SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

WORK AND ENERGY

Class 09 - Science

Time Allowed: 2 hours and 58 minutes **Maximum Marks: 159**

Section A

1. S.I. unit of power is _____. **[1]**

   a) J/s b) s/J

   c) Js d) Js^2

2. Kilowatt hour is a unit of _____. **[1]**

   a) mass b) power

   c) energy d) joule

3. Water falls from a height of 30 m at the rate of 20 kg/s to operate a turbine. The losses due to frictional forces are 20% of energy. How much power is generated by the turbine? (g = 10 m/s^2) **[1]**

   a) 10.2 kW b) 7.0 kW

   c) 12.3 kW d) 4.8 kW

4. A microphone converts sound energy to: **[1]**

   a) A pulse b) Sound energy

   c) Electrical signal/energy d) A wave

5. In the explosion of a cracker/bomb: **[1]**

   a) momentum is conserved b) energy is produced

   c) momentum remains unconserved d) internal energy is absorbed

6. The work done by a force on a body will be positive if the: **[1]**

   a) body moves perpendicular to the direction of motion b) body moves opposite to the direction of the applied force

   c) the body moves along the direction of the applied force d) body does not move

7. A truck of mass 800 kg generates a power of 20000 W. How much time does the truck need to accelerate from a speed of 20 m s^{-1} to 30 m s^{-1}? **[1]**

   a) 10 s b) 7.5 s

   c) 5 s d) 6.3 s

8. One unit of electricity is consumed by A : P = 40 W bulb used for t = 25 hours **[1]**
   B : P = 20 W bulb used for t = 50 hours

Both A and B are true as energy E in kWh is best related as

a) E = Pt

b) $E = \frac{t}{1000}$

c) $E = \frac{pt}{1000}$

d) $E = \frac{p}{100}$

9. The value of one kWh is: **[1]**

a) 300 joule

b) 3.6×10^6 joule

c) 3.6×10^3Joule

d) 3.6×10^8Joule

10. In a collision: **[1]**

a) the momentum of the system is constant

b) momentum is always transferred

c) momentum is always lost

d) energy is lost always

11. **Statement 1**: Potential energy of a stretched or compressed spring is directly proportional to square of extension or compression. **[1]**

Statement 2: Graph between potential energy of a spring versus the extension or compression of the spring is a straight line.

a) Both statement 1 and statement 2 are true but statement 2 is not the correct explanation of statement 1.

b) Statement 1 is true but statement 2 is false

c) Both statement 1 and statement 2 are false.

d) Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.

12. If a force of F newton moves a body with constant speed v, the power delivered by it is: **[1]**

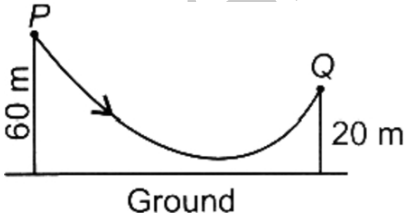
a) $\frac{F}{V}$

b) F^2v

c) Fv

d) $\frac{V}{F}$

13. A skier of mass 50 kg stands at point P at the top of the ski jump and moves from P to Q and takes off his jump at Q as shown in figure. If 50% of the change in the gravitational potential energy of the skier between points P and Q becomes the kinetic energy at Q, then the speed at which the skier arrives at Q is **[1]**



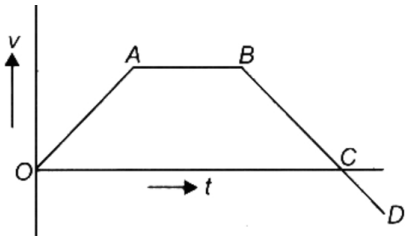
a) 10m s^{-1}

b) 20m s^{-1}

c) 40m s^{-1}

d) 30m s^{-1}

14. A body moves under a variable force. For the body a plot of velocity versus time is shown in figure. The correct statement is **[1]**



a) In moving from B to C, work done by the force on the body is positive

b) In moving from A to B, the body does work on the system

c) In moving from O to A, work done by the force on the body is negative

d) In moving from C to D, work done by the force on the body is positive

15. _____ is the SI unit of work. **[1]**

a) joule

b) energy

c) work

d) mass

16. A body is falling from a height h. After it has fallen a height $\frac{h}{2}$. it will possess **[1]**

a) only potential energy

b) more kinetic and less potential energy

c) only kinetic energy

d) half potential and half kinetic energy

17. To observe and compare the pressure exerted by solid iron cuboid on the sand, a student takes a cuboid of 5 kg and has a dimension of its base 30 cm ×15 cm and measures its pressure, then he mounts the cuboid on a cylinder having a radius of base 7 cm and weight equal to 1 kg. The pressure of the whole set-up on the sand is: **[1]**

a) decreased by 3.5 times

b) remains same

c) can't say

d) increased by 3.5 times

18. The potential energy of a person is minimum when: **[1]**

a) a person is sitting in a chair

b) a person is sitting on the ground

c) a person is lying on the ground

d) person is standing

19. When a stone of mass 'm' falls through a vertical height 'd', the decrease in the gravitational energy is: **[1]**

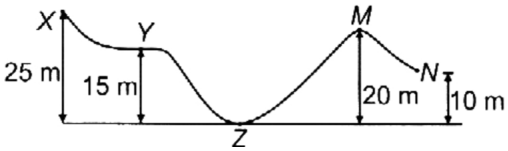
a) $\frac{mg}{d}$

b) $\frac{md}{g}$

c) mgd

d) $\frac{mg^2}{2}$

20. The diagram shows an object released from point X and travelling on a frictionless track. If a heavier object is taken in consideration then **[1]**



i. It will move with a greater speed at Y.

ii. The speed of the object at M is 10 m s^{-1}.

a) Neither (i) nor (ii) is true.

b) Only (i) is true.

c) Both (i) and (ii) are true.

d) Only (ii) is true.

21. When an object starts to fall freely, which statement is incorrect about it? **[1]**

A. Its potential energy is increased and kinetic energy is decreased

B. Its kinetic energy is increased and potential energy is decreased

C. Potential energy remains unchanged

D. Kinetic energy remains unchanged

a) A, C and D

b) A and D

c) A, B, C and D

d) B and C

22. Which of the following statement are incorrect **[1]**

A. A bird sitting on a tree possesses potential energy only.

B. A stationary object may have energy.

C. A flying bird has kinetic energy only.

D. An aeroplane running on the run-way possesses kinetic & potential energy both.

a) A, B, C and D

b) A, B and C

c) C and D

d) B and C

23. Which of the following statement are incorrect **[1]**

A. A bird sitting on tree possess potential energy only

B. A stationary object may have energy

C. A flying bird has kinetic energy only

D. An aero plane running on the run- way possess kinetic & potential energy both

a) A, B, C and D

b) B and D

c) C and D

d) A and C

24. Find the incorrect statement **[1]**

A. The P. E of a freely falling object increases progressively.

B. Body at rest may possess energy.

C. There is no transfer of energy between you and the rock when you push a huge rack and fail to move it.

D. K.E. is converted into heat and sound energy when a freely falling object eventually stops on reaching the ground.

a) D

b) B

c) C

d) A

25. When an object starts to fall freely, which statement is incorrect about it **[1]**

A. Its potential energy is increased and kinetic energy is decreased

B. Its kinetic energy is increased and potential energy is decreased

C. Potential energy remains unchanged

D. Kinetic energy remains unchanged

a) All of these

b) (B) and (C) are correct

c) (A) and (B) are correct

d) (A), (C) and (D) are incorrect

26. A body performs no work. Does it imply that the body possesses no energy? **[1]**

27. By how much will the speed of a body, of fixed mass, increase if its kinetic energy becomes four times its intial kinetic energy? **[1]**

28. When a book is lifted from a table, against which force work is done? **[1]**

29. What type of energy is stored in the spring of a watch? **[1]**

30. Is it possible that some force is acting on a body but still the work done is zero? **[1]**

31. Define 1 J of work. **[1]**

32. Define work. How is work measured? When is work done by a force negative? **[1]**

33. A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some work or not? **[1]**

34. What is energy? **[1]**

35. What will cause greater change in kinetic energy of a body? Changing its mass or changing its velocity? **[1]**

Section B

36. The volume of 50 g substance is 20 cm^3. If the density of water is 1 g cm^{-3}, will the substance float or sink? **[2]**

37. Suppose a hammer which falls freely on a nail placed on a piece of wood of mass 1 kg, if it falls from a height of 1 m, how much kinetic energy it will have just before hitting the nail? Take g = 10 ms^{-2}. **[2]**

38. A mass of 10 kg falls from a height of 50 cm. Calculate (i) Velocity of the body (ii) Kinetic energy of body when it just reaches the ground level. Does the velocity depend upon the mass of the particle? Explain. (Take g = 10 ms^{-2}) **[2]**

39. Five bulbs each having 100 W power are used for 4 h, a heater having 1500 W power is used for 2 h and an electric iron of power 1000 W is used for 5 h. **[2]**

    i. Calculate the total energy consumed by them.

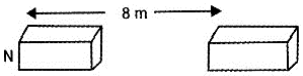
    ii. Convert this energy into joules.

40. If an electric bulb of 100 watt is lighted for 2 hours. how much electric energy would be consumed? **[2]**

41. How is the power related to the speed at which a body can be lifted? How many kilograms will a man working with the power of 100 W, be able to lift at constant speed of 1 ms^{-1} vertically? (g = 10 ms^{-2}) **[2]**

42. If the power of a motor is 40 kW, at what speed can it raise a load of 20,000 N? **[2]**

43. 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]**



44. Two boys A and B weighing 60 kg and 40 kg respectively, climb on a staircase each carrying a load of 20 kg on their head. The staircase has 10 steps, each of height 50 cm. If A takes 20 s to climb and B takes 10 s to climb, then **[2]**

    i. who possesses greater power?

    ii. find the ratio of their powers.

45. What is the work to be done to increase the velocity of a car from 30 km h^{-1} to 60 km h^{-1} if the mass of the car is 1500 kg? **[2]**

46. 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?

47. The speed of a vehicle of mass 500 kg increases from 36 km/h to 72 km/h. Calculate the increase in its kinetic energy. **[2]**

48. 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]**

49. The weight of a person on a planet A is about half of that on the Earth. He can jump up to 0.4 m high on the **[2]**

Earth. How high can he jump on planet A?

50. A certain household has consumed 250 units of energy during a month. How much energy is this in joules? **[2]**

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

52. A 150 kg car engine develops 500 W for each kg. What force does it exert in moving the car at a speed of 20 ms^{-1}? **[2]**

53. A balloon of volume 50 m^3 is filled with hot air of density 0.4 kgm^{-3}, if the weight of the fabric of balloon is 12 kgf and equipment 'P' is attached to it, such that balloon is in the state of equilibrium. Calculate:i) Weight of hot air,ii) Weight of hot air, balloon and equipmentiii) Upthrust,iv) Weight of equipment. **[2]**

54. The kinetic energy of an object of mass m moving with a velocity of 5 ms^{-1} is 25 J. What will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased to three times? **[2]**

55. An electric heater is rated 1500 W. How much energy does it use in 10 hours? **[2]**

Section C

56. Avinash can run at a speed of 8 ms^1 against the frictional force of 10 N, and Kapil can move at a speed of 3 ms^{-1} against the frictional force of 25 N. Who is more powerful and why? **[3]**

57. An automobile engine propels a 1,000 kg car A along a levelled road at a speed of 36 km h^{-1}. Find the power if the opposing frictional force is 100 N. Now, suppose after travelling a distance of 200 m, this car collides with another stationary car B of same mass and comes to rest. Let its engine also stop at the same time. Now, car B starts moving on the same level road without getting its engine started. Find the speed of the car B just after the collision. **[3]**

58. A test tube loaded with lead shots weighs 50 gf and floats upto the mark 'X' in water. The test tube is then made to float alcohol. It is found that 10 gf of lead shots have to be removed, so as to float it to level 'X'. Find RD of alcohol. **[3]**

Section D

59. **Read the following text carefully and answer the questions that follow:** **[4]**

The commercial unit of energy is kilowatt-hour which is written as kWh. The SI unit of electrical energy is joule.

A joule is the amount of electrical energy consumed when an appliance of 1 watt power is used for one second. Joule represents a very small quantity of energy so we use a bigger unit called kilowatt hour.

One kilowatt hour is the amount of electrical energy consumed when an electrical appliance with a power rating of 1 kilowatt is used for 1 hour.

1 kW h is the energy used in one hour at the rate of 1000 J s - 1 (or 1 kW).

1 kW h = 1 kW $\times$ 1 h

= 1000 W $\times$ 3600 s

= 3600000 J

1 kW h = 3.6 $\times$ 106 J.

The energy used in households, industries and commercial establishments are usually expressed in kilowatt hour. For example, electrical energy used during a month is expressed in terms of ‘units’. Here, 1 ‘unit’ means 1 kilowatt hour. The electricity meter installed in our home records the electrical energy consumed by us in kilowatt-hours.

i. What is the commercial unit of energy? (1)

ii. What is the SI unit of electrical energy? (1)

iii. How is electrical energy used during a month expressed and recorded? (2)

OR

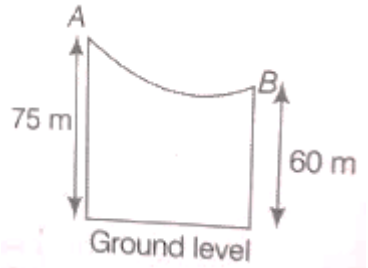
Find out the relation between Kilowatt-hour and joule. (2)

60. 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. **[4]**

i. Define potential energy.

ii. Give an example where potential energy is acquired by a body due to a 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.

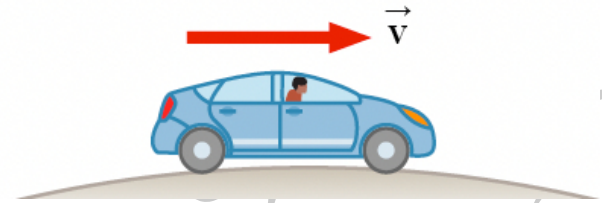


OR

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?

61. **Read the following text carefully and answer the questions that follow:** **[4]**

In physics, potential energy is the energy held by an object because of its position relative to other objects, stresses within itself, its electric charge, or other factors. The kinetic energy of an object is the energy that it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its stated velocity. A car is moving on a levelled road and gets its velocity doubled.



i. How would the potential energy of the car change? (1)

ii. How would the kinetic energy of the car change? (1)

iii. How will its momentum change? Give reasons for your answer. (2)

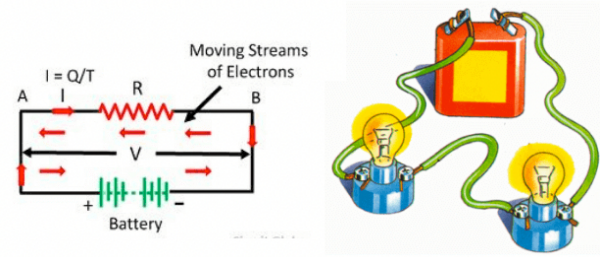
OR

What is the relation between mechanical energy, potential energy, and kinetic energy? (2)

62. **Read the following text carefully and answer the questions that follow:** **[4]**

Electrical energy is energy derived as a result of the movement of electrically charged particles. When used

loosely, electrical energy refers to the energy that has been converted from electric potential energy.



i. When 1 Joule of work is said to be done? (1)

ii. An electric oven is rated 5000 W. How many units of electrical energy does it use in 2 hours? (1)

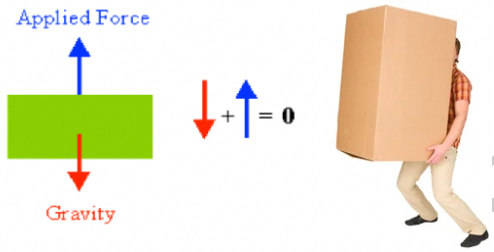
iii. When a carpet is beaten with a stick, dust comes out of it. Explain. (2)

OR

A lamp consumes 1000 J of electrical energy in 10s. What is its power? (2)

63. **Read the following text carefully and answer the questions that follow:** **[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 × 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.

i. Define work done. (1)

ii. How much work is done by the men in lifting the box? (1)

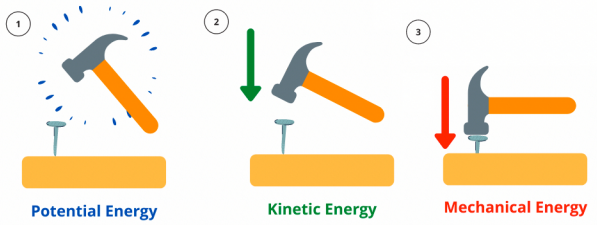
iii. How much work do they do in just holding it? (2)

OR

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

64. **Read the following text carefully and answer the questions that follow:** **[4]**

In physics, work is the energy transferred to or from an object via the application of force along with a displacement. In its simplest form, it is often represented as the product of force and displacement. A force is said to do positive work if (when applied) it has a component in the direction of the displacement of the point of application. A force does negative work if it has a component opposite to the direction of the displacement at the point of application of the force.



i. State the law of conservation of energy. (1)

ii. Define mechanical energy. (1)

iii. Calculate the energy in kWh consumed in 5 hours by four devices of power 600 W each. (2)

OR

Can a body have energy, without having momentum? If yes, why? (2)

65. **Read the following text carefully and answer the questions that follow:** **[4]**

An old man takes 10 minutes to do a particular work whereas a young man takes 5 minutes to do the same work. The rate of doing work of a young man is more than that of an old man. This rate of doing work is called power. Hence, power of young man is more than that of an old man. Thus, Power is defined as the rate of doing work.

$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$

$P = \frac{W}{t}$

When work is done an equal amount of energy is consumed. Power is a scalar quantity. The SI unit of power is watt which is denoted by symbol W.

1 watt is the power of an appliance which does work at the rate of 1 joule per second.

1 watt = 1 joule/1 second

1 watt = 1 joule per second.

The power of an electrical appliance tells us the rate at which electrical energy is consumed by it. Watt is a small unit of power. Sometimes, bigger units of power called kilowatt (kW) and megawatt (MW) are also used.

1 kilowatt = 1000 watts

1 kW = 1000 W

1 megawatt = 1000,000 watts

$1MW = 10^6$ W

i. What is power? (1)

ii. Define the SI unit of power. (1)

iii. What does the power of an electrical appliance tell? (2)

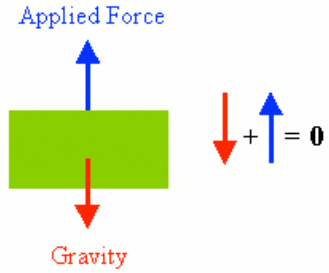
OR

How many watts are there in 1 kilowatt and 1 megawatt? (2)

66. **Read the following text carefully and answer the questions that follow:** **[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.



i. How much force is applied in this condition? (1)

ii. How much work is done in lifting the body? (1)

iii. What happens to the work performed? (2)

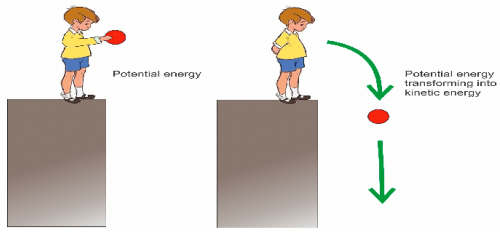
OR

What are the quantities on which the amount of work done depends? (2)

67. **Read the following text carefully and answer the questions that follow:** **[4]**

Potential energy is stored energy that depends upon the relative position of various parts of a system. Spring has more potential energy when it is compressed or stretched. A steel ball has more potential energy raised

above the ground than it has after falling to Earth.



i. If a mass of 10 kg is dropped from a height of 50 cm, then find potential energy just before dropping. (1)

ii. If a mass of 10 kg is dropped from a height of 50 cm, then what is kinetic energy just on touching the ground? (1)

iii. Also, what is the velocity with which it hits the ground? (take, q = 10 ms^{-2}) (2)

OR

Can a body have energy, without having momentum? If yes, why? (2)

68. **Read the following text carefully and answer the questions that follow:** **[4]**

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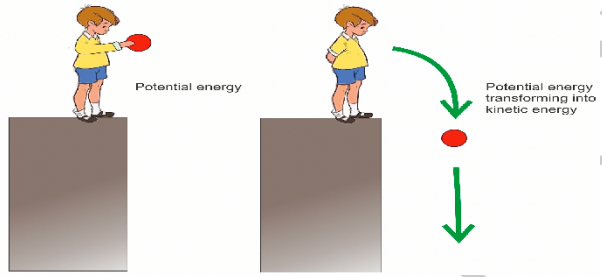

If a body falls from a height bounces from the ground and again goes upwards with loss of a part of its energy.

i. How will its potential energy change? (1)

ii. What are various energy conversions taking place? (1)

iii. What will be its ultimate energy? (2)

OR

The potential energy of a freely falling object decreases progressively. Does given violate the law of conservation of energy? Why? (2)

Section E

69. i. What happens when you shake a wet piece of cloth? Explain your observation. **[5]**

ii. An electric bulb of 200 W is used for 6 hrs a day. Calculate the energy consumed by it in a day in Joules and kilowatt-hour unit.

70. A man standing on the top of a tower 60 m high throws a ball in the vertically upward direction with a velocity of 20 ms^{-1}. How long will it take the ball to pass by the man while moving in the downward direction? How long will it take the ball to hit the ground? (Take g = 10 ms^{-2}) **[5]**

71. i. Define kinetic energy of an object. Can kinetic energy of an object be negative? Give reason. **[5]**

ii. A car weighing 1200 kg is uniformly accelerated from rest and covers a distance of 40m in 5 s. Calculate the work the car engine had to do during this time.

72. i. A body has a mass m and velocity v. If the mass is increased four times and velocity is decreased two times, calculate the ratio of the kinetic energies in the above cases. **[5]**

ii. What kind of energy transformation takes place when sparkle is lighted?

73. Calculate the electricity bill amount for a month of April, if 4 bulbs of 40 W for 5 h, 4 tubelights of 60 W for 5 h, a TV of 100 W for 6 h, a washing machine of 400 W for 3 h are used per day. The cost per unit is Rs. 1.80. **[5]**

74. i. Define work. State two factors on which the magnitude of work depends. **[5]**

ii. A car and a truck have the same speed of 30 m/s. If their masses are in the ratio 2 : 3; find the ratio of kinetic energy.

75. The area of cross-section of the stem of a hydrometer is 0.32 cm^2 and its length is 20 cm. Its mass is 22.8 g and volume of the bulb is 10 cm^3. **[5]**

Find.

i) The density of the liquid in which it floats upto its midpoint.

ii) The density of the liquid in which it is completely immersed.