Ravi Maths Tuition Centre

Time : 1 Mins **WORK POWER ENERGY 1 1** **Marks : 1468**

1. A body x with a momentum p collides with another identical stationary body y one dimensionally. During the collision y gives an impulse J to body x. Then coefficient of restitution is:

   a) $\frac{2J}{p} - 1$ b) $\frac{J}{p} + 1$ c) $\frac{J}{p} - 1$ d) $\frac{J}{2p} - 1$

2. A radioactive nucleus initially at rest decays by emitting an electron and neutron at right angles to one another. The momentum of the electron is 3.2 x 10^{-23} kg-m/sec and that of the neutron is 6.4 x 10^{-23} kg-m/sec. The direction of the recoiling nucleus with that of the electron motion is:

   a) $\tan^{-1}(0.5)$ b) $\tan^{-1}(2)$ c) $\pi - tan^{-1}(2)$ d) $\frac{\pi}{2} + tan^{-1}(2)$

3. A block of mass l0 kg moving in x -direction with a constant speed of 10 ms^{-l}, is subject to a retarding force F- 0.1 x J/m during its travel from x = 20 m to 30 m. Its final KE will be

   _____

   a) 450J b) 275J c) 250J d) 475J

4. In question number 4, if the collision between the block and the incline is completely elastic, then the vertical (upward) component of the velocity of the block at point B, immediately after it strikes the second incline is

   a) $\sqrt{30}$ m/s b) $\sqrt{15}$ m/s c) 0 d) -$\sqrt{15}$ m/s

5. A simple pendulum of length 1m has a wooden bob of mass 1 kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of 2 x 10^{2} m S^{-1}. The height to which the bob rises before swinging back is
   (Takeg = 10 m S^{-2})

   a) 0.2m b) 0.6m c) 8m d) 1m

6. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be_____

   a) 24V b) -1.2V c) -2.4V d) 1.2V

7. Light of frequency 1.5 times the threshold frequency is incident on a photo sensitive material. What will be the photoelectric current if the frequency is halved the intensify is doubled

   _____

   a) 0 b) doubled c) four times d) one fourth

8. If the mornentum of electron is changed by P, then the de- Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be _____

   a) 200P b) 400P c) $\frac{P}{200}$ d) 100P

9. Two masses of 1 g and 9 g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momenta is:

   a) 1 : 9 b) 9 : 1 c) 1 : 3 d) 3 : 1

10. A tank of 2 x 2 x 3 is to be filled with water from a well of average depth 10 m. The work done will be:

    a) 1176 x 10^3 J b) 1276 x 10^3 J c) 1476 x 10^3 J d) 1576 x 10^3 J

11. A ball is dropped from a height h. If the coefficient of restitution be e, then the body rebounds to a height of:

    a) eh b) e^2h c) e^3h d) e^4h

12. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by:

    a) $\mu = \frac{2}{tan\theta}$ b) $\mu = 2tan\theta$ c) $\mu = tan\theta$ d) $\mu = \frac{1}{tan\theta}$

13. block of mass 4 kg is placed on a rough horizontal plane. A time dependent force $F=kf^2$ acts on the block, where k =2 N/s^2. Force of friction between block and the plane at t = 2 see is:

    a) 8 N b) 4 N c) 2 N d) 1 N

14. In two separate collisions, the coefficients of restitutions 'e_1' and 'e_2' are in the ratio 3: 1. In the first collision the relative velocity of approach is twice the relative velocity of separation. Then the ratio between the relative velocity of approach and relative velocity of separation in the second collision is:

    a) 1:6 b) 2:3 c) 3:2 d) 6:1

15. A body of mass m moving with velocity v makes a head-on collision with another body of mass 2 m which is initially at rest. The loss of kinetic energy of the colliding body (mass m) is: (in kJ)

    a) $\frac{1}{2}$ of its initial KE b) $\frac{1}{9}$ of its initial KE c) $\frac{8}{9}$ of its initial KE d) $\frac{1}{4}$ of its initial KE

16. A ball is dropped from height 20 m. If coefficient of restitution is 0.9, what will be the height attained after first bounce?

    a) 1.62 m b) 16.2 m c) 18 m d) 14 m

17. The kinetic energy K of a particle moving in a straight line depends upon the distance s as; $K = as^2$. The force acting on the particle is:

    a) 2as b) 2mas c) 2a d) $\sqrt{a^2}$

18. The bob of a pendulum is released from a horizontal position. If the length of pendulum is 2 m, what is the speed with which the bob arrives at the lower most point. Assume that 10% of its energy is dissipated against air resistance.
    (Take g = 10 m S^{-2})

    a) 4 ms^{-1} b) 6 ms^{-1} c) 8 ms^{-1} d) 10 ms^{-1}

19. A cricket ball of mass 150 g moving with a speed of 126 km/h hits at the middle of the bat, held firmly at its position by the batsman. The ball moves straight back to the bowler after hitting the bat. Assuming that collision between ball and bat is completely elastic and the two remain in contact for 0.001 s, the force that the batsman had to apply to hold the bat firmly at its place would be :
    a) 10.5 N b) 21 N c) 1.05 x 10^4 N d) 2.1 x 10^4 N
20. An adult weighing 600 N raises the centre of gravity of his body by 0.25 m while taking each step of . 1m length in jogging. Ifhe jogs for 6 km, the energy . utilised by him in jogging assuming that there is no energy loss due to friction of ground and air.
    Assuming that the body of the adult is capable of converting 10% of energy intake in the form of food, calculate the energy equivalents of food that would be required to compensate energy utilized for jogging.
    a) 3 x 10^6 J and 9 x 10^6 J b) 9 x 10^5 J and 9 x 10^6 J c) 4 x 10^5 J and 9 x 10^6 J
    d) 6 x 10^4 J and 3 x 10^6 J
21. A constant power P is applied to a particle of mass m. The distance travelled by the particle when its velocity increases from v_1 to v_2 is: (neglect friction)
    a) $\frac{3P}{m}\left(v_2^2 - v_1^2\right)$ b) $\frac{m}{3P}\left(v_2 - v_1\right)$ c) $\frac{3P}{m}\left(v_2^3 - v_1^3\right)$ d) $\frac{m}{3P}\left(v_2^2 - v_1^2\right)$
22. A 1.5 kg block is initially at rest on a horizontal frictionless surface when a horizontal force in the positive direction of x-axis is applied to the block. The force is given by:
    $\vec{F} = \left(4 - x^2\right)\hat{i}$, where x is in metre and the initial position of the block is x = 0 The maximum kinetic energy of the block between x = 0 and x = 2. 0m is
    a) 2.33 J b) 8.67 J c) 5.33 J d) 6.67 J
23. A body is allowed to fall on the ground from a height hi. If it is to rebound to a height h_2, then the coefficient of restitution is:
    a) $\frac{h_2}{h_1}$ b) $\sqrt{\frac{h_2}{h_1}}$ c) $\frac{h_1}{h_2}$ d) $\sqrt{\frac{h_1}{h_2}}$
24. Work done by the conservative force on a system is equal to:
    a) the change in kinetic energy of the system
    b) the change in potential energy of the system
    c) the change in total mechanical energy of the system d) none of the above
25. The slope of the kinetic energy versus position vector gives the rate of change of:
    a) work b) velocity c) force d) power e) momentum
26. An explosion blows a rock into three parts. Two parts go off at right angles to each other. These two are, 1 kg fiist part moving with a velocity of 12 ms 1 and 2 kg/second part moving with a velocity of g ms^{-l}. If the third part flies off with a velocity of 4 ms^{-1}, its mass would be
    _____
    a) 7kg b) 17kg c) 3kg d) 5kg
27. A ball which is at rest is dropped from a height h metre. As it bounces off the floor its speed is 80% of what it was just before touching the ground. The ball will then rise to nearly a height:
    a) 0.94h b) 0.80h c) 0.75h d) 0.64h

28. A metre scale of mass 100 kg is pivoted at one end. It is held at 30° with the horizontal. What is the potential energy associated with it?
    a) 0.10J b) 0.15J c) 0.20J d) 0.25J

29. A cannon of mass 2m located at the base of an inclined plane shoots a shell of mass m in horizontal direction with velocity v_0 . The angle of inclination of plane is 45° and the coefficient of friction between the cannon and the plane is 0.5. The height to which cannon ascends the plane as a result of recoil is:
    a) $\frac{v_0^2}{2g}$ b) $\frac{v_0^2}{12g}$ c) $\frac{v_0^2}{6g}$ d) $\frac{v_0^2}{g}$

30. A vertical spring with force constant k is fixed on a table. A ball ofmass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d. The net work done in the process is _____
    a) $mg(h+d)-\frac{1}{2}kd^2$ b) $mg(h-d)-\frac{1}{2}kd^2$ c) $mg(h-d)+\frac{1}{2}kd^2$ d) $mg(h+d)+\frac{1}{2}kd^2$

31. In the first ball of mass m moving with a velocity u collides head-on with the second ball of mass m at rest. If the coefficient of restitution is e, then the ratio of the velocities of the first and the second ball after the collision is, the ratio of the final and initial velocities of the first ball is:
    a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{1+e}{2}$ d) $\frac{1-e}{2}$

32. For a moving particle (mass m, velocity v) having a momentum p, which one of the following correctly describes the kinetic energy of the particle
    a) $\frac{p^2}{2m}$ b) $\frac{p}{2m}$ c) $\frac{v^2}{2m}$ d) $\frac{v}{2m}$

33. A bullet of mass 0.05 kg moving with a speed of 80 m s^{-1} enters a wooden block and is stopped after a distance of 0.40 m. The average resistive force exerted by the block on the bullet is:
    a) 300 N b) 20 N c) 400 N d) 40 N

34. The work done by the man is

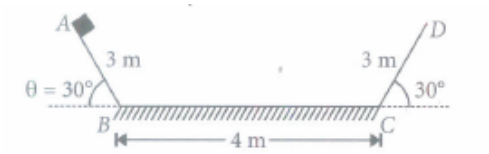
    a) mgl b) mgh c) $-\frac{1}{2}mgl$ d) mg(l- h)

35. A stone projected up with a velocity u reaches a maximum height h. When it is at a height of 3h/4 from the ground, the ratio of KE and PE at that point is:
    a) 3 : 1 b) 1 : 1 c) 1 : 3 d) 1 : 2

36. A projectile is moving at 20 m s^{-1} at its highest point, where it breaks into equal parts due to an internal explosion. One part moves vertically up at 30 m s^{-1} with respect to the ground. Then the other part will move at:
    a) 20 ms^{-1} b) $10\sqrt{31}\ ms^{-1}$ c) 50 ms^{-1} d) 30 ms^{-1}

37. A track has two inclined surface AB and DC each of length 3 m and angle of inclination of 30° with the horizontal and a central horizontal part of length 4 m as shown in figure. A block of mass 0.2 kg slides from rest from point A. The inclined surfaces are frictionless. If the

coefficient of friction between the block and the horizontal flat surface is 0.2, where will the block finally come to rest



a) 0.5 m away from point B b) 3.5 m away from point B c) 0.5 m away from point C
d) 1.5 m away from point C

38. A metal ball ofmass 2 kg moving with a velocity of 36 km/ h has a head on collision with a stationary ball of mass 3 kg. If after the collision, the two balls move together, the loss in kinetic energy due to collision is _____
a) 140J b) 100J c) 60J d) 40J

39. An electron of mass m with a velocity $\mathrm{v} = v_0\hat{i}\left(v_0 > 0\right)$ enters an electric field $\mathrm{E} = -\mathrm{E}_0\hat{i}\left(\mathrm{E}_0\right.$ = constant > 0) at t =0. If l_o is its de-Broglie wavelength initially, then its de- Broglie wavelength at time / is _____

a) $\lambda_0 t$ b) $\lambda_0\left(1+\frac{e\mathrm{E}_0}{mv_0}t\right)$ c) $\frac{\lambda_0}{\left(1+\frac{e\mathrm{E}_0}{mv_0}t\right)}$ d) l_o

40. A spherical ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1 kg at rest. After the collision, A and B move with velocities VI m S^{-1} and V^2 m S-I respectively making angles of 30° and 60° with respect to the original direction of motion of A. The ratio $\frac{v_1}{v_2}$ will be
a) $\frac{\sqrt{3}}{4}$ b) $\frac{4}{\sqrt{3}}$ c) $\frac{1}{\sqrt{3}}$ d) $\sqrt{3}$

41. A block of mass 5 kg is resting on a smooth surface. At what angle a force of 20 N be acted on the body so that it will acquired a kinetic energy of 40 J after moving 4 m?
a) 30° b) 45° c) 60° d) 120°

42. 4 m^3 of water is to be pumped to a height of 20 m and forced into a reservoir at a pressure of 2 x 10^5 N/m^2. The work done by the motor is: (external pressure = 10^5N/m^2)
a) 8 x 10^5 J b) 16 x 10^5 J c) 12 x 10^5 J d) 32 x 10^5 J

43. Ball I collides with another identical ball at rest. For what value of coefficient of restitution e, the velocity of second ball becomes two times that of I after collision?
a) $\frac{1}{3}$ b) $\frac{1}{2}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$

44. A 2 kg block slides on a horizontal floor with a speed of 4 m/s. It strikes an uncompressed spring and compresses it till the block is motionless. The kinetic frictional force is 15 N and spring constant is 10,000 N/m. The spring compresses by:
a) 8.5 cm b) 5.5 cm c) 2.5 cm d) 11.0 cm

45. A bomb of mass 9 kg explodes into two pieces of masses 3 kg and 6 kg. The velocity of mass 3 kg is 16 m/s. The KE of mass 6 kg (in joule) is:
a) 96 b) 384 c) 192 d) 768

46. An engine pumps water continuously through a hose. Water leaves the hose with a velocity v and m is the mass per unit length of the water jet. What is the rate at which kinetic energy is imparted to water?

a) mv^2 b) $\frac{1}{2}mv^2$ c) $\frac{1}{2}m^2v^2$ d) $\frac{1}{2}mv^3$

47. A particle with total energy E is moving in a potential energy region U(x). Motion of the particle is restricted to the region when _____

a) $U(x) > E$ b) $U(x) < E$ c) U(x) = 0 d) $U(x) \leq E$

48. A particle of mass 1 g moving with a velocity $\vec{v}_1 = 3\hat{i} - 2\hat{j}\ \text{ms}^{-1}$ experiences a perfectly in elastic collision with another particle of mass 2 g and velocity $\vec{v}_2 = 4\hat{j} - 6\hat{K}\ \text{ms}^{-1}$ The velocity of the particle is

a) 2.3 ms^{-1} b) 4.6 ms^{-1} c) 9.2 ms^{-1} d) 6 ms^{-1}

49. Which of the following statements is false?

a)

Area under force/displacement curve with prope ralgebraic sign represents work done by the force.

b)

Area under the P - V graph represents the work done in case of expansion or compression of a gas.

c) In a conservative field work is path independent.

d) Work does not depend on the frame of reference.

50. An engine pumps water continuously through a hole. If the speed with which water passes through the hole nozzle is v and k is the mass per unit length of the water jet as it leaves the nozzle, the rate at which kinetic energy is being imparted to the water is:

a) $\frac{1}{2}kv^2$ b) $\frac{1}{2}kv^3$ c) $\frac{v^2}{2k}$ d) $\frac{v^3}{2k}$

51. Fast neutrons can easily be slowed down by

a) the use oflead shield b) passing them through heavy water

c) elastic collision with heavy nucleus d) applying a strong electric field

52. Assertion: In a perfectly inelastic collision the kinetic energy is never conserved.
Reason: The objects get deformed and stick together in perfectly in elastic collision.

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

b)

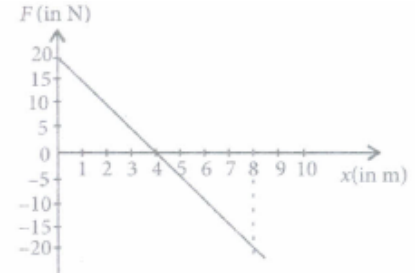
If both assertion and reason are true but reason is not the correct explanation of assertion.

c) If assertion is true but reason is false. d) If both assertion and reason are false

53. Two radiations of photons energies 1 eV and 2.5 eV, successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximurn speeds of the emitted electrons is _____

a) 1:4 b) 1:1 c) 1:2 d) 1:5

54. A force F acting on an object varies with distance x as shown in the figure.



The work done by the force in moving the object from x = 0 to x = 8 m is

a) zero J b) 80 J c) -40 J d) 40 J

55. For a system to follow the law of conservation of linear momentum during a collision, the condition is:

(i) total external force acting on the system is zero.

(ii) total external force acting on the system is finite and time of collision is negligible.

(iii) total internal force acting on the system is zero.

a) (i) only b) (ii) only c) (iii) only d) (i) or (ii)

56. If a porter with a suitcase on his head moves up a staircase, work done by the upward lifting force relative to him will be:

a) +mgh b) -mgh c) zero d) none of these

57. A ball of mass 2 kg moving with velocity 3 m/s, collides with spring of natural length 2 m and force constant 144 N/m. What will be length of compressed spring?

a) 2 m b) 1.5 m c) 1 m d) 0.5 m

58. Body A of mass 4m moving with speed u collides with another body B of mass 2m, at rest. The collision is head on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is _____

a) $\frac{8}{9}$ b) $\frac{4}{9}$ c) $\frac{5}{9}$ d) $\frac{1}{9}$

59. Which of the following statements is correct?

a) Heat is absorbed in exothermic reaction. b) Heat is released in endothermic reaction.

c) Energy released in burning 1 litre of gasoline is 300 MJ.

d) Chemical energy is associated with the forces that give rise to the stability of substances.

60. A body of mass 2.0 kg makes an elastic collision with another body at rest and continues to move in the original direction but with one-fourth of its original speed u. What is the mass of other body and the speed of the two body center of mass?

a) 1.0 kg and $\frac{2}{3}v$ b) 1.2 kg and c) 1.4 kg and $\frac{10}{17}v$ d) 1.5 kg and $\frac{4}{7}v$

61. A 120 g mass has a velocity $\vec{v} = 2\hat{i} + 5\hat{j}$ m S^{-1} at a certain instant. Its kinetic energy is

a) 3 J b) 4 J c) 5 J d) 1.74 J

62. A block m_1 strikes a stationary block m_3 inelastically. Another block m_2 is kept on m_3. Neglecting the friction between all contacting surfaces, the fractional decrease of KE of the system in collision is:

a) $\frac{m_1}{m_1+m_2+m_3}$ b) $\frac{m_1}{m_2+m_3}$ c) $\frac{m_3}{m_1+m_3}$ d) $\frac{m_2+m_3}{m_1+m_2+m_3}$

63. Assertion: The conservation of kinetic energy in elastic collision applies after the collision is over and does not hold at every instant of the collision.
Reason: During a collision the total linear momentum is conserved at each instant of the collision.
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 both assertion and reason are false

64. A block of mass M slides down the surface of a bowl of radius R from its rim to the bottom. What will be the kinetic energy of the block at the bottom?
a) 2MgR b) MgR c) MgR/2 d) MgR/4

65. A spherical ball of mass ml collides head on with another ball of mass m_2 at rest. The collision is elastic. The fraction of kinetic energy lost by m_1 is :
a) $\frac{4m_1m_2}{(m_1+m_2)^2}$ b) $\frac{m_1}{m_1+m_2}$ c) $\frac{m_2}{m_1+m_2}$ d) $\frac{m_1m_2}{(m_1+m_2)^2}$

66. Consider the following statements A and B. Identify the correct choice in the given answers.
A. In a one dimensional perfectly elastic collision between two moving bodies of equal masses, the bodies merely exchange their velocities after collision.
B. If a lighter body at rest suffers perfectly elastic collision with a very heavy body moving with a certain velocity, then after collision both travel with same velocity.
a) A and B are correct b) Both A and B are wrong c) A is correct, B is wrong
d) A is wrong, B is correct

67. If we throw a body upwards with velocity of 4 m/s, at what height does its kinetic energy reduce to half of the initial value? (Take g = 10 m s^{-2})
a) 1 m b) 0.4 m c) 4 m d) 4.1 m

68. A 15 g ball is shot from a spring gun whose spring has a force constant 600 N m-1. The spring is compressed by 5 cm. The greatest possible horizontal range of the ball for this compression (Take g = 10 m S^{-2})
a) 6 m b) 8 m c) 10 m d) 12 m

69. The momentum of a body is increased by 25%. The kinetic energy is increased by about
a) 25% b) 5% c) 56% d) 38%

70. Two spherical bodies of mass M and 5M and radii Rand 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smaller body before collision is:
a) 7.5 R b) 4.5 R c) 2.5 R d) 1.5 R

71. In the first ball of mass m moving with a velocity u collides head-on with the second ball of mass m at rest. If the coefficient of restitution is e, then the ratio of the velocities of the first and the second ball after the collision is, the ratio of final velocity of the second ball to the initial velocity of the first ball is:
a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{1+e}{2}$ d) $\frac{1-e}{2}$

72. Momentum is closely related to:
a) impulse b) kinetic energy c) angular momentum d) tangential velocity

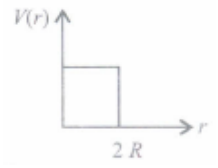
73. A force $\left(4\hat{i}+\hat{j}-2\hat{k}\right)$ N acting on a body maintains its velocity at $\left(2\hat{i}+2\hat{j}-3\hat{k}\right)$ m s^{-1} . The power exerted is
    a) 4 W b) 5 W c) 2 W d) 2 W
74. A 10 gm bullet is fired from a rifle horizontally into a 5 kg block of wood suspended by a string and the bullet gets embedded in the block. The impact causes the block to swing to a height of 2.5 cm above its initial level. The velocity of the bullet is:
    a) 286.8 m/sec b) 350.7 m/sec c) 1000 m/sec d) 523 m/sec
75. A particle is released from a height S. At certain height its kinetic energy is three times its potential energy. The height and speed of the particle at that instant are respectively:
    a) $\frac{S}{4}, \frac{3gs}{2}$ b) $\frac{S}{4}, \sqrt{\frac{3gs}{2}}$ c) $\frac{S}{2}, \sqrt{\frac{3gs}{2}}$ d) $\frac{S}{4}, \sqrt{\frac{3gs}{2}}$
76. A steel ball of mass 5 g is thrown downward with a velocity 10 m/s from a height 19.5 m. It penetrates sand by 50 cm. The change in mechanical energy will be:
    (g = 10 m/s^2)
    a) 1 J b) 1.25 J c) 1.5 J d) 1.75 J
77. A particle of mass M moves in a circle of radius R with a constant speed v. The work done when it completes one circle is:
    a) $\frac{Mv^2}{R} \times 2\pi R$ b) $\frac{1}{2}Mv^2$ c) $\frac{Mv^2}{R} \times \pi R$ d) zero
78. A body is dropped from a height of 8 m. After striking the surface it rises to 6 m, what is fractional loss in kinetic energy during impact? (Assuming air resistance to be negligible.)
    a) 2/5 b) 1/4 c) 3/4 d) 1/5
79. A ball of mass 100g is projected vertically upwards from the ground with a velocity of 49 m/s. At the same time another identical ball is dropped from a height of 98 m to fall freely along the same path as followed by the first ball. After sometime the two balls collide and stick together. The velocity of the 'combined mass' just after the collision is:
    a) 4.9 m/s upward b) 4.9 m/s downward c) 9.8 m/s upward d) 9.8 m/ downward
80. A sphere P of mass m and velocity V_i undergoes an oblique and perfectly elastic collision with an identical sphere Q initially at rest. The angle θ between the velocities of the spheres after the collision shall be
    a) 0 b) 45° c) 90° d) 180°
81. The power of a water pump is 2 kW If g = 10 m s^{-2}, the amount of water it can raise in one minute to a height of 10m is
    a) 2000 litre b) 1000 litre c) 100 litre d) 1200 litre
82. A ball falls under gravity from a height of 10 m with an initial downward velocity u. It collides with the ground, losses 50% of its energy in collision and then rises back to the same height. The initial velocity u is
    a) 7 m S^{-1} b) 25 m S^{-1} c) 14 m S^{-1} d) 28 m S^{-1}
83. A body of mass m falls from a height h and collides with another body of same mass. After collision the two bodies combine and move through distance till they come to rest. Find the work done against the resistive force.

a) $\frac{1}{2}mg(h+2d)$ b) $\frac{1}{2}mg(h+4d)$ c) $\frac{1}{2}mg(h-d)$ d) $\frac{1}{2}mg(h-2d)$

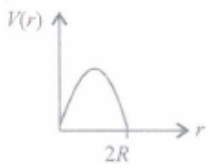
84. For photoelectric ernission frorn certain metal the cut-off frequency is n. If radiation of frequency 2v impinges on the metal plate, the maximum possible velocity of the emitted electron will be _____ (m is the electron mass)
a) $\sqrt{hv/m}$ b) $\sqrt{2hv/m}$ c) $2\sqrt{hv/m}$ d) $\sqrt{hv/(2m)}$

85. A stone is projected vertically upto reach maximum height h. The ratio of its KE to its potential energy at a height (4/5)h, will be:
a) 5: 4 b) 4: 5 c) 1: 4 d) 4: 1

86. Which of the following potential energy curves possibly describe the elastic collision of two billiard balls?
Here r is the distance between centres of the balls.

a) 

b) 

c) 

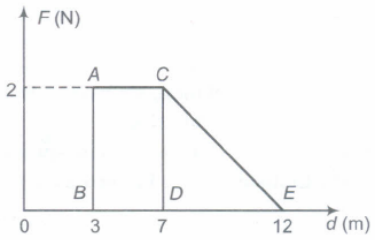
d) 

87. A body of mass 1 kg begins to move under the action of a time dependent force $F = \left(2t\hat{i} + 3t^2\hat{i}\right)$N, where 7 and) are unit vectors along x and y-axes. What power will be developed by the force at the time t?
a) $(2t^2 + 3t^{2)}W$ b) $(2t^2 + 4t^{4)}W$ c) $(2t^3 + 3t^4)W$ d) $(2t^3 + 3t^5)W$

88. When the force retards the motion of a body, the work done is:
a) zero b) -ve c) +ve
d) +ve or -ve depending upon the magnitude of force and displacement

89. The coefficient of restitution e for a perfectly elastic collision is _____
a) 1 b) 0 c) infinite d) -1

90. Force F on a particle moving in a straight line varies with distance d as shown in the figure. The work done on the particle during its displacement of 12m is:



a) 18 J b) 21 J c) 26 J d) 13 J

91. A bicyclist comes to a skidding stop in 10 m. During this process, the force on the bicycle due to the road is 200 N and is directly opposed to the motion. The work done by the cycle on the road is :
a) +2000 J b) -200 J c) zero d) 20000 J

92. A body of mass 1kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (g = 10 m/s^2)
a) 30J b) 40J c) 10J d) 20J

93. A spacecraft of mass M moves with velocity V in free space at first, then it explodes, breaking into two pieces. If after explosion a piece of mass m comes to rest, the other piece of spacecraft will have a velocity:

a) $\frac{MV}{M-m}$ b) $\frac{MV}{M+m}$ c) $\frac{mV}{M-m}$ d) $\frac{mV}{M+m}$

94. Which of the following is not an example of perfectly inelastic collision?
    a) A bullet fired into a block if bullet gets embedded into block
    b) Capture of electrons by an atom c) A man jumping onto a moving boat
    d) A ball bearing striking another ball bearing

95. A bob of mass m, suspended by a string of length l_1 is given a minimum velocity required to complete a full circle in the vertical plane. At the highest point, it collides elastically with another bob of mass m suspended by a string of length l_2, which is initially at rest. Both the strings are mass-less and inextensible. If the second bob, after collision acquires the minimum speed required to complete a full circle in the vertical plane, the ratio l_1/l_2 is
    a) 1 b) 3 c) 5 d) 1/5

96. If a body is moving on a horizontal rough road and the body is in dynamic equilibrium, then net work done is:
    a) +ve b) -ve c) zero d) unity

97. A neutron collides, head-on with a deuterium at rest. What fraction of the neutron's energy would be transferred to the deuterium?
    a) 89% b) 11% c) 79% d) 21%

98. The amount of energy released in burning 1 kg of coal is
    a) 3 MJ b) 30 MJ c) 300 MJ d) 3000 MJ

99. A moving body of mass mand velocity 3 km/h collides with a rest body of mass 2 m and sticks to it. Now the combined mass starts to move. What will be the combined velocity?
    a) 3 km/h b) 2 km/h c) 1 km/h d) 4 km/h

100. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly-off at right angles to each other, one with a velocity of $2\hat{i}$ m/s and the other with a velocity of $3\hat{j}$ m/s. If the explosion takes place in 10^{-5} see, the average force acting on the third piece (in newtons) is:
    a) $(2\hat{i}+3\hat{j})\times 10^{-5}$ b) $-(2\hat{i}+3\hat{j})\times 10^{-5}$ c) $(3\hat{j}-2\hat{i})\times 10^{5}$ d) $(2\hat{i}-3\hat{j})\times 10^{-5}$

101. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force F = k/ r2, where k is a constant:

    a) The potential energy of a particle is zero b) The potential energy of a particle is $\frac{k}{r}$

    c) The total energy of a particle is $-\frac{k}{2r}$ d) The kinetic energy of a particle is $-\frac{k}{r}$

102. Which of the following statements is incorrect?
    a) Most of the collisions on the macroscopic scale are inelastic collisions
    b) In a perfectly inelastic collision, there is a complete loss of KE

c) Forces involved in an elastic collision are conservative in nature

d)

Oblique collision is that collision in which the colliding bodies do not move along the same straight line path

103. A bullet of mass 10 g leaves a rifle at an initial velocity of 1000 m/s and strikes the earth at the same level with a velocity of 500 m/s. the work done in joules overcoming the resistance of air will be:

a) 375 b) 3750 c) 5000 d) 500

104. A bullet when fired at a target has its velocity decreased to 50% after penetrating 30 em into it. Then, the additional thickness it will penetrate before coming to rest is:

a) 10 cm b) 30 cm c) 40 cm d) 60 cm

105. Which of the following statements is true?

a) Kinetic energy is conserved in all types of collisions.

b) By definition there is no difference between elastic and perfectly elastic collisions

c) By definition there is no difference between inelastic and perfectly inelastic collisions.

d) After the collision, the relative displacement of the particles can decrease with time

106. When a long spring is stretched by 2 em, its potential energy is V. If the spring is stretched by 10 em, the potential energy in it will be

a) 10 V b) 25 V c) $\frac{V}{5}$ d) 5V

107. If the force acting on a body is inversely proportional to its speed, then its kinetic energy is

a) linearly related to time b) inversely proportional to time

c) inversely proportional to the square of time d) a constant

108. An elevator which can carry a maximum load of 1800 kg (elevator + passengers) is moving up with a constant speed of 2 m s^{-1}. The frictional force opposing the motion is 4000 N. What is minimum power delivered by the motor to the elevator?

a) 22 kW b) 44 kW c) 66 kW d) 88 kW

109. The work done in first six seconds is:

a) 18 m J b) zero c) $\frac{9}{2}$ m J d) 36 m J

110. Assertion: Work done by the force of friction in moving a body around a closed loop is zero.
Reason: Work done does not depend upon the nature of force.

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 both assertion and reason are false

111. A simple pendulum of length l is moved aside till the string makes an angle 9), with the vertical. If the acceleration due to gravity is g, the kinetic energy of the bob when the string is inclined at 92 to the vertical is

a) $mgl\cos\left(\theta_1-\theta_2\right)$ b) $mgl\left(\cos\theta_2-\cos\theta_1\right)$ c) $mgl\left(\cos\theta_1-\cos\theta_2\right)$ d) $mgl\sin\left(\theta_1-\theta_2\right)$

112. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine?
a) 400W b) 200w c) 100W d) 800W

113. A ball of mass m collides with a wall with speed v and rebounds on the same line with the same speed. If the mass of the wall is taken as infinite, then the work done by the ball on the wall is
a) mv^2 b) $\frac{1}{2}mv^2$ c) 2mv d) zero

114. A car of mass 400 kg and travelling at 72 km/h crashes into a truck of mass 4000 kg and travelling at 9 km/h in the same direction. The car bounces back at a speed of 18 km/h. The speed of the truck after the impact is:
a) 9 km/h b) 18 km/h c) 27 km/h d) 36 km/h

115. A car is driven for 0.9 sec. If the car travelling initially with 36 km/h is stopped by the driver after observing a signal by the deceleration of 5 m/s^2, the total distance travelled by the car before coming to rest is:
a) 19 m b) 26.5 m c) 21 m d) 28 m

116. A particle of mass m moving with a speed v hits elastically another stationary particle of mass 2m on a smooth horizontal circular tube of radius r. The time in which the next collision will take place is equal to:
a) $\frac{2\pi r}{v}$ b) $\frac{4\pi r}{v}$ c) $\frac{3\pi r}{2v}$ d) $\frac{\pi r}{v}$

117. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to expiosion is _____
a) mv^2 b) $\frac{3}{2}mv^2$ c) $3mv^2$ d) $4mv^2$

118. In a shotput event an athlete throws the shotput of mass 20 kg with an initial speed of 2 m S^{-1} at 45° from a height 3 m above ground. Assuming air resistance to be negligible and acceleration due to gravity to be 10 m S^{-2}, the kinetic energy of the shotput when it just reaches the ground will be :
a) 2.5 J b) 5 J c) 525 J d) 640 J

119. A bullet of mass m moving horizontally with a velocity v strikes a block of wood of mass M and gets embedded in the block. The block is suspended from the ceiling by a massless string. The height to which block rises is
a) $\frac{v^2}{2g}\left(\frac{m}{M+m}\right)^2$ b) $\frac{v^2}{2g}\left(\frac{M+m}{m}\right)^2$ c) $\frac{v^2}{2g}\left(\frac{m}{M}\right)^2$ d) $\frac{v^2}{2g}\left(\frac{M}{m}\right)^2$

120. bag P (mass M) hangs by a long thread and a bullet (mass m) comes horizontally with velocity υ and gets caught in the bag. Then for the combined (bag + bullet) system
a) momentum is $\frac{m\upsilon M}{M+m}$ b) kinetic energy is $\frac{1}{2}m\upsilon^2$ c) momentum is $\frac{m\upsilon(M+m)}{M}$
d) kinetic energy is $\frac{m^2\upsilon^2}{2(M+m)}$

121. An object of mass m is allowed to fall from rest along a rough inclined plane. The speed of the object on reaching the bottom of the plane is proportional to:
a) m^0 b) m c) m^2 d) m^{-1}

122. The potential energy of a certain spring when stretched through a distance s is 10 joule. The amount of work (in joule) that must be done on this spring to stretch it through additional distance swill be:
a) 30 b) 40 c) 10 d) 220

123. In the question number 25, the kinetic energy of the air is
a) $\frac{1}{2}Apvt$ b) $\frac{1}{2}Apv^2t$ c) $\frac{1}{2}Apv^3t$ d) $2Apv^3t$

124. A parrot is in a cage which is hanging from a spring balance. Initially, the parrot sits in the cage and in the second instance, the parrot flies about inside the cage:
a) the reading of the balance will be greater when the parrot flies in the cage:
b) the reading of the balance remains unchanged.
c) the reading of the balance remains unchanged. d) none of the above

125. A water pump lifts water at the rate of 5 litre per second through an average height of 8 m from a well of depth 12 m Its power will be:
a) 1280 watt b) 980 watt c) 1180 watt d) 1080 watt

126. The rate of change of kinetic energy is:
a) 0.4 joule/see b) 0.08 joule/see c) 0.04 joule/see d) 0.2 joule/see

127. A rubber ball is dropped from a height of 5 m on a planet where the acceleration due to gravity is not known. On bouncing, it rises to 1.8 m. The ball loses its velocity on bouncing by a factor of :
a) 16/25 b) 2/5 c) 3/5 d) 9/5

128. A body of mass m collides against a wall with a velocity v and rebounds with the same speed. Its change of momentum is
a) $2mv$ b) mv c) $-mv$ d) zero

129. If the momentum of a certain body be increased by 50%, its KE will increase by:
a) 25% b) 50% c) 100% d) 125%

130. Consider a drop of rain water having mass 1g falling from a height of 1 km. It hits the ground with a speed of 50 m/ s. Take g constant with a value of 10 m/s^2. The work done by the (i) gravitational force and the (ii) resistive force of air is _____
a) (i)-10 J, (ii)-8.25 J b) (i) 1.25 J, (ii) − 8.25 J c) (i) 100 J, (ii) − 8.75 J d) (i) 10 J, (ii) − 8.75 J

131. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant k = 50 N/m. The maximum compression of the spring would be _____
a) 0.5m b) 0.15m c) 0.12m d) 1.5m

132. Assertion: No work is done if the displacement is zero.
Reason: Work done by the force is defined to be the product of component of the force in the direction of the displacement and the magnitude of displacement.
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 both assertion and reason are false

133. A block of mass 0.50 kg is moving with a speed of 2.00 ms^{-1} on a smooth surface. It strikes another mass of 1.00 kg and then they move together as a single body. The energy loss during the collision is:
a) 0.16 J b) 1.00 J c) 0.67 J d) 0.34 J

134. A ball of mass m moves with speed v and strikes a wall having infinite mass and it returns with same speed, then the work done by the ball on the wall is:
a) zero b) mυJ c) (m/υ)J d) (υ/m)J

135. When the energy of the incident radiation is increased by 20% the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is _____
a) 0.65eV b) 1.0eV c) 1.3eV d) l.5eV

136. A boy weighing 50 kg finished long jump at a distance of 8 m. Considering that he moved along a parabolic path and his angle of jump was 45°, his initial KE will be:
a) 960 J b) 1560 J c) 2460 J d) 1960 J

137. A nuclide at rest emits an o-particle. In this process:
a) αparticle moves with large velocity and the nucleus remains at rest
b) both α-particle and nucleus move with equal speed in opposite directions
c) both move in opposite directions but nucleus with greater speed
d) both move in opposite directions but α-particle with greater speed

138. An electric motor creates a tension of 4500 N in a hoisting cable and reels it in at the rate of 2 m s^{-l}. What is the power of the electric motor?
a) 15 kW b) 9 kW c) 225 W d) 9000 hp

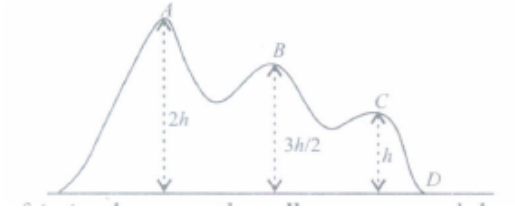
139. A shell of mass 200 grn is ejected from a gun of mass 4 kg by an explosion that generates 1.05 kJ of energy. The initial velocity of the shell is _____
a) 100 ms^{-1} b) 80 ms^{-1} c) 40 ms^{-1} d) 120 ms^{-1}

140. How much water a pump of 2 kW can raise in one minute to a height of 10 m? (Take g=10 m/s^2)
a) 1000L b) 1200L c) 100L d) 2000L

141. Assertion: Energy can neither be created nor destroyed.
Reason: The principle of conservation of energy cannot be proved.
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 both assertion and reason are false

142. A rope ladder with a length 1 carrying a man with a mass mat its end is attached to the basket of a balloon with a mass M. The entire system is in equilibrium in the air. As the man climbs up the ladder into the balloon, the balloon descends by a height h. Then, the potential energy of the man:
a) increases by mg(l- h) b) increases by mgl c) increases by mgh
d) increases by mg(21 - h)

143. A small roller coaster starts at point A with a speed u on a curved track as shown in the figure



The friction between the roller coaster and the track is negligible and it always remains in contact with the track. The speed of roller coaster at point D on the track will be

a) $(u^2 + gh)^{1/2}$ b) $(u^2 + 2gh)^{1/2}$ c) $(u^2 + 4gh)^{1/2}$ d) u

144. A body is initially at rest. It undergoes one dimensional motion with constant acceleration. The power delivered to it at time *t* is proportional to

a) $t^{1/2}$ b) t c) $t^{3/2}$ d) t^2

145. A car is moving on a straight horizontal road with a speed u. If the coefficient of friction between the tyres and the road is u, the shortest distance in which the car can be stopped is:

a) $\frac{v^2}{2\mu g}$ b) $\frac{v^2}{\mu g}$ c) $\left(\frac{v}{\mu g}\right)^2$ d) $\frac{v^2}{\mu}$

146. The correct relation between joule and erg is :

a) $1J = 10^{-5}$ erg b) $1J = 10^5$ erg c) $1J = 10^{-7}$ erg d) $1J = 10^7$ erg

147. A ball is dropped from height h on a plane. If the coefficient of restitution of the plane is e and if ball hits ground two times, the height upto which it reaches after two jumps, will be:

a) e^4 h b) eh c) 2eh d) eh/2

148. In an elastic collision between two bodies, complete energy is transferred when:

a) both bodies have equal mass b) both bodies are moving

c) heavy body is moving and lighter one is at rest

d) heavy body is moving and lighter one is at rest

149. The vessels A and B of equal volume and weight are immersed in water to depth h. The vessel A has an opening at the bottom through which water can enter. If the work done in immersing A and Bare W_A and W_B respectively, then:

a) $W_A = W_B$ b) $W_A < W_B$ c) $W_A > W_B$ d) none of these

150. A bullet having a speed of 100 m/sec crashes through a plank of wood. After passing through a plank, its speed is 80 m/sec. Another bullet of the same mass and size, but travelling at 80 m/sec, is fired at the plank. The speed of the second bullet after travelling through the plank is: (Assume that resistance of the plank is independent of the speed of the bullet)

a) $10\sqrt{7}ms^{-1}$ b) $20\sqrt{7}ms^{-1}$ c) $30\sqrt{7}ms^{-1}$ d) $20\sqrt{5}ms^{-1}$

151. A body contained to move in y-direction is subjected to a force given by:

$\vec{F} = (-2\hat{i} + 15\hat{j} + 6\hat{k})N$

The work done by this force in moving the body a distance of 10 m along the y-axis is:

a) 20 J b) 150 J c) 160 J d) 190 J

152. If the kinetic energy of a particle is increased by 300%, the momentun: of the particle will increase by _____

a) 20% b) 200% c) 100% d) 50%

153. A body of mass 1 kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (g = 10 ms^{-2})
a) 30 J b) 40 J c) 10 J d) 20 J

154. A body projected vertically from the earth reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force is greatest _____
a) at the highest position of the body b) at the instantjust before the body hits the earth
c) it remains constant all through d) at the instantjust after the body is projected

155. A ball whose KE is E_1, is thrown at an angle of 45° with the horizontal; its KE at the highest point of its flight will be:
a) $E/\sqrt{2}$ b) E/2 c) zero d) E

156. Two equal masses ml and m_2 moving along the same straight line with velocities +3 m/s and -5 m/s respectively, collide elastically. Their velocities after the collision will be respectively:
a) +4 m s^{-1} for both b) -3 m s^{-1} and +5 m s^{-1} c) 4 m s^{-1} and +4 m s^{-1}
d) -5 m s^{-1} and +3 m s^{-1}

157. The blades of a windmill sweep out a circle of area A. If the wind flows at a velocity v perpendicular to the circle, then the mass of the air of density p passing through it in time t is
a) $Av\rho t$ b) $2Av\rho t$ c) $Av^2\rho t$ d) $\frac{1}{2}Av\rho t$

158. In perfectly inelastic collisions, the relative velocity of the bodies:
a) before impact is zero b) before impact is zero c) after impact is zero
d) is characterised by none of the above

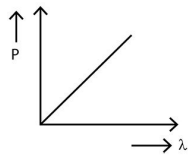
159. A vessel at rest explodes, breaking it into three pieces. Two pieces having equal mass fly-off perpendicular to one another with the same speed of 30 m/s. The third piece has three times the mass of each other piece. What is the direction and magnitude of its velocity immediately after the explosion?
a) $10\sqrt{2}$ m/s,135^0 b) $10\sqrt{2}$ m/s,90^0 c) $10\sqrt{2}$ m/s,60^0 d) $10\sqrt{2}$ m/s,30^0

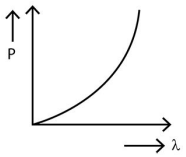
160. A ball is dropped from a height of 20 cm. Ball rebounds to a height of 10 cm. What is the loss of energy?
a) 25% b) 75% c) 50% d) 100%

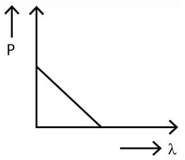
161. A ball is let to fall from a height ho. There are n collisions with the Earth. If the velocity of rebound after n collisions is v_n and the ball rises to a height h_n, then coefficient of restitution e is given by:
a) $e^n = \sqrt{\frac{h_n}{h_0}}$ b) $e^n = \sqrt{\frac{h_0}{h_n}}$ c) $ne = \sqrt{\frac{h_n}{h_0}}$ d) $\sqrt{ne} = \sqrt{\frac{h_n}{h_0}}$

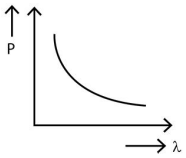
162. A body of mass 4 kg is moving with momentum of 8 kg m s^{-1}. A force of 0.2 N acts on it in the direction of motion of the body for 10 s. The increase in kinetic energy is
a) 10 J b) 8.5 J c) 4.5 J d) 4 J

163. Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength?

a) 

b) 

c) 

d) 

164. A proton is kept at rest. A positively charged particle is released from rest at a distance d in its field. Consider two experiments; one in which the charged particle is a proton and in another a positron. In the same time t, the work done on the two moving charged particles is
a) same as the same force law is involved in the two experiments
b)
less for the case of a positron, as the positron moves away more rapidly and the force on it weakens
c) more for the case of a positron, as the positron moves away a larger distance.
d) same as the work done by charged particle on the stationary proton

165. A body of mass 40 kg having velocity 4 m/s collides with another body of mass 60 kg having velocity 2 m/s. If the collision is inelastic, then loss in kinetic energy will be:
a) 440 J b) 392 J c) 48 J d) 144 J

166. Force of 4 N is applied on a body of mass 20 kg. The work done in 3rd second is:
a) 2J b) 4J c) 16 J d) 1.2J

167. A trolley of mass 300 kg carrying a sand bag of 25 kg is moving uniformly with a speed of 27 km/h on a frictionless track. After a while, sand starts leaking out of a hole on the floor of the trolley at the rate of 0.05 kg /sec. What is the speed of the trolley after the entire sand bag is empty?
a) 30 m/s b) 27 km/h c) 35 m/s d) 35 km/h

168. A ball moving with a velocity ur collides elastically with another ball of equal mass, in a one-dimensional collision. Which of the following is not possible?
a) First ball will come to rest b) Second ball will move with a velocity $\vec{\mu_1}$
c) Both balls will move with velocity $\vec{\mu_1}$ after collision
d) The first ball will move with a velocity less than $\vec{\mu_1}$

169. A big particle of mass (3 + m) kg blasts into 3 pieces, such that a particle of mass 1 kg moves along x-axis, with velocity 2m/s and a particle of mass 2 kg moves with velocity 1 m/s perpendicular to direction of 1 kg particle. If the third particle moves with velocity $\sqrt{2}$ m/s, then m/s:
a) 2 kg b) 1 kg c) $2\sqrt{2}$ kg d) none of these

170. In the question number 13, the work done by friction in 10 s is
a) 200 J b) -200 J c) 600 J d) -600 J

171. 1000 kg elevator rises from rest in the basement to the fourth floor, a distance of 20 m. As it passes the fourth floor its speed is 4 m/sec. There is a constant frictional force of 500 N. The work done by the lifting mechanism is
a) 196 x 10^3 J b) 204 x 10^3 J c) 214 x 10^3 J d) 203 x 10^5 J

172. Two bodies A and B have masses 20 kg and 5 kg respectively. Each one is acted upon by a force of 4 kg wt. If they acquire the same kinetic energy in times t_A and t_B, then the ratio $\frac{t_A}{t_B}$ is :

a) $\frac{1}{2}$ b) 2 c) $\frac{2}{5}$ d) $\frac{5}{6}$

173. A ball is allowed to fall from a height of 10 m. If there is 40% loss of energy due to impact, then after one impact ball will go up to:

a) 10 m b) 8 m c) 4 m d) 6 m

174. An electric pump is used to fill an overhead tank of capacity 9 m^3 kept at a height of 10m above the ground. If the pump takes 5 minutes to fill the tank by consuming 10 kW power, the efficiency of the pump should be: (Takeg = $10ms^{-2}$)

a) 60% b) 40% c) 20% d) 30%

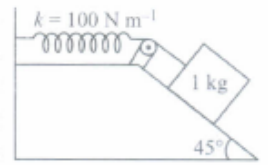
175. A mass m moving horizontally (along the x-axis) with velocity y collides and sticks to mass of 3m moving vertically upward (along they-axis) with velocity 2v. Thi final velocity of the combination is _____

a) $\frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}$ b) $\frac{1}{3}v\hat{i} + \frac{2}{3}v\hat{j}$ c) $\frac{2}{3}v\hat{i} + \frac{1}{3}v\hat{j}$ d) $\frac{3}{2}v\hat{i} + \frac{1}{4}v\hat{j}$

176. Two masses ma and mb moving with velocities v_a and v_b in opposite direction collide elastically and after that m_a and m_b move with velocities v_b and v_a respectively. Then the ratio m_a/m_b is:

a) $\frac{v_a - v_b}{v_a + v_b}$ b) $\frac{m_a + m_b}{m_a}$ c) 1 d) 1/2

177. A 1 kg block situated on a rough incline is connected to a spring of negligible mass having spring constant 100 N m^{-1} as shown in the figure.



The block is released from rest with the spring in the unstretched position. The block moves 10 cm down the incline before coming to rest. The coefficient of friction between the block and the incline is

(Take g = 10 m s^{-2} and assume that the pulley is frictionless)

a) 0.2 b) 0.3 c) 0.5 d) 0.6

178. A bucket full of water weighs 5 kg, it is pulled from a well 20 m deep. There is a small hole in the bucket through which water leaks at a constant rate of 0.2 kg/m. The total work done in pulling the bucket up from the well is : (g = 10 m/s^2)

a) 600 J b) 400 J c) 100 J d) 500 J

179. A particle of mass 4 m which is at rest explodes into three fragments. Two of the fragments, each of mass m are found to move with a speed of v each in perpendicular directions. What is the total energy released in the process?

a) $3mv^2$ b) $\frac{7}{2}mv^2$ c) $\frac{3}{2}mv^2$ d) $4mv^2$

180. A ball of mass m_1 makes a head-on elastic collision with a ball of mass m_2 which is initially at rest. The transfer of kinetic energy to the second ball is maximum when:

a) $m_1 >> m_2$ b) $m_1 = m_2$ c) $m_1 < 2$ d) $m_1 \not< m_2$

181. The area under force-displacement curve represents
a) velocity b) acceleration c) impulse d) work done

182. A machine is delivering constant power to drive a body along a straight line. What is the relation between the distance travelled by the body against time?
a) $s^2 \propto t^3$ b) $s^2 \propto t^{-3}$ c) $s^3 \propto t^2$ d) $S \propto t^3$

183. A neutron moving with velocity v collides with a stationary α-particle. The velocity of the neutron after the collision is:
a) -3v/5 b) 3v/5 c) 2v/5 d) -2v/5

184. If two masses m_1 and m_2 collide, the ratio of change in their respective velocities is proportional to:
a) $\frac{m_1}{m_2}$ b) $\sqrt{\frac{m_1}{m_2}}$ c) $\frac{m_2}{m_1}$ d) $\sqrt{\frac{m_2}{m_1}}$

185. A bullet of mass m is fired with certain velocity from a gun of mass M. Gun, which is attached with one end of spring, compresses it by distance d. If k is spring constant, then velocity of bullet is:
a) $(d/m)\sqrt{km}$ b) $(d/m)\sqrt{km}$ c) $md\sqrt{1/Mk}$ d) $mk\sqrt{1/dM}$

186. The velocity of the second ball is maximum when
a) $m_1 >> m_2$ b) $m_l = m_2$ c) $m_1 << m_2$ d) $m_1 \not< m_2$

187. If a ball of mass m elastically collides against a wall with velocity v and returns in the opposite direction with the same velocity, then the change in momentum is equal to:
a) 2m b) 2v c) 2mv d) 4mv

188. An open watertight railway wagon of mass 5 x 10^3 kg is moving with an initial velocity of 1.2 m/s without friction on a railway track. Rain falls vertically downwards into the wagon. What change will occur in the kinetic energy of the wagon, when it has collected 10^3 kg of water?
a) 1200 J b) 300 J c) 600 J d) 900 J

189. Which of the following is not an inelastic collision?
a) A man jumps on a cart b) A bullet embedded in a block c) Collision of two glass balls
d) None of the above

190. A ball of mass 2 kg and anothef of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of
a) $1:\sqrt{2}$ b) $\sqrt{2}:1$ c) 1:4 d) 1:2

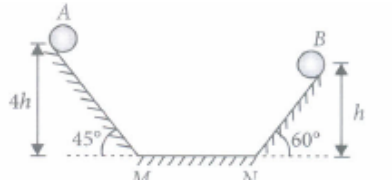
191. On microscopic level, all forms of energy may be studied as:
a) potential b) kinetic c) potential or kinetic d) nuclear

192. Two billiard balls, each of mass 50 g, moving in opposite directions to each other with a speed 6 m/s collide and rebound with the same speed. The impulse imparted to each ball is:
a) 0.3 N-s b) 0.6 N-s c) 0.9 N-s d) 1.2 N-s

193. A particle of mass 100 g is thrown vertically upwards with a speed of S m/s. The work done by the force of gravity during the time the particle goes up is:

a) -0.5J b) -125J c) 1.25J d) 0.5J

194. Two identical balls A and B are released from the positions shown in the figure. They collide elastically on horizontal portion MN. The ratio of heights attained by A and B after collision will be (neglect friction)



a) 1: 4 b) 2: 1 c) 4: 13 d) 2: 11

195. Match the Column I with Column II

Column I		**Column II**	
(A)	When a body does work against friction, its kinetic energy	(i)	independent of time
(B)	Work done by a body is	(ii)	time
(C)	Power of a body varies inversely as	(iii)	force must be conservative
(D)	When work done over a closed path is zero	(iv)	decreases

a) A - p, B - q, C - r, D - s b) A - q, B - r, C - s, D - P c) A - s, B - r, C - q, D - P
d) A - s, B - P. C - q, D - r

196. A position dependent force F = (7 - 2x + $3x^2$) N acts on a small abject of mass 2 kg to displace it from x = 0 to x = 5 m. The work done in joule is:
a) 70 J b) 270 J c) 35 J d) 135 J

197. If the potential energy of a gas molecule is $U = \frac{M}{r^6} - \frac{N}{r^{12}}$, M and N being positive constants, then the potential energy at equilibrium must be:
a) zero b) $M^2/4N$ c) $N^2/4M$ d) $MN^2/4$ e) $NM^2/4$

198. Force acting on a particle moving in a straight line varies with the velocity of the particle as $F = \frac{K}{v}$, where K is a constant. The work done by this force in time tis:

a) $\frac{K}{v^2}t$ b) 2Kt c) Kt d) $\frac{2Kt}{v^2}$

199. A particle of mass 10 g moves along a circle of radius 6.4 em with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8×10^{-4} J by the end of the second revolution after the beginning of the motion?
a) 0.2 m/s^2 b) 0.1 m/s^2 c) 0.15 m/s^2 d) 0.18 m/s^2

200. A particle of mass m is driven by a machine that delivers a constant power of k watts. If the particle starts from rest the force on the parlicle at time t is _____
a) $\sqrt{mkt}^{-1/2}$ b) $\sqrt{2mkt}^{-1/2}$ c) $\frac{1}{2}\sqrt{mkt}^{-1/2}$ d) $\sqrt{\frac{mk}{2}}t^{-1/2}$

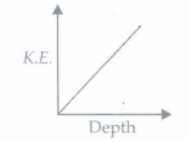
201. The threshold fiequency for a photosensitive metal is 3.3 $\times$ 10^{14} Hz. If light of frequency 8.2 $\times$ 10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly _____

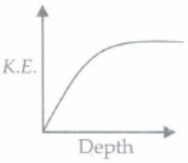
a) 2V b) 3V c) 5V d) 1V

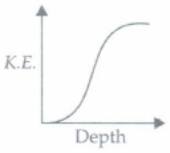
202. A particle of mass 2 m is projected at an angle of 45° with the horizontal with a velocity of 20. $\sqrt{2}$ m/s. After I see explosion takes place and the particle is broken into two equal pieces. As a result of explosion one part comes to rest. The maximum height from the ground attained by the other part is:(g = 10 m/s^2)

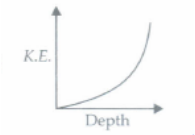
a) 50 m b) 25 m c) 40 m d) 35 m

203. Which of the diagrams in figure correctly shows the change in kinetic energy of an iron sphere falling freely in a lake having sufficient depth to impart it a terminal velocity?

a) 

b) 

c) 

d) 

204. A ball bounces to 80% of its original height. What fraction of its potential energy is lost in each bounce?

a) 0.20 b) 0.60 c) 0.40 d) 1

205. A bullet of mass 10 gm is fired horizontally with a velocity 1000 ms^{-1} from a rifle situated at a height 50 m above the ground. If the bullet reaches the ground with a velocity 500 m s^{-1}, the work done against air resistance in the trajectory of the bullet is: (Take g = 10 ms^{-2})

a) 5005 J b) 3755 J c) 3750 J d) 17.5 J

206. A particle in a certain conservative force field has a potential energy given by V = $\frac{20xy}{z}$. The force exerted on it is :

a) $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{K}$ b) $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}+\left(\frac{20xy}{z^2}\right)\hat{K}$ c) $-\left(\frac{20y}{z}\right)\hat{i}-\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{K}$

d) $\left(\frac{20y}{z}\right)\hat{i}+\left(\frac{20x}{z}\right)\hat{j}-\left(\frac{20xy}{z^2}\right)\hat{K}$

207. Which of the following energies is conserved for the system?

a) Kinetic energy b) Potential energy c) Mechanical energy d) None of these

208. The work done in dragging a stone of mass 100 kg up an inclined plane 1 in 100 through a distance of 10 m is:

a) zero b) 980J c) 9800J d) 98J

209. The first ball of mass m moving with a velocity u collides head-on with the second ball of mass m at rest. If the coefficient of restitution is e, then the ratio of the velocities of the first and the second ball after the collision is:

a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{1+e}{2}$ d) $\frac{1-e}{2}$

210. Which of the following statements is correct?

a) Kinetic energy of a system can be changed without changing its momentum

b) Kinetic energy of a system cannot be changed without changing its momentum

c) Momentum of a system cannot be changed without changing its kinetic energy.

d) Body cannot have energy without having momentum

211. A particle of mass 5 m initially at rest explodes into three fragments with mass ratio 3: 1: 1. Two of the fragments each of mass m are found to move with a speed 60 m/s in mutually perpendicular directions. The velocity of third fragment is:

a) $60\sqrt{2}\ ms^{-1}$ b) $20\sqrt{3}\ ms^{-1}$ c) $10\sqrt{2}\ ms^{-1}$ d) $20\sqrt{2}\ ms^{-1}$

212. A neutron in a nuclear reactor collides head on elastically with the nucleus of a carbon atom initially at rest. The fraction of kinetic energy transferred from the neutron to the carbon atom is

a) $\frac{11}{12}$ b) $\frac{2}{11}$ c) $\frac{48}{121}$ d) $\frac{48}{169}$

213. A mass of 2.9 kg is suspended from a string of length 50 cm and is at rest. Another body of mass 10 gm which is moving horizontally with a velocity of 150 m/sec strikes it. After striking the two bodies combine together. The tension in the string, when it makes an angle of 60° with the vertical, is:

a) 135.3 N b) 165.5 N c) 142.4 N d) 90 N

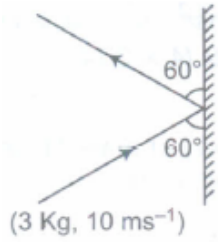
214. An electron and a proton are detected in a cosmic ray experiment, the first with kinetic energy 10 keV, and the second with 100 keV. The ratio of their speeds is (where me and mp are masses of electron and proton respectively)

a) $\sqrt{\frac{1}{10}\frac{m_e}{m_p}}$ b) $\sqrt{\frac{1}{10}\frac{m_p}{m_e}}$ c) $\frac{1}{10}\frac{m_e}{m_p}$ d) $\frac{1}{10}\frac{m_p}{m_e}$

215. A particle of mass M, starting from rest, undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is:

a) $\frac{MV^2}{T}$ b) $\frac{1}{2}\frac{MV^2}{T^2}$ c) $\frac{MV^2}{T^2}$ d) $\frac{1}{2}\frac{MV^2}{T}$

216. A 3 kg ball strikes a heavy rigid wall with a speed of 10 m/s at an angle of 60°. It gets reflected with the same speed and angle as shown here. If the ball is in contact with the wall for 0.20 s, what is the average force exerted on the ball by the wall



a) 150N b) zero c) $150\sqrt{3}N$ d) 300 N

217. If v be the instantaneous velocity of the body dropped from the top of a tower, when it is located at height h, then which of the following remains constant?

a) gh + v^2 b) $gh + \frac{v^2}{2}$ c) $gh - \frac{v^2}{2}$ d) gh- v^2

218. A particle strikes elastically with another particle with velocity V. After collision, it moves with half the velocity in the same direction. Find the velocity of the second particle if it is initially at rest.

a) $\frac{3V}{2}$ b) $\frac{V}{2}$ c) V d) none of these

219. A body of mass 3 kg is under a force which causes a displacement in it, given by $s = t^2/3$ (in m). Find the work done by the force in 2 second
a) 2 J b) 3.8 J c) 5.2 J d) 2.6 J

220. A ball collides elastically with another ball of the same mass. The collision is oblique and initially one of the balls was at rest. After the collision, the two balls move with same speeds. What will be the angle between the velocity of the balls after the collision?
a) 30° b) 45° c) 60° d) 90°

221. A ball strikes against the floor and returns with double the velocity; in which type of collision is it possible?
a) Perfectly elastic b) Inelastic c) Perfectly inelastic d) It is not possible

222. A U^{238} nucleus initially at rest emits an a-particle and is converted into Th^{234}. If the KE of α-particle be 4.1 MeV, the KE of the residual Th^{234} nucleus is:
a) 6.8 MeV b) 0.68 MeV c) 0.07008 MeV d) 0.0068 MeV

223. An object of mass 5 kg is projected with a velocity of 20 m S^{-1} at an angle of 60° to the horizontal. At the highest point of its path, the projectile explodes and breaks up into two fragments of masses 1 kg and 4 kg. The fragments separate horizontally after the explosion, which releases internal energy such that K.E. of the system at the highest point is doubled. Find the separation between the two fragments when they reach the ground.
a) 11 m b) 22 m c) 44 m d) 66 m

224. Water is falling on the blades of a turbine from a height of 25 m. 3 x 10^3 kg of water pours on the blade per minute. If the whole of energy is transferred to the turbine, power delivered is:
a) 12250 W b) 16250 W c) 8250 W d) 20250 W

225. A 0.5 kg ball moving with speed of 12 m/s strikes a hard wall at an angle of 30^o with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.25 seconds, the average force acting on the wall is _____ .
a) 24N b) 12N c) 96N d) 48N

226. The potential energy of a system increases if work is done _____
a) upon the system by a non-conservative force
b) by the system against a conservative force
c) by the system against a non-conservative force
d) upon the system by a conservative force

227. A ball of mass m is dropped from a cliff of height H. The ratio of its kinetic energy to the potential energy when it is fallen through a height 3/4 H is
a) 3:4 b) 4:3 c) 1:3 d) 3:1

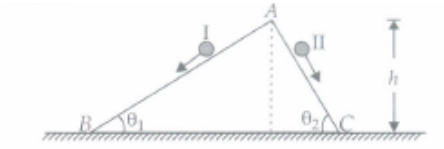
228. The potential energy of a 1 kg particle free to move along the x-axis is given by:
$V(x) = (\frac{x^4}{4} - \frac{x^2}{2})J$
The total mechanical energy of the particle is 2 J. Then the maximum speed (in m/s) is:
a) 2 b) $3/\sqrt{2}$ c) $\sqrt{2}$ d) $1/\sqrt{2}$

229. A man squatting on the ground gets straight up and stands. The force of reaction of ground on the man during the process is
a) constant and equal to mg in magnitude. b) constant and greater than mg in magnitude.
c) variable but always greater than mg

d) at first greater than mg, and later becomes equal to mg.

230. Two bodies, having masses in the ratio 1: 4, have kinetic energies in the ratio 4: 1. The ratio of their linear momentum is
a) 1: 1 b) 1: 2 c) 2: 1 d) 1: 4

231. Two inclined frictionless tracks, one gradual and the other steep meet at A from where two stones are allowed to slide down from rest, one on each track as shown in figure. Which of the following statements is correct?



a) Both the stones reach the bottom at the same time but not with the same speed
b)
Both the stones reach the bottom with the same speed and stone I reaches the bottom earlier than stone II.
c)
Both the stones reach the bottom with the same speed and stone II reaches the bottom earlier than stone I.
d) Both the stones reach the bottom at different times and with different speeds

232. A solid cylinder of mass 2 kg and radius 4 cm is rotating about its axis at the rate of 3 rpm. The torque required to stop after 2p revolutions is _____
a) 2×10^{-3}Nm b) 12×10^{4}Nm c) 2×10^{6}Nm d) 2×10^{-6}Nm

233. A moving mass of 8 kg collides elastically with a stationary mass of 2 kg. If E be the initial kinetic energy of the moving mass, the kinetic energy left with it after the collision will be:
a) 0.80E b) 0.64E c) 0.36E d) 0.08E

234. A car running at 25 km h^{-1} can be brought to rest by applying brakes in a distance of 0.5 m. If the car is running at 75 km h^{-1}how far will it go before coming to rest, if the braking force remains the same?
a) 1m b) 2m c) 3 m d) None of these

235. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de- Broglie wavelength of the particle is _____
a) 25% b) 75% c) 60% d) 50%

236. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between road and tyres is 0.5, the shortest distance in which the car can be stopped is:
a) 30 m b) 40 m c) 72 m d) 20 m

237. Two bodies of masses 0.1 kg and 0.4 kg move towards each other with the velocities 1 m/s and 0.1 m/s respectively. After collision they stick together. In 10 see the combined mass travels:
a) 120 m b) 0.12 m c) 12 m d) 1.2 m

238. A man M_1 of mass 80 kg runs up a staircase in 15 s. Another man M_2 also of mass 80 kg runs up the same staircase in 20 s. The ratio of the power developed by them will be:
a) 1 b) 4/3 c) 16/9 d) none of these

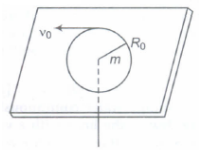
239. How many 2.5 kg bricks can a man carry up a staircase 3.6 m high in one hour if he works at the average rate of 9.8 watt?
a) 800 b) 200 c) 600 d) 400

240. A beam of cathode rays is subjected to crossed Electric (E) and Magnetic fields (B). The fields are adjusted such that the beam is not deflected. The specific charge of the cathode rays is given by _____
a) $\frac{B^2}{2VE^2}$ b) $\frac{2VB^2}{E^2}$ c) $\frac{2VE^2}{B^2}$ d) $\frac{E^2}{2VB^2}$

241. A body of mass m moving with a velocity u collides elastically directly against another stationary body of mass 3m. The velocity of the second body after the collision will be:
a) $\frac{u}{2}$ b) $\frac{u}{3}$ c) $\frac{u}{4}$ d) u

242. In the question number 15, the work done by applied force is
a) 10 J b) 50 J c) 100 J d) 150 J

243. A mass m moves in a circle on a smooth horizontal plane with velocity V_0 at a radius R_0. The mass is attached to a string which passes through a smooth hole in the plane as shown. The tension in the string is increased gradually and finally m moves in a circle of radius $R_0/2$. The final value of the kinetic energy is



a) $2mv_0^2$ b) $1/2mv_0^2$ c) mv_0^2 d) $1/4mv_0^2$

244. In which of the following cases the work done increases the potential energy?
a) Both conservative and non-conservative forces b) Conservative force only
c) Non-conservative force only d) Neither conservative nor non-conservative forces

245. A billiard ball moving with a speed of 5 m/s collides with an identical ball, originally at rest. If the first ball stops dead after collision, then the second ball will move forward with a speed of:
a) 10 ms^{-1} b) 5 ms^{-1} c) 2.5 ms^{-1} d) 1.0 ms^{-1}

246. A block is released from the top of a smooth inclined plane of inclination θ . Let v be the speed of the particle after travelling a distance s down the plane. Then which of the following will remain constant?
a) $v^2 + 2g\sin\theta$ b) $v^2 - 2g\sin\theta$ c) $v^2 - \sqrt{2g\sin\theta}$ d) $v^2 + \sqrt{2g\sin\theta}$

247. A bullet of mass m moving with velocity v strikes a suspended wooden block of mass M. If the block rises to a height h, the initial velocity of the bullet will be:
a) 200 m/s b) 220 m/s c) 204 m/s d) 284 m/s

248. Photons with energy 5 eV are incident on a cathode C in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 6 eV are incident on C, no photoelectrons will reach the anode A, if the stopping potential of Arelative to C is _____
a) +3V b) +4V c) -1V d) -3V

249. The kinetic energy acquired by a mass (m) in travelling distance (s) starting from rest under the action of a constant force is directly proportional to:
a) $1/\sqrt{m}$ b) 1/m c) $\sqrt{m}$ d) m

250. Assertion: Energy associated with a mere kilogram of matter is 9×10^{16} J
Reason: It follows from the relation $E = mc^2$
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 both assertion and reason are false

251. A cricket ball of mass 0.5 kg strikes a cricket bat normally with a velocity of 20 ms^{-1} and rebounds with a velocity of 10 ms^{-1} . The impulse of the force exerted by the ball on the bat is:
a) 15N-s b) 25N-s c) 30N-s d) 10N-s

252. A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump? (Take g = 10 m S^{-2})
a) 36.5 kW b) 44.4 kW c) 52.5 kW d) 60.5 kW

253. A particle of mass m_1 is moving with a velocity v_1 and another particle of mass m_2 is moving with a velocity v_2. Both of them have the same momentum but their different kinetic energies are E_1 and E_2 respectively. If $m_1 > m_2$ then _____
a) $E_1 = E_2$ b) $E_2 > E_1$ c) $\frac{E_1}{E_2} = \frac{m_1}{m_2}$ d) $E_1 > E_2$

254. A spring is compressed between two toy carts of masses m_1 and m_2. When the toy carts are released the spring exerts on each toy cart equal and opposite forces for the same time t. If the coefficients of friction J.I between the ground and the toy carts are equal, then the displacements of the toy carts are in the ratio
a) $\frac{s_1}{s_2} = \frac{m_2}{m_1}$ b) $\frac{s_1}{s_2} = \frac{m_1}{m_2}$ c) $\frac{s_1}{s_2} = \left(\frac{m_2}{m_1}\right)^2$ d) $\frac{s_1}{s_2} = \left(\frac{m_1}{m_2}\right)^2$

255. The work done by friction in 10 s is
a) 200 J b) -200 J c) 600 J d) -600 J

256. The change of momentum of the first ball is maximum when
a) $m_1 >> m_2$ b) $m_1 = m_2$ c) $m_1 << m_2$ d) $m_1 \overset{<}{-} > m_2$

257. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of
a) $1:\sqrt{2}$ b) $\sqrt{2}:1$ c) 1 : 4 d) 1 : 2

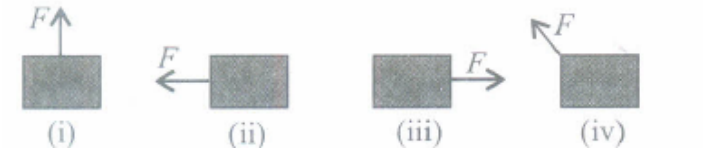
258. A uniform force of $(3\hat{i} + \hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i} + \hat{k})$ metre to position $(4\hat{i} + 3\hat{j} - \hat{k})$ metre. The work done by the force on the particle is:
a) 6 J b) 13 J c) 15 J d) 9 J

259. A plastic ball is dropped from a height of 1m and rebounds several times from the floor. If 1.03 sec elapse from the moment it is dropped to the second impact with the floor, what is the coefficient of restitution?
a) 0.03 b) 0.64 c) 0.02 d) 0.05

260. A rock of mass m is dropped to the ground from a height h. A second rock with mass 2m is dropped from the same height. When second rock strikes the ground, what is its kinetic energy?
a) Twice that of the first rock b) Four times that of the first rock
c) The same as that of the first rock d) Half that of the first rock

261. Two spheres A ard B mass m_1 and m_2 respectively collide. A is at rest initially and B is moving with velocity v along x-axis. After collision B has a velocity $\frac{v}{2}$ direction perpendicular to the original direction. The mass A moves after collision in the direction.
a) Same as that of, B b) Opposite to that of B c) $\mathrm{q} = \tan^{-1}(1/2)$ to the x-axis
d) $\mathrm{q} = \tan^{-1}(-1/2)$ to the x-axis

262. Figure shows four situations in which a force is applied to a block. In all four cases, the force has the same magnitude, and the displacement of the block is to the right and of the same magnitude. Which of the following cases work done by the applied force on the block is zero?



a) (i) b) (ii) c) (iii) d) (iv)

263. A tennis ball falls freely from a height H on to an inclined smooth plane making an angle 45° with horizontal. After bouncing the ball falls on the plane again. The distance between the two points striking the plane is:
a) $4\sqrt{2}H$ b) $\frac{H}{\sqrt{2}}$ c) $H\sqrt{2}$ d) zero

264. When two bodies collide elastically, then
a) KE of the system alone is conserved b) KE of the system alone is conserved
c) KE of the system alone is conserved d) neither KE nor momentum is conserved

265. A ball of mass m moving with a speed $2v_o$ collides head-on with an identical ball at rest. If e is the coefficient of restitution, then what will be the ratio of velocity of two balls after collision?
a) $\frac{1-e}{1+e}$ b) $\frac{1+e}{1-e}$ c) $\frac{e-1}{e+1}$ d) $\frac{e+1}{e-1}$

266. A weightlifter lifts a weight off the ground and holds it up
a) work is done in lifting as well as holding the weight
b) no work is done in both lifting and holding the weight
c) work is done in lifting the weight but no work is required to done in holding it up
d) no work is done in lifting the weight but work is required to be done in holding it up

267. Electrons used in an electron microscope are accelerated by avoltage of 25 kV. If the voltage is increased to 100 kV then the de-Broglie wavelength associated with the electrons would _____ .
a) increase by 2 times b) decrease by 2 times c) decrease by 4 time
d) increase by 4 times

268. If a person is pushing a box inside a moving train, the work done in the frame of the earth will be:

a) $\vec{F}.\vec{s_0}$ b) $\vec{F}.\vec{s}$ c) $\vec{F}.\left(\vec{s}+\vec{s_0}\right)$ d) zero

269. A bullet hits and gets embedded in a solid block resting on a frictionless surface. In this process which one of the following is correct?
a) Only momentum is conserved b) Only kinetic energy is conserved
c) Neither momentum nor kinetic energy is conserved
d) Both momentum and kinetic energy are conserved.

270. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from the ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be:
a) 2 Mg/k b) 4 Mg/k c) Mg/2k d) Mg/k

271. Two spheres of same size, one of mass 2 kg and another of mass 4 kg, are dropped simultaneously from the top of Qutub Minar (height =72 m). When they are 1m above the ground, the two spheres have the same:
a) momentum b) kinetic energy c) potential energy d) acceleration

272. If two balls, each of mass 0.06 kg moving in opposite directions with speed 4 m/s collide and rebound with the same speed, then the impulse imparted to each ball due to other is:
a) 0.48 kg-m/s b) 0.24 kg-m/s c) 0.81 kg-m/s d) zero

273. A heavy weight is suspended from a spring. A person raises the weight till the spring becomes slack. The work done by him is W. The energy stored in the stretched spring was E. What will be the gain in gravitational potential energy?
a) W b) E c) W + E d) W-E

274. An object of mass m accelerates uniformly from rest to a speed v_F in time t_F. The work done on the object as a function of time t in terms of v_F and t_F is:

a) $W=\frac{1}{2}mv_F^2t_F^2t^2$ b) $W=\frac{1}{2}m\left(\frac{v_F}{t_F}\right)t^2$ c) W=zero d) $W=\frac{1}{2}m\left(\frac{v_F}{t_F}\right)^2t^2$

275. Three particles each of mass m are located at vertices of an equilateral triangle ABC. They start moving with equal speeds each along the medians of the triangle and collide at its centroid G. If after collision A comes to rest and B returns on its path along GB, then C:
a) also comes to rest b) also comes to rest c) moves with a speed along BG
d) moves with a speed along AG

276. Two unequal masses are tied together with a compressed spring. When the cord is burnt with a match releasing the spring the two masses fly apart with equal
a) kinetic energy b) speed c) momentum d) acceleration

277. A crane lifts a mass of 100 kg to a height of 10m in 20 s. The power of the crane is (Take g = 10 m S^{-2})
a) 100 W b) 200 W c) 250 W d) 500 W

278. The work done in lifting water from a well 6 m deep using a bucket of mass 0.5 kg and volume 2.5 litres will be:
a) 176.4J b) 4.764×10^3J c) 276.4J d) 3.76×10^2J

279. A neutron moving with velocity u collides elastically with an atom of mass number A. If the collision is head-on and the initial kinetic energy of neutron is E, then the final kinetic energy of the neutron after collision is:
a) $(\frac{A+1}{A-1})^2 E$ b) $(\frac{A-1}{A+1})^2 E$ c) $(\frac{A-1}{A+1}) E$ d) $(\frac{A+1}{A-1}) E$

280. A block of mass 2 kg initially at rest moves under the action of an applied horizontal force of 6 N on a rough horizontal surface. The coefficient of friction between block and surface is 0.1. The work done by the applied force in 10 s is (Take g = 10 m s^{-2})
a) 200 J b) -200 J c) 600 J d) -600 J

281. A toy gun uses a spring of force constant K. When charged before being triggered in the upward direction, the spring is compressed by a distance x. If the mass of shot is m, on being triggered it will go upto a height of:
a) $\frac{Kx^2}{mg}$ b) $\frac{x^2}{Kmg}$ c) $\frac{Kx^2}{2mg}$ d) $\frac{K^2x^2}{mg}$

282. Assertion: Kilowatt hour is the unit of power.
Reason: One kilowatt hour is equivalent to 3.6 x 10^5 J.
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 both assertion and reason are false

283. The angle between force $\vec{F} = (3\hat{i} + 4\hat{j} - 5\hat{k})$ unit and displacement $\vec{d} = (5\hat{i} + 4\hat{j} + 3\hat{k})$ unit is
a) $\cos^{-1}(0.16)$ b) $\cos^{-1}(0.32)$ c) $\cos^{-1}(0.24)$ d) $\cos^{-1}(0.64)$

284. When two spheres of equal masses undergo glancing elastic collision with one of them at rest, after collision they will move
a) opposite to one another b) in the same direction c) together
d) at right angle to each other

285. A source S_1 is producing, 10^{15} photons por second of wavelength 5000. Another source S_2 is producing 1.02 $\times$ 10^{15} photonsper second of wavelength 5100 then, (power of S_2) is equal to_____
a) 1.00 b) 1.02 c) 1.04 d) 0.98

286. A curved surface is shown in figure. The portion BCD is frictionless. There are two spherical balls of identical radii and masses. Balls are released from rest one by one from A which is at a slightly greater height than C. With the surface AB, ball 1 has a small friction and ball 2 has a negligible friction. For which balls is total mechanical energy conserved?

a) 1 and 2 b) 1 c) 2 d) Cannot be predicted

287. In an explosion a body breaks up into two pieces of unequal masses. In this:
a) both parts will have numerically equal momentum
b) lighter part will have more momentum c) heavier part will have more momentum
d) both parts will have equal kinetic energies

288. A simple pendulum is vibrating in an evacuated chamber. It will oscillate with:

a) constant amplitude b) decreasing amplitude c) increasing amplitude
d) none of these

289. A body is acted upon by a force which is inversely proportional to the distance x. The work done will be proportional to:
a) x b) x^2 c) $x^{3/2}$ d) none of these

290. The number of photoelectrons emitted for light of- a frequency v (higher than the threshold frequency vo) is proportional to _____
a) Threshold frequency (v_0) b) Intensity of light c) Frequency of light d) $v - v_0$

291. The earth circles the sun once a year. The work which would have to be done on the earth to bring it to rest relative to the sun is : (Ignore the rotation of the earth about its own axis. Given that mass of the earth = 6×10^{24} kg and distance between the sun and the earth is 1.5×10^8 km)
a) 2.7×10^{30} J b) 2.7×10^{31} J c) -2.7×10^{33} J d) $+ 2.7 \times 10^{33}$ J

292. The kinetic energies in joule at t = 0 and t = 6 see are respectively:
a) 0 and 0 b) 18 m and 18 m c) 0 and 18 m d) 18 m and 0

293. A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement x is proportional to:
a) x^2 b) e^X c) x d) $\log_e x$

294. A bullet of mass m fired at 30° to the horizontal leaves the barrel of the gun with a velocity v. The bullet hits a soft target at a height h above the ground while it is moving downward and emerges out with half the kinetic energy it had before hitting the target. Which of the following statements is correct in respect of bullet after it emerges out of the target?
a) The velocity of the bullet remains the same.
b) The velocity of the bullet will be reduced to half its initial value.
c) The velocity of the bullet will be more than half of its earlier velocity
d) The bullet will continue to move along the same parabolic path.

295. Two men with weights in the ratio 4 : 3 run up a staircase in time in the ratio 12 : 11. The ratio of power of the first to that of second is
a) $\frac{4}{3}$ b) $\frac{12}{11}$ c) $\frac{48}{33}$ d) $\frac{11}{9}$

296. The speed of the earth is:
a) zero b) equal to that of the ball c) greater than that of the ball
d) much less than that of the ball

297. The centripetal acceleration of a particle varies inversely with the square of the radius r of the circular path. The kinetic energy of the particle is directly proportional to:
a) r b) r^2 c) r^{-1} d) r^{-2}

298. The instantaneous power delivered to the body in time t is proportional to:
a) $\frac{V}{T}t$ b) $\frac{V^2}{T}t^2$ c) $\frac{V^2}{T^2}t$ d) $\frac{V^2}{T^2}t^2$

299. Two blocks of wood P and Qare connected with each other through a spring and are placed on a frictionless table. If the spring is compressed and released, then K p : KQ will be equal to
a) $m_Q : m_p$ b) $\sqrt{m_Q} : \sqrt{m_p}$ c) $\sqrt{m_p} : \sqrt{m_q}$ d) $m_p : m_Q$

300. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude P_o. The instantaneous velocity of this car is proportional to

_____

a) t^2P_0 b) $t^{1/2}$ c) $t^{-1/2}$ d) $\frac{t}{\sqrt{m}}$

301. A pump motor is used to deliver water at a certain rate from a given pipe. To obtain, twice as much water from the same pipe, in the same time, the power of motor has to be increased to:
a) 2 times b) 4 times c) 8 times d) 16 times

302. A stone of mass 10 kg is lying at the bed of a lake 5 m deep. If the relative density of the stone is 2, the amount of work done to bring it to the top of the lake will be:
a) 245J b) 285 J c) 345J d) 385J

303. Two identical balls A and B moving with velocities + 0.5 m/s and - 0.3 m/s respectively, collide head on elastically. The velocity of the balls A and B after collision will be respectively

_____

a) - 0.3 m/s and + 0.5 m/s b) + 0.3 m/s and 0.5 m/s c) 0.5 m/s and + 0.3 m/s
d) + 0.5 m/s and + 0.3 m/s

304. The wavelength 1, of an electron and λ_p of a photon are of same energy E are related by

_____

a) $\lambda_p \propto \lambda_e$ b) $\lambda_p \propto \sqrt{\lambda_e}$ c) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$ d) $\lambda_p \propto \lambda_e^2$

305. A tennis ball is thrown from a-height h above the ground. If the ball strikes to the ground with elastic collision, what height will the ball achieve after the third collision?
a) he^6 b) e^2h c) e^3h d) None of these

306. At her maximum height, a girl in a swing is 3 m above the ground and at the lowest point she is 2 m above the ground. What is her maximum velocity?
a) $\sqrt{29.4}ms^{-1}$ b) $\sqrt{98}ms^{-1}$ c) $\sqrt{1.6}ms^{-1}$ d) $9.8ms^{-1}$

307. The potential energy function for the force between two atoms in a diatomic molecule is approximately given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^2}$ where a and b are constants and x is the distance between the atoms. If the dissociation energy of the molecules is $D = \left[U(x=\infty) - U_{at \quad equilibriam}\right]$, D is

a) $\frac{b^2}{2a}$ b) $\frac{b^2}{12a}$ c) $\frac{b^2}{4a}$ d) $\frac{b^2}{6a}$

308. A bullet when fired at a target with a velocity of 100 mlsec penetrates one metre into it. If the bullet is fired at a similar target with a thickness 0.5 metre, then it will emerge from it with a velocity of:

a) $5\sqrt{2}$ m/s b) $\frac{50}{\sqrt{2}}$ m/s c) 50 m/s d) 10 m/s

309. Two bodies M and N of equal masses are suspended from two separate springs of spring constants K_1 and K_2 respectively. If the two bodies oscillate vertically such that their maximum velocities are equal, the ratio of the amplitude of vibration of M to that of N is

a) $\frac{K_1}{K_2}$ b) $\sqrt{\frac{K_1}{K_2}}$ c) $\frac{K_2}{K_1}$ d) $\sqrt{\frac{K_2}{K_1}}$

310. A ball is 'thrown on a staircase with the initial velocity u. It will strike with the nth step for what value of x, where band h are the width and height of step respectively?

a) $n = \frac{2hu^2}{b^2g}$ b) $n = \frac{hu^2}{b^2g}$ c) $n = \frac{hu^2}{2b^2g}$ d) $n = \frac{3hu^2}{2b^2g}$

311. The negative of the work done by the conservative internal forces on a system equals to the change in

a) total energy b) kinetic energy c) potential energy d) none of these

312. The potential energy of the balloon:

a) decreases by mgh b) increases by mgh c) increases by mg(l- h)
d) increases by mgl

313. On a frictionless surface, a block of mass M moving at speed v collides elastically with another block of same mass M which is initially at rest. After collision the first block moves at an angle θ to its initial direction and has a speed v/3. The second block's speed after the collision is:

a) $\sqrt{3}/2v$ b) $2\sqrt{2}/3v$ c) 3/4v d) $3/\sqrt{2}$v

314. If a number of forces act on a body and the body is in static or dynamic equilibrium, then:

a) work done by individual forces must be zero b) net work done is +ve
c) net work done is -ve d) net work done is zero

315. In question number 4, the speed of the block at point C, immediately before it leaves the second incline is

a) $\sqrt{120}$ m/s b) $\sqrt{105}$ m/s c) $\sqrt{90}$ m/s d) $\sqrt{75}$ m/s

316. A body is falling freely under the action of gravity alone in vacuum. Which of the following quantities remain constant during the fall?

a) Kinetic energy b) Potential energy c) Total mechanical energy
d) Total linear momentum

317. A bullet of mass 10 g leaves a rifle at an initial veloocity of 1000 m/s and strikes the earth at the same level with a velocity of 500 m/s. The work done in.ioule to overcome the resistance of air will be _____

a) 375 b) 3750 c) 5000 d) 500

318. During inelastic collision between two bodies, which of the following quantities always remains conserved?

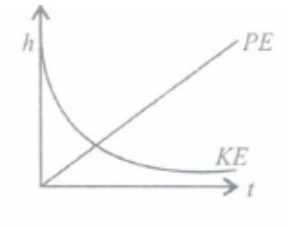
a) Total kinetic energy b) Total mechanical energy c) Total linear momentum
d) Speed of each body

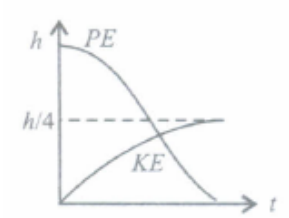
319. In inelastic collision:

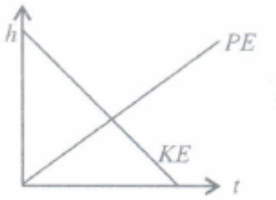
a) momentum, kinetic energy and total energy are conserved
b) momentum, kinetic energy and total energy are not conserved

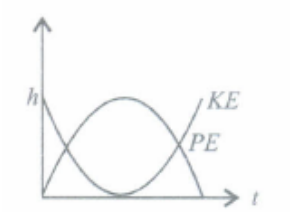
c) momentum and kinetic energy are conserved but total energy is not conserved
d) total energy and momentum are conserved but kinetic energy is not conserved

320. A raindrop falling from a height h above ground, attains a near terminal velocity when it has fallen through a height $\frac{3}{4}h$. Which of the diagrams shown in figure correctly shows the change in kinetic and potential energy of the drop during its fall up to the ground?

a) 

b) 

c) 

d) 

321. The height of the dam, in a hydroelectric power station is 10m. In order to generate 1MW of electric power, the mass of water (in kg/s) that must fall per second on the blades of the turbines is
a) 10^6 b) 10^5 c) 10^3 d) 10^4

322. The recoil velocity of a 4.0 kg rifle that shoots a 0.050 kg bullet at a speed of 280 ms $^{-1}$ is:
a) +3.5ms^{-1} b) -3.5ms^{-1} c) $-\sqrt{3.5}ms^{-1}$ d) $+\sqrt{3.5}ms^{-1}$

323. A body of mass 5 kg falls from a height of 20 m on the ground and it rebounds to a height of 0.2 m. If the loss in potential energy is used up by the body, then what will be the temperature rise? (Specific heat of the material = 0.09 cal gm^{-1} °C^{-1})
a) 5°C b) 4°C c) 8°C d) None of these

324. bullet of mass 10 g moving horizontally with a velocity of 400 m s $^{-1}$ strikes of wooden block of mass 2 kg which is suspended by a light inextensible string of length 5m. As aresult the centre of gravity of the block is found to rise a vertical distance of 10 cm. The speed of the bullet after it emerges out horizontally from the block will be
a) 160 m s^{-1} b) 100 m s^{-1} c) 80 m s^{-1} d) 120 m s^{-1}

325. A person holding a rifle (mass of person and rifle together is 100 kg) stands on a smooth surface and fires 10 shots horizontally, in 5 s. Each bullet has a mass of 10 g with a muzzle velocity of 800 ms^{-l} . The final velocity acquired by the person and the average force exerted on the person are _____
a) $-1.6\ \text{ms}^{-1}; 8\ \text{N}$ b) $-0.08\ \text{ms}^{-1}; 16\ \text{N}$ c) $-0.8\ \text{ms}^{-1}; 8\ \text{N}$ d) $1.6\ \text{ms}^{-1}; 16\ \text{N}$

326. A body is being raised to a height h from the surface of earth. What is the sign of work done by applied force and gravitational force respectively?
a) Positive, Positive b) Positive, Negative c) Negative, Positive d) Negative, Negative

327. The human hean discharges 75 cc of blood through the arteries at each beat against an average pressure of 10 em of mercury. Assuming that the pulse frequency is 72 per minute, the rate of working of heart is: (Density of mercury = 13.6 gm/cc and g = 9.8m/s^2)

a) 11.9W b) 1.19W c) 0.119W d) 119W

328. A running man has half the kinetic energy than a boy of half his mass has. The man speeds up by 1 m/sec and then has the same kinetic energy as the boy. What were the origin a speeds (in m s-I) of the man and the boy respectively?
a) 2.4, 4.8 b) 2.4, 3.4 c) 3.4,4.8, d) 3.4,6.8

329. Two balls at the same temperature collide, which is conserved?
a) Temperature b) Velocity c) Kinetic energy d) Momentum

330. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hanges freely from the edge of the table. The total mass of the chain is 4 kg. The work done in pulling the entire chain on the table (Take g = 10m s^{-2})
a) 12.9 J b) 6.3 J c) 3.6 J d) 2.0 J

331. A uniform chain has a mass m and length I. It is held on a frictionless table with one-sixth of its length hanging over the edge. The work done in just pulling the hanging part back on the table is:
a) $\frac{mgl}{72}$ b) $\frac{mgl}{36}$ c) $\frac{mgl}{12}$ d) $\frac{mgl}{6}$

332. The string of a pendulum is of length I. It is made horizontal and then left. A nail is located at a distance d below the point of suspension. For the ball to completely swing around in a circle centred on the nail, the value of d in terms of length I is:
a) 0.5I b) 0.6I c) 0.4I d) 0.25I

333. A litre of petrol, on complete combustion, gives off heat equivalent to 3 x 10^7 J. In a test drive, a car weighing 1200 kg, including the mass of driver, runs 15 km/litre, while moving with a uniform speed on a straight track. Assuming that friction offered by the road surface and air to be uniform. Calculate the force of friction acting on the car during the test drive, if the efficiency of the car engine were 0.5.
a) 100 N b) 1000 N c) 500 N d) 5000 N

334. A force of 10N displaces an object by 10 m. If work done is 50 J, then direction of force, make an angle with the direction of displacement:
a) 120^0 b) 90° c) 60° d) none of these

335. When a spring is wound, a certain amount of PE is stored in it. If this wound spring is dissolved in acid, the stored energy:
a) is completely lost b) appears in the form of electromagnetic waves
c) appears in the form of heat raising the temperature of acid
d) appears in the form of KE by splashing acid drops

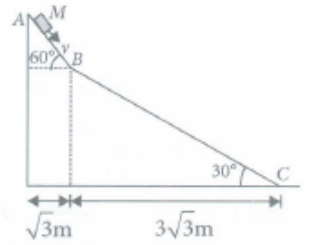
336. If K_I and K_F represent the initial and final kinetic energies of the system respectively, then:
a) $K_I = K_F = 0$ b) $K_I = 0, K_F < 0$ c) $K_I = 0, K_F > 0$ d) $K_I > O, K_F > 0$

337. An engine is attached to a wagon through a shock absorber of length 1.5 m. The system with a total mass of 50,000 kg is moving with a speed of 36 km/h, when the brakes are applied to bring it to rest. In the process of the system being brought to rest, the spring of the shock absorber gets compressed by 1.0 m. If 90% of energy of the wagon is lost due to friction, calculate the spring constant.
a) 10^4 N/m b) 6 x 10^2 N/m c) 5 x 10^5 N/m d) 3 x 10^4 N/m

338. A cable pulls a box with force of 5 kN and raises it at the rate of 2 m s-l. What is the power of the engine providing tension to the cable?
a) 2 kW b) 2.5 kW c) 5 kW d) None of these

339. The work done against force of friction is
a) 8.7 J b) 10.7 J c) 7.8 J d) 12.7 J

340. A small block of mass M moves on a frictionless surface of an inclined plane, as shown in the figure. The angle of the incline suddenly changes from 60° to 30° at point B. The block is initially at rest at A. Assume that collisions between the block and the incline are totally inelastic. The speed of the block at point B immediately after it strikes the second incline is



a) $\sqrt{60}$ m/s b) $\sqrt{45}$ m/s c) $\sqrt{30}$ m/s d) $\sqrt{15}$ m/s

341. If a body is placed on another body and is moving with it, then work done by frictional force on the upper body relative to ground is:
a) -ve b) zero c) +ve d) unity

342. Two similar springs P and Q have spring constants K_P and K_Q, such that $K_P > K_Q$. They are stretched, first by the same amount (case a,) then by the same force (case b). The work done by the springs W_P and W_Q are related as, in case (a) and case (b), respectively _____ .
a) $W_P = W_Q; W_P = W_Q$ b) $W_P > W_Q; W_Q > W_P$ c) \(W_{P} d) $W_P = W_Q; W_P > W_Q$

343. block of mass 2 kg is dropped from a height of 40 cm on a spring whose force-constant is 1960 N m^{-1}. The maximum distance through which the spring is compressed by :
a) 5 cm b) 15 cm c) 20 cm d) 10 cm

344. The work done by applied force is
a) 10 J b) 50 J c) 100 J d) 12.7 J

345. A body just dropped from a tower explodes into two pieces of equal mass in mid-air. Which of the following is not possible?
a) Each part will follow parabolic path b) Only one part will follow parabolic path
c) Both parts move along a vertical line
d) One part reaches the ground earlier than the other

346. A shell is fired from a cannon with velocity v m/s at an angle e with the horizontal direction. At the highest point in its path, it explodes into two pieces of equal mass. One of the pieces retraces its path to the cannon and the speed (in m/s) of the other piece immediately after the explosion is:
a) $3v\cos\theta$ b) $2v\cos\theta$ c) $\frac{3v}{2}\cos\theta$ d) $\frac{\sqrt{3}v\cos\theta}{2}$

347. Water falls from a height of 60 m at the ratio of 15 kg/s to operate a turbine. The losses due to frictional forces are 10% of energy. How much power is generated by the turbine? (g = 10m/ s^2)
a) 12.3 kW b) 7.0 kW c) 8.1 kW d) 10.2 kW

348. A body of mass 1000 kg is moving horizontally with a velocity 50 m/s. A mass of 250 kg is added. Find the final velocity:
a) 40 m/s b) 20 m/s c) $30\sqrt{2}\ m/s$ d) 50 m/s

349. Consider a one-dimensional motion of a particle with total energy E. There are four regions A, B, C and D in which the relation between potential energy V, kinetic energy K and total energy E is as given below:
Region A : V > E Region B : V < E
Region C : K > E Region D : V > K
Which of the following regions the particle cannot be found?
a) Region A b) Region B c) Region C d) Region D

350. α-parlicle consists of _____
a) 2 electrons,2 protons and 2 neutrons b) 2 electrons and 4 protons only
c) 2 protons only d) 2 protons and 2 neutrons only

351. If g is acceleration due to gravity on the earth's surface, the gain in the potential energy of an object of mass m raised from surface of the earth to a height equal to radius R of the earth is:
a) $\frac{1}{2}$mgR b) 2mgR c) mgR d) $\frac{1}{4}$ mgR

352. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m, above the ground. The velocity attained by the ball is:
a) 10 m/s b) 30 m/s c) 40 m/s d) 20 m/s

353. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power ernitted is 9 m W. The number of photons arriving per sec on the average at a target irradiated by this beam is _____
a) 3×10^6 b) 9×10^{15} c) 3×10^{19} d) 9×10^{17}

354. A neutron having mass of 1.67 x 10^{-27} kg and moving at 108 m/s collides with a deutron at rest and sticks to it. If the mass of the deutron is 3.34 x 10^{-27} kg; the speed of the combination is:
a) 2.56 x 10^3 m/s b) 2.98 x 10^5 m/s c) 3.33 x 10^7 m/s d) 5.01 x 10^9 m/s

355. A mass of 20 kg moving with a speed of 10 m/s collides with another stationary mass of 5 kg. As a result of the collision, the two masses stick together. The kinetic energy of the composite mass will be:
a) 600 J b) 1000 J c) 800 J d) 1200 J

356. Light of two different frequencies whose photons have energies 1eV and 2.5eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximurn speeds of emitted electrons will be _____
a) 1:4 b) 1:2 c) 1:1 d) 1:5

357. A body constrained to move along y-axis is subjected to a constant force $\vec{F} = -\hat{i} + 2\hat{j} + 3\hat{k}$N. The work done by this force in moving the body a distance of 4 m along y-axis is
a) 4 J b) 8 J c) 12 J d) 24 J

358. A 50 kg mass is travelling at a speed of 2 m/s. Another 60 kg mass is travelling at a speed of 12 m/s in the same direction, strikes the first mass. After the collision the 50 kg mass is travelling with a speed of 4 m/s. The coefficient of restitution of the collision is:
a) $\frac{19}{30}$ b) $\frac{30}{19}$ c) $\frac{20}{11}$ d) $\frac{11}{20}$

359. If the ball is thrown towards the surface of the earth:
a) the earth remains stationary while the ball moves downwards
b) the ball remains stationary while the earth moves upwards
c) the ball and the earth move towards each other
d) the ball and the earth move away from each other

360. When a constant force is applied to a body moving with constant acceleration, power does not remain constant. For power to be constant, the force has to vary with speed as follows:
a) $F \propto \frac{1}{v}$ b) $F \propto \frac{1}{\sqrt{v}}$ c) $F \propto v$ d) $F \propto v^2$

361. Two putty balls of equal mass moving with equal velocity in mutually perpendicular directions, stick together after collision. If the balls were initially moving with a velocity of $45\sqrt{2}$ ms^{-1} each, the velocity of their combined mass after collision is:
a) $22.5\sqrt{2}$ ms^{-1} b) 90 ms^{-1} c) 45 ms^{-1} d) 5 ms^{-1}

362. A simple pendulum of mass 200 gm and length 100 cm is moved aside till the string makes an angle of 60° with the vertical. The kinetic and potential energies of the bob, when the string is inclined at 30° to the vertical, are:
a) 7.174 x 10^6 erg, 2.626 x 10^6 erg b) 7.174 x 10^6 erg, 2.626 x 10^6 erg
c) 2.6 x 10^6 erg, 5.6 x 10^6 erg d) 3.6 x 10^6 erg, 6.2 x 10^6 erg

363. Two particles having position vectors $\vec{r}_1 = (3\hat{i} + 5\hat{j})$ metres and $\vec{r}_2 = (-5\hat{i} - 3\hat{j})$ metres are moving with velocities $\vec{v}_1 = (4\hat{i} + 3\hat{j})$ and $\vec{v}_2 = (a\hat{i} + 7\hat{j})$ m/s. If they collide after 2 seconds, the value of a is:
a) 2 b) 4 c) 6 d) 8

364. In a ballistics demonstration a police officer fires a bullet of mass 50 g with speed 200 m S-I on soft plywood of thickness 2 cm. The bullet emerges with only 10% of its initial kinetic energy. The emergent speed of the bullet is
a) $2\sqrt{10}$ms^{-1} b) $20\sqrt{10}$ms^{-1} c) $10\sqrt{2}$ms^{-1} d) $10\sqrt{20}$ms^{-1}

365. If K E and K B are the kinetic energies of the earth and the ball respectively, then:
a) $\frac{K_E}{K_B} = 1$ b) $\frac{K_E}{K_B} = \frac{m}{M}$ c) $\frac{K_E}{K_B} = \frac{M}{m}$ d) $\frac{K_E}{K_B} = \frac{m^2}{M^2}$

366. During an inelastic collision of two particles
a) $(KE)_{final} = (KE)_{initial}$ b) $(KE)_{final\ must}$ be greater than $(KE)_{initial}$
c) $(KE)_{final\ must}$ be less than $(KE)_{initial}$ d) $(KE)_{final}$ may be greater or less than $(KE)_{initial}$

367. Two bodies with masses M_I and M_2 have equal kinetic energies. If P_I and P_2 are their respective momenta, then P_1 / P_2 is equal to:
a) $M_1 : M_2$ b) $M_1^2 : M_2^2$ c) $M_1^2 : M_2^2$ d) $\sqrt{M_1} : \sqrt{m_2}$

368. A smooth sphere is moving on a horizontal surface with velocity vector $2\hat{i} + 2\hat{j}$ immediately before it hits a vertical wall. The wall is parallel to $\hat{j}$ vector and the coefficient of restitution between the sphere and the wall is e = $\frac{1}{2}$ The velocity vector of the sphere after it hits the wall is:
a) $\hat{i} - \hat{j}$ b) $-\hat{i} + 2\hat{j}$ c) $-\hat{i} - \hat{j}$ d) $2\hat{i} - \hat{j}$

369. A certain metallic surface is illuminated with monochromatic light of wavelength 1. The stopping potential forphoto-electric current for this light is $3V_o$. If the same surface is illuminated with light of wavelength 21, the stopping potential is V_o. The threshold wavelength for this surface for photo-electric effect is _____
a) 4λ b) $\frac{\lambda}{4}$ c) $\frac{\lambda}{6}$ d) 61

370. The velocity of a particle at which the kinetic energy is equal to its rest energy is:
a) $\left(\frac{3c}{2}\right)$ b) $3\frac{c}{\sqrt{2}}$ c) $\frac{(3c)^{1/2}}{2}$ d) $\frac{c\sqrt{3}}{2}$

371. An electron and a proton are moving under the influence of mutual forces. In calculating the change in the kinetic energy of the system during motion, one ignores the magnetic force of one on another. This is because,
a) the two magnetic forces are equal and opposite, so they produce no net effect
b) the magnetic forces do no work on each particle.
c) the magnetic forces do equal and opposite (but non-zero) work on each particle.
d) the magnetic forces are necessarily negligible.

372. Assertion: A spring has potential energy, when it is either compressed or stretched.
Reason: In compressing or stretching a spring, work is done on it against the restoring force.
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 both assertion and reason are false

373. Two balls A and B of mass 0.10 kg and 0.25 kg respectively are connected by a stretched spring of negligible mass and placed on a smooth table. When the balls are released simultaneously, the initial acceleration of ball B is 10 cm/s^2 westward. The magnitude and direction of acceleration of the ball A are
a) 2.5 cm/sec^2 , westward b) 2.5 cm/sec^2 , eastward c) 25 cm/sec^2 , westward
d) 25 cm/sec^2 , eastward

374. Power supplied to a particle of mass 2 kg varies with time as $\boldsymbol{P} = \frac{\boldsymbol{3t^2}}{\boldsymbol{2}}$ watt. Here, I is in seconds. If velocity of particle at t = 0 is υ = 0, the velocity of particle at time t = 2 s will be:
a) 1 m/s b) 4 m/s c) 2 m/s d) $2\sqrt{2} m/s$

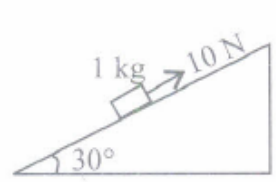
375. A particle moves from a point $(-2\hat{i}+5\hat{j})$ to $(4\hat{j}+3\hat{k})$ when a force of $(4\hat{i}+3\hat{j})$ N is applied. How much work has been done by the force?
a) 8 J b) 11 J c) 5 J d) 2 J

376. Which of the following statements is wrong?
a) KE of a body is independent of the direction of motion
b)
In an elastic collision of two bodies, the momentum and energy of each body is conserved
c) If two protons are brought towards each other, the PE of the system increases
d) A body can have energy without momentum.

377. Which one of the following is not a conservative force?
a) Force of friction b) Magnetic force c) Gravitational force d) Electrostatic force

378. Assertion: A light body and a heavy body have same momentum. Then they also have same kinetic energy.
Reason: Kinetic energy does not depend on mass of the body.
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 both assertion and reason are false

379. A block of mass 1 kg is pushed up a surface inclined to horizontal at an angle of 30° by a force of 10 N parallel to the inclined surface as shown in the figure.
The coefficient of friction between block and the incline is 0.1. If the block is pushed up by 10 m along the incline, then the work against gravity is (Take g = 10 ms^{-2})



a) 10 J b) 50 J c) 100 J d) 150 J

380. One man takes 1 minute to raise a box to a height of 1 metre and another man takes 1/2 minute to do so. The energy of the two is
a) different b) same c) energy of the first is more d) energy of the second is more

381. Identify the false statement from the following.
a) Work-energy theorem is not independent of Newton's second law.
b) Work-energy theorem holds in all inertial frames
c) Work done by friction over a closed path is zero d) Work done is a scalar quantity.

382. A body of mass m, moving with uniform velocity of 40 m/sec, collides with another mass m_2 at least and then the two together begin to move with a uniform velocity of 30 m/sec. The ratio of their masses (m_1/m_2) is:
a) 0.75 b) 1.33 c) 3.0 d) 4.0

383. A machine has an efficiency of 25%. Energy is fed into the machine at the rate of 1 kW. The output of the machine is:
a) 40 W b) 250 W c) 750 W d) 25 kW

384. A pendulum bob of mass m is hanging from a fixed point by a light thread of length l. A horizontal speed V_o is imparted to the bob so that it takes up horizontal position. If g is the acceleration due to gravity, then V_o is:
a) mgl b) $\sqrt{2gl}$ c) $\sqrt{gl}$ d) gl

385. A light body A and a heavy body B have equal linear momentum. Then the KE of the body A:
a) is equal to that of B b) is greater than that of B c) is smaller than that of B d) is zero

386. Assertion: For two bodies, the sum of the mutual forces exerted between them is zero from Newton's third law.
Reason: The sum of work done by the two forces must always cancel.
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 both assertion and reason are false

387. out of the following which energy ofsystem is conserved?
a) Potential energy b) Mechanical energy c) None of these d) Kinetic energy

388. Water is flowing in a river at 2 m S^{-1}. The river is 50 m wide and has an average depth of 5 m. The power available from the current in the river is (Density of water = 1000 kg m^{-3})
a) 0.5 MW b) 1 MW c) 1.5 MW d) 2 MW

389. Energy required to break one bond in DNA is
a) 10^{-10} J b) 10^{-18} J c) 10^{-7} J d) 10^{-20} J

390. A ball of mass M_1 collides elastically and head-on with another ball of mass M_2 which is initially at rest. In which of the following cases the transfer of momentum will be maximum?
a) $M_1 = M_2$ b) $M_1 > M_2$ c) M_1 2 d) Data is not sufficient to predict it

391. Two bodies with kinetic energies in the ratio 4 : 1 are moving with equal linear momentum. The ratio of their masses is _____
a) 1:2 b) 1:1 c) 4:1 d) 1:4

392. A particle of mass m moving with velocity v collides with a stationary particle of mass 2m. The speed of the system after collision will be:
a) v/2 b) 2v c) v/3 d) 3v

393. An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-l} and the second part of mass 2 kg moves with speed 8 ms^{-1}. If the third part flies off with speed 4 ms^{-l} then its mass is _____
a) 5Kg b) 7Kg c) 17Kg d) 3Kg

394. A moving block having mass m, collides with another stationary block having mass 4m. The lighter block fomes to rest after collision. When the initial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be:
a) 0.8 b) 0.25 c) 0.5 d) 0.4

395. Which of the following remains constant for an isolated system?
a) Sum of kinetic energy and potential energy b) Kinetic energy c) Potential energy
d) None of the above

396. A particle acted upon by constant force $4\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ is displaced from the point $i + 2\hat{j} + 3\hat{k}$ to point $5\hat{i} + 4\hat{j} + \hat{k}$. The total work done by the forces in SI unit is
a) 20 b) 40 c) 50 d) 30

397. A variable force, given by the 2-dimensional vector $\vec{F} = \left(3x^2\hat{i} + 4\hat{j}\right)$, acts on a particle. The force is in newton and x is in metre. What is the change in the kinetic energy of the particle as it moves from the point with coordinates (2, 3) to (3, 0)? (The coordinates are in metres.)
a) -7 J b) zero c) +7 J d) + 19 J

398. A bird resting on the floor of an airtight box which is being carried by a boy, starts flying. The boy feels that now the box:
a) is heavier b) is lighter c) shows no change in weight
d) is lighter in the beginning and heavier later

399. A cannon after firing recoils due to:
a) conservation of energy b) backward thrust of gases produced
c) Newton's third law of motion d) Newton's first law of motion

400. If K_R and KB the kinetic energies of rifle and bullet respectively, then:
a) $\frac{K_R}{K_B} = 1$ b) $\frac{K_R}{K_B} = \frac{m}{M}$ c) $\frac{K_R}{K_B} = \frac{M}{m}$ d) $\frac{K_R}{K_B} = \frac{m^2}{M^2}$