a force. The trolley comes to rest after traversing a distance of 16 m. **[2]**
   a. How much work is done on the trolley?
   b. How much work is done by the girl?
10. Give three examples when the object is not displaced in spite of a force acting on it. **[2]**
11. The work done in lifting a box on to a platform does not depend upon how fast it is lifted up. Explain your answer giving proper reason. **[2]**
12. A body moves along a circular path. How much work is done in doing so? Explain. **[2]**
13. Justify giving proper reasoning whether the work done in the following cases is positive or negative **[2]**
    a) Work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket
    b) Work done by gravitational force in the above case.
14. Certain force acting on a 20 kg mass changes its velocity from 5 ms^{-1} to 2 ms^{-1}. Calculate the work done by the force. **[2]**
15. A stone is thrown vertically upward with an initial velocity of 40 ms^{-1}. Taking g = 10 ms^{-2}, find the maximum height reached by the stone. What is the net displacement and the total distance covered by the stone? **[2]**
16. Why it is easier for a man to swim in sea water than in river water? **[2]**
17. An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The initial and the final points of the path of the object lie on the same horizontal line. What is the work done by the force of gravity on the object? **[2]**
18. Write an expression for the work done when a force is acting on an object in the direction of its displacement. **[2]**
19. An object of mass, *m* is moving with a constant velocity, *v*. How much work should be done on the object in order to bring the object to rest? **[2]**
20. It is possible that an object is in the state nof accelerated motion due to external force acting on it, but no work is being done by the force? Explain with example. **[2]**

21. What is the work done by the force of gravity on a satellite moving round the earth? Justify your answer. **[2]**

22. Mountains roads rarely go straight up but wind up gradually. Why? **[2]**

23. Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 kmh^{-1}. **[2]**

24. An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The initial and final points of the path of the object lie on the same horizontal line. What is the work done by the force of gravity on the object? **[2]**

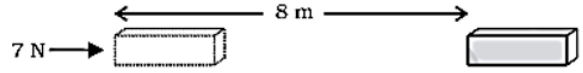
25. Calculate the work done against the gravity. **[2]**

26. A person is holding a bucket by applying a vertical force of 10 N. He moves a horizontal distance of 5 m and then climbs up a vertical distance of 10 m Calculate the total work done by him. **[2]**

27. A force of 10 N displaces a body by a distance of 2 m at an angle 60^o to its own direction. Find the amount of work done. **[2]**

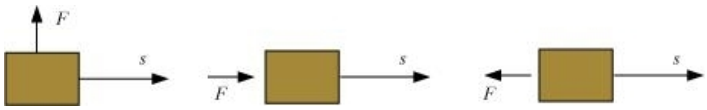
28. What is the work done by a coolie walking on a horizontal platform with a load on his head? **[2]**

29. A force of 7 N acts on an object. The displacement is, say 8 m, in the direction of the force given in figure. Let us take it that the force acts on the object through the displacement. What is the work done in this case? **[2]**



30. Calculate the work done in lifting 200 kg of a mass through a vertical distance of 6 m. Assume g = 10 m/s^2. **[2]**

31. In each of the following a force, *F* is acting on an object of mass, *m*. The direction of displacement is from west to east shown by the longer arrow. Observe the diagrams carefully and state whether the work done by the force is negative, positive or zero. **[2]**

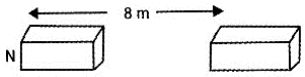


32. A force of 20 N displaces a body through a distance of 1 m at an angle of 60° from its own direction. Calculate the amount of work done. **[2]**

33. Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 km/h? **[2]**

34. Why a dead body floats, with its head immersed in water. **[2]**

35. A force of 7N acts on an object. The displacement is say 8 m, in the direction of the force. Let us take it that the force acts on the object through the displacement. What is the work done in this case? **[2]**



36. A man rowing a boat upstream is at rest with respect to the shore. Is he doing work? **[2]**

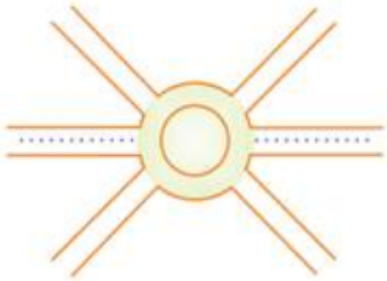
37. A boy of mass 40 kg runs up flight of 50 steps each 10 cm high in 5 second. Find **[2]**

i) the work done by the boy ii) the power developed. (g = 9.8 ms^{-2})

Section C

38. A boy is moving on a straight road against a frictional force of 5 N. After travelling a distance of 1.5 km he forgot the correct path at a round about (Fig.) of radius 100 m. However, he moves on the circular path for one **[3]**

and half cycle and then he moves forward upto 2.0 km. Calculate the work done by him.



39. On a railway station, a passenger hires a coolie to pick his luggage and carry it to the train. When the coolie finished his work, he asked for the money. But the passenger refused to pay him saying that he has done no work. Answer the following questions based on the above information: **[3]**

a. Was the passenger right in saying so?

b. What values are not promoted by the passenger?

c. Give a situation seen in everyday life when no work is said to be done by you even though you get tired.

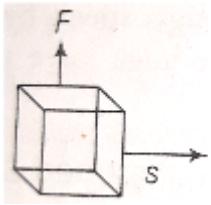
40. Prachi and Kanchi were observing a building having two different staircase. One slanting and other vertically spiral. Prachi was of the opinion that a person using slanting staircase will be doing more work against gravity but Kanchi thought otherwise. They started arguing. Sanchi, their friend, explained and gave entirely different view and pacified them. **[3]**

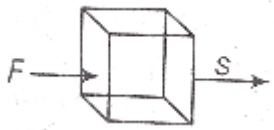
a. What according to you was the explanation given by Sanchi?

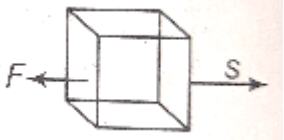
b. What appreciable values do you see in the Sanchi?

41. Sony says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her? Why? **[3]**

42. In each of the following, a force F is acting on an object of mass m. The direction of displacement is from West to east shown by the longer arrow. Observe the figure carefully and state whether the work done by the force is negative, positive or zero. **[3]**

i. 

ii. 

iii. 

43. A vehicle of 1 tonne travelling by a speed of 60 ms^{-1} notices a cow on the road 9m ahead applies brakes. It stops just in front of the cow. **[3]**

i. Find out the KE of the vehicle before applying brakes.

ii. Calculate the retarding force provided by the brakes.

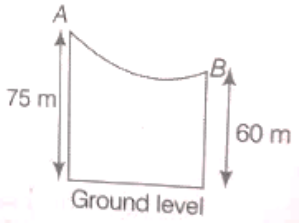
iii. How much time did it take to stop after the brakes were applied?

iv. What is the work done by the braking force?

44. Work is **closely related to energy**. The work-energy principle states that an increase in the kinetic energy of a rigid body is caused by an equal amount of positive work done on the body by the resultant force acting on that body. **[3]**

i. Define potential energy.

ii. Give an example where potential energy is acquired by a body due to change in its shape.



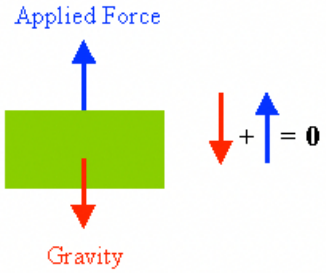
iii. A skier of mass 50 kg stands at A, at the top of a ski jump. He takes off from A for his jump to B. Calculate the change in his gravitational potential energy between A and B.

Section D

Question No. 45 to 48 are based on the given text. Read the text carefully and answer the questions: **[4]**

Work is the energy applied to an object as it moves some distance. The amount of work done is directly proportional to the magnitude of force applied, as well as the displacement of the object. In some cases, there may be an angle between the direction of displacement and the force vector.

A body of mass 5 Kg is lifted vertically at a height of 12m.



45. How much force is applied in this condition?

46. How much work is done in lifting the body?

47. What happens to the work performed?

48. What are the quantities on which the amount of work done depends?

Question No. 49 to 52 are based on the given text. Read the text carefully and answer the questions: **[4]**

A vehicle of 1 tonne travelling by a speed of 60 ms^{-1} notices a cow on the road 9m ahead applies brakes. It stops just in front of the cow.

49. Find out the KE of the vehicle before applying brakes.

50. Calculate the retarding force provided by the brakes.

51. How much time did it take to stop after the brakes were applied?

52. What is the work done by the braking force?

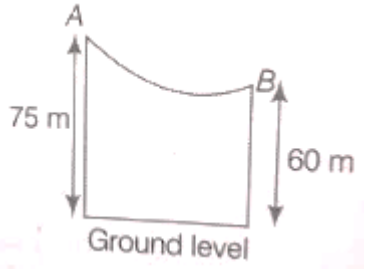
Question No. 53 to 56 are based on the given text. Read the text carefully and answer the questions: **[4]**

Work is **closely related to energy**. The work-energy principle states that an increase in the kinetic energy of a rigid body is caused by an equal amount of positive work done on the body by the resultant force acting on that body.

53. Define potential energy.

54. Give an example where potential energy is acquired by a body due to a change in its shape.

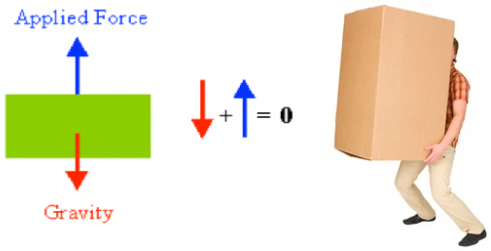
55. A skier of mass 50 kg stands at A, at the top of a ski jump. He takes off from A for his jump to B. Calculate the change in his gravitational potential energy between A and B.



56. An object of mass, m is moving with a constant velocity, v. How much work should be done on the object in order to bring the object to rest ?

Question No. 57 to 60 are based on the given text. Read the text carefully and answer the questions: **[4]**

Work is done **whenever a force moves something over a distance**. You can calculate the energy transferred, or work done, by multiplying the force by the distance moved in the direction of the force. Energy transferred = work done = force $\times$ distance moved in the direction of the force.



Four men lift a 250 kg box to a height of 1 m and hold it without raising or lowering it.

57. Define work done.

58. How much work is done by the men in lifting the box?

59. How much work do they do in just holding it?

60. Why do they get tired while holding it? (g = 10 ms^{-2})

61. **State True or False:** **[4]**

(a) One joule of work is said to be done on an object when a force of 1N displaces the object by 1 m along the line of action of a force. **[1]**

(b) Work done is negative when the force is in the direction of displacement. **[1]**

(c) Work done by a force can be positive, negative, or zero. **[1]**

(d) Work done in moving a body is equal to the product of force exerted on the body and the distance moved by the body in the direction of a force. **[1]**

62. **Read the passage and answer any four question** **[4]**

Life is impossible without energy. The Sun is the biggest natural source of energy for us. An object that possesses energy can exert a force on another object. When this happens, energy is transferred from the former to the latter. The second object may move as it receives energy and therefore does some work. Thus, the first object had the capacity to do work. This implies that any object that possesses energy can do work. The energy possessed by an object is thus measured in terms of its capacity of doing work. According to the law of conservation of energy, the total energy before and after the transformation remains the same.

i. One joule work is said to be done when

(I) a force of 1 N displaces a body by 1 cm

(II) a force of 1 N displaces a body by 1 m

(III) a force of 1 dyne displaces a body by 1 m

(IV) a force of 1 dyne displaces a body by 1 cm.

Choose the correct option among the following:

a. (I) and (III)

b. (I) and (IV)

c. (II) and (III)

d. Only (II)

ii. Energy can neither be_____nor be _____ it can only be transformed from one form to another.

a. created, destroyed

b. formed, reversed

c. invented, discovered

d. none of these

iii. 1KJ us equal to

a. 1000J

b. 200J

c. 3000J

d. 500J

iv. The head of a nail hammered into the wooden plank becomes hot. This is because of:

a. conversion of K. E into heat energy.

b. conversion of P. E into heat energy.

c. conversion of chemical energy into heat energy.

d. conversion of mechanical energy into heat energy.

v. Whenever energy gets transformed, the total energy

a. became zero

b. remain unchanged

c. changes

d. none of these

Section E

63. Look at the activities listed below. Reason out whether or not work is done in the light of your understanding of the term ‘work’. **[5]**

a. Suma is swimming in a pond.

b. A donkey is carrying a load on its back.

c. A wind-mill is lifting water from a well.

d. A green plant is carrying out photosynthesis.

e. An engine is pulling a train.

f. Food grains are getting dried in the sun.

g. A sailboat is moving due to wind energy.

64. i. What do you mean by work? Give an example of negative work done. **[5]**

ii. Can a body have energy, without having momentum? If yes, why?

Section F

65. **Fill in the blanks:** **[8]**

(a) When a body is moved on the ground by applying force, then work is done against _____. **[1]**

(b) If we push a huge rock and it does not move despite all the effort then work is not done as there is no _____ of the rock. **[1]**

(c) Suppose a baby is pulling a toy car parallel to the ground. He exerts a force in the direction of _____ of the car. **[1]**

(d) Work done is _____ when the force acts opposite to the direction of displacement. **[1]**

(e) Work done is _____ when a force acts at right angles to the direction of motion of the body. **[1]**

(f) Work is said to be done when force produces _____. **[1]**

(g) Work done is _____ when the force is in the direction of displacement. **[1]**

(h) When a force of 1 newton moves a body through a distance of 1 metre in its own direction, then the work done is known as _____. **[1]**