Choose the correct answer

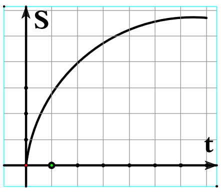
(1) A particle moves in a straight line and the equation of its motion $x = 2 + \ln(t+1)$ then ....

(a) Its velocity and the acceleration of motion always decrease.
(b) Its velocity and the acceleration of motion always increase.
(c) The velocity decreases and the acceleration of motion increases.
(d) The velocity increases and the acceleration of motion decreases.

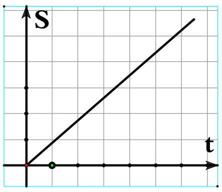
---

(2) The graph which represents the displacment-time graph of a particle moving in acceleration is ….

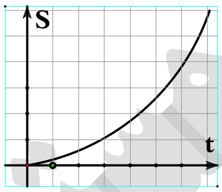
(a)



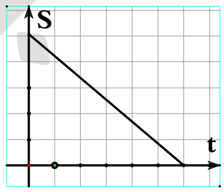
(b)



(c)



(d)



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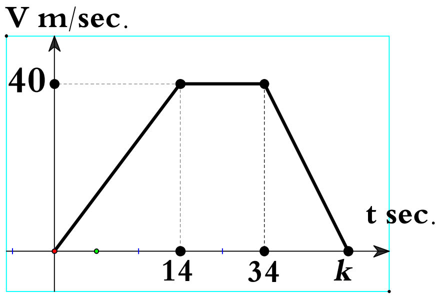
(3) If the diagram shows the velocity-time graph of a car travelled total distance 1480 m. During the time interval [0 , k] then the incorrect statement is ………



(a) $k = 54$ sec.

(b) The acceleration of the particle when $t \in [0\ ,\ 14]$ is $\frac{20}{7}$ $\mathbf{m/sec^2}$

(c) The average acceleration of the particle when $t \in [0\ ,\ 34]$ is $\frac{20}{17}$ $\mathbf{m/sec^2}$

(d) The velocity of the particle at $t = 10$ sec is 20 m / sec

---

(4) A particle moves in a straight line such that $\vec{v} = (-\,t^2 + 4\,t - 4)\hat{i}$ then the incorrect statement is ………

(a) The particle changes its direction at $t = 2$ sec.
(b) The particle moves in an acceleration motion when $t \succ 2$
(c) The velocity of the particle decreases when $t \succ 2$
(d) The particle moves in an retardation motion when $t \prec 2$

---

(5) If $v = 1 + \sin t$, $x = -3$ when $t = 0$ then:

(a) $x = t + \cos t$ **(b)** $x = t - \cos t$
(c) $x = t - \cos t + 2$ **(d)** $x = t - \cos t - 2$

(6) If $v = t^3 - 3t^2 + 2t$ then the distance covered within the time interval $[0 , 2]$

(a) $\frac{1}{4}$ unit length **(b)** $\frac{1}{2}$ unit length **(c)** $\frac{9}{4}$ unit length **(d)** $\frac{11}{4}$ unit length

---

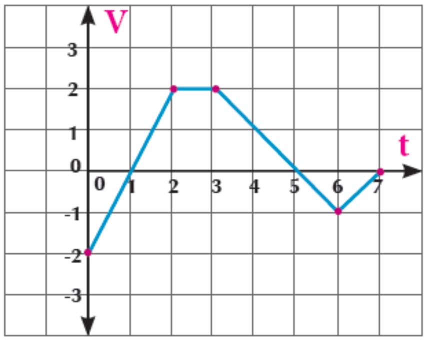
(7) If $a = 2s$, $v_0 = -1$ then S = …… when $v = 1$

(a) zero **(b)** 4 unit length **(c)** $\frac{25}{6}$ unit length **(d)** $\frac{13}{3}$ unit length

---

(8) From the velocity-time graph in the opposite figure, the magnitude of displacement in the interval $[0 , 7]$ is equal to ....

(a) 3 unit length **(b)** 5 unit length
(c) 7 unit length **(d)** 8 unit length



---

(9) If $x = t^2 - 3t + 2$ then the particle changes its motion when:

(a) t = 1 , t = 2 **(b)** t = 1 **(c)** t = 1.5 **(d)** t = 2

---

(10) If $V(t) = \frac{2}{\pi}\cos(\frac{2t}{\pi})$ and $X(\pi^2) = 1$ then $X(t) =$ …….

(a) $\frac{2}{\pi}\sin(\frac{2t}{\pi}) + 1$ **(b)** $\frac{2}{\pi}\sin(\frac{2t}{\pi}) - 1$ **(c)** $\sin(\frac{2t}{\pi}) + 1$ **(d)** $\sin(\frac{2t}{\pi}) - 1$

---

(11) A body of a mass 500 gm is let to fall from a height of 4.9 meters on the ground surface, then its momentum as it comes the ground is …….

(a) 2.45 kg. m/sec **(b) 4.9** newton.sec **(c) 2450** kg. m/sec **(d) 4.9** kg.wt.sec

---

(12) A rocket of mass 4 tons including the fuel is launched at velocity 200 m/sec, and it throws out the fuel at a constant rate of a magnitude 100 kg per second. If the momentum is constant then the velocity of the rocket after 10 seconds in km/h unit is …….

(a) $\frac{800}{3}$ **(b) 600** **(c) 800** **(d) 960**

---

(13) A body moves in a straight line with a uniform velocity under the action of the two forces $\overrightarrow{F_1} = 2a\ \hat{i} - 3\ \hat{j} + 4\hat{k}$ and $\overrightarrow{F_2} = 6\ \hat{i} + b\ \hat{j} + e\hat{k}$ then a + b + e equals ……

(a) 4 **(b) 3** **(c) – 3** **(d)** - 4

(14) If a body of mass 20 kg.wt lands with a uniform velocity on an inclined plane to the horizontal with angle of measure 30º, then the resistance of the plane in kg.wt equals ….

(a) zero **(b) 10** **(c) $10\sqrt{3}$** **(d) 20**

---

(15) A body of mass unit moves under the action of the force $\overrightarrow{F} = 5\,\hat{i}$ if its velocity vector $\overrightarrow{V} = (at^2 + bt)\,\hat{i}$ then **a + b** is:

(a) 0 **(b)** $\frac{5}{2}$ **(c)** $\frac{7}{2}$ **(d) 5**

---

(16) A bullet of mass **7** gm is shot vertically from the barrel of a pistol with velocity **245** m/sec on a vertical barrier of wood to embed in it for **12.25** cm before being at rest. then the wood resistance to the bullet equals…….

(a) 173.2 newton **(b) 1715** newton **(c) 1715** kg.wt **(d) 17.15** dyn

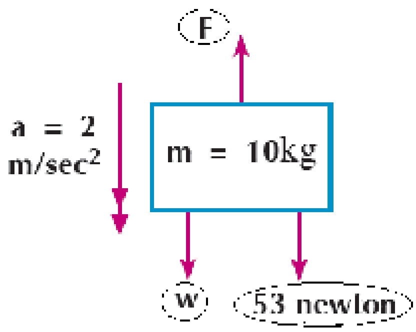
---

(17) If a body of mass $m = 2t + 3$ kg moves in a straight line and its displacement vector as a function of time is given by the relation $\overrightarrow{S} = (\frac{3}{2}t^2 + 2t)\,\hat{i}$, S is measured in meter and,t in second, then the magnitude of the force acting upon the body in newton is ……

(a) 2 t + 3 **(b) 12 t + 3** **(c) 12 t + 13** **(d) 6t + 13**

---

(18) The force F acts upon the body whose mass is m and acquires it a uniform acceleration shown in the figures, both magnitude and direction, then F= ……N



(a) 171 **(b) 131** **(c) 43** **(d) 83**

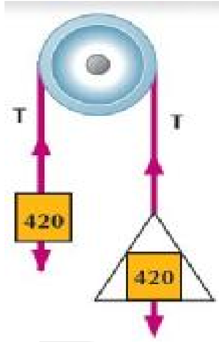
---

(19) A cyclist and his cycle of mass **85** kg move with a uniform acceleration of magnitude $\mathbf{0.5\,m/sec^2}$, then the force used to occur this acceleration is:

(a) 42.5 kg.wt **(b) 42.5** newton **(c) 170** kg.wt **(d) 170** newton

---

(20) Two masses each of a magnitude **420** gm one of them is placed in a pan of mass **140** gm. and the system moves from rest, then the pressure on the pulley =.......... gm.wt



(a) 480 dyn **(b) 480 gm.wt**
(c) 960 gm.wt **(d) 960 dyn**

---

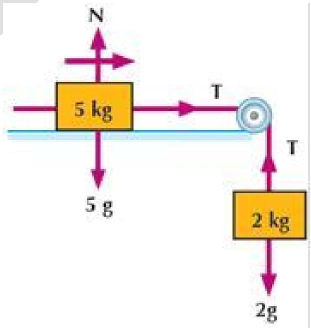
(21) In the Previous question the Pressure on the scale pan is ………..
(a) 960 gm.wt **(b) 960** dyn **(c) 360** gm.wt **(d)360** dyn

---

(22) If a force of magnitude **16** kg.wt acts on a body for a quarter of second, then the magnitude of the force impulse in N.sec unit is equal to…….
(a) 4 **(b) 32** **(c) 39.2** **(d) 64**

---

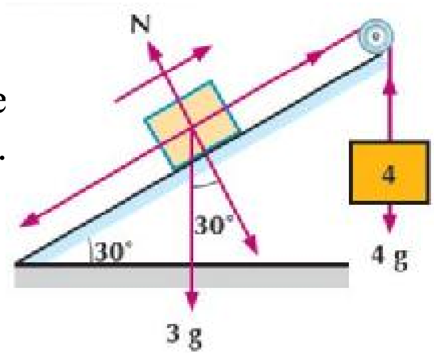
(23) In the opposite Figure:if the system starting from rest, Then the distance traveled after **2** seconds = ...m



(a) 5.6 cm **(b) 5.6** m
(c) 2.8 cm **(d) 2.8** m

---

(24) In the opposite Figure:
The body **3** kg is placed on the smooth inclined plane and connected by the body **4** kg suspended vertically.
Then pressure on the pulley =...............



(a) 25.2 newton **(b)** $25.2\sqrt{3}$ kg.wt
(c) 25.2 kg.wt **(d)** $25.2\sqrt{3}$ newton

---

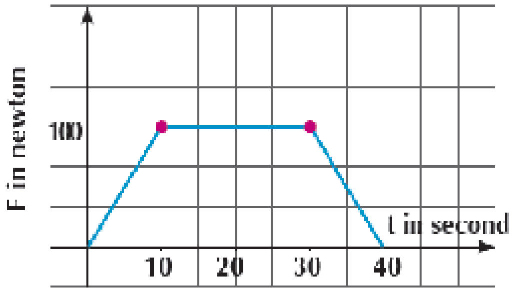
(25) If the two forces $\overrightarrow{F_1} = \hat{i} + 5\hat{j} + 7\hat{k}$ and $\overrightarrow{F_2} = 2\hat{i} - \hat{j} - 2\hat{k}$ act on a body for a time interval of magnitude **2** seconds, then the magnitude of the impulse of the force in kg.m/sec unit is equal to …… where F measured in newton.
(a) $5\sqrt{2}$ **(b)** $10\sqrt{2}$ **(c)** $\frac{50}{49}\sqrt{2}$ **(d)** $100\sqrt{2}$

---

(26) If a force of magnitude **90** newton acts upon a body of mass **10** kg for five seconds, then the change of the velocity of the body in the same direction of the force is equal to…….
(a) 45m/sec **(b) 50**m/sec **(c) 90**m/sec **(d) 120** m/sec

---

(27) A body of mass **20** kg is placed on a smooth horizontal plane. If it moves under the action of a force in a constant direction and its magnitude changes over time as shown in the figure, then the change in velocity of the body during the first 30 seconds is equal to …………m/sec.



(a) 150 **(b) 1000** **(c) 125** **(d) 2000**

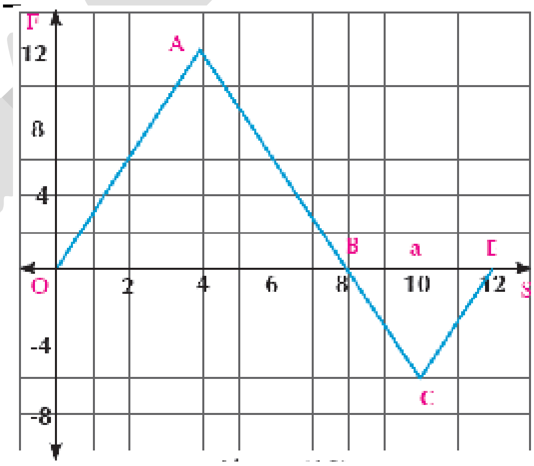
----

(28) If a force of magnitude 8 newton acts on a body at rest of mass 4 kg, then the velocity which the body acquires by the end of five seconds from the beginning of the motion is equal to ………

(a) 6.4 m/sec **(b)** 10 m/sec **(c)** 20 m/sec **(d)** 40 m/sec

----

(29) The Figure illustrates the action of a variable force on a body, then the work done in erg by this force When the body moves from **S=0** to **S= 12** is ….. where f measured in dyn and s in cm.



(a) 60 **(b) 36**

(c) 48 **(d) 12**

----

(30) A person goes shopping and pushes a shopping cart with a force of magnitude 35 newtons inclined at 25° to the horizontal to move the cart a distance 50 meters, then the work done by the person = ... erg

(a) 1586 **(b) 1750** **(c)** $\mathbf{1.586\times10^{10}}$ **(d)** $\mathbf{1.75\times10^{10}}$

----

(31) The work done to move a mass of magnitude 600 gm a distance 4m with acceleration of magnitude $20\ cm/sec^2$ is equal to .... erg

(a) $\mathbf{4.8\times10^{6}}$ **(b) 4800** **(c) 0.48** **(d) 4.8**

----

(32) If a body moves in a straight line from point **A (2, 3)** to point **B (7, 6)** under the action of the force $\vec{F}=3\hat{i}+4\hat{j}$,then the change in potential energy = ... joule where F measured in newton and S in cm.

(a) -27 **(b) -0.27** **(c) 27** **(d) 0.27**

----

(33) A body moves in a straight line under the action of the force $\vec{F} = 3\hat{i} + 4\hat{j}$ such that its displacement vector S is given as a function of time by the relation $\vec{S} = t\,\hat{i} + (t^2 + t)\hat{j}$ then the power of the force when $t = 3$ sec. is ……dyn.cm/sec. where F measured in dyn and S in cm.

(a) $25\sqrt{2}$ **(b) 31** **(c) 57** **(d)** $15\sqrt{17}$

---

(34) A train of mass **375** tons and the power of its engine is **625** horses moves on horizontal ground with maximum velocity of magnitude **90** km/h, then the resistance which it encounters per ton of the train's mass = ... kg.w

(a) 5 **(b) 6** **(c) 7** **(d) 8**

---

(35) A body is placed at the top of a smooth inclined plane of height **2.5** m. and is let to descend on the plane, then it reaches the base of the plane with velocity = ... m/sec

(a) 5 **(b) 6** **(c) 7** **(d) 8**

---

(36) A body of mass **35** kg is placed on a pressure scale on the floor of a lift moving with a uniform acceleration $1.4\ m/sec^2$ downwards, then the reading of the scale is .... kg.w

(a) 35 **(b) 343** **(c) 30** **(d) 294**

---

(37) A body is projected horizontally with velocity **2.8** m/sec on a rough horizontal plane and the coefficient of kinetic friction between it and the body is $\frac{1}{10}$, then the distance traveled by the body on the plane before it rests equals........meters.

(a) 3 **(b) 4** **(c) 5** **(d) 6**

---

(38) If a body of mass 1kg. moves in a straight line such that the acceleration of the body is given by the relation **a = 4t + 2** where a is measured in m/sec^2, t in second , then the change of momentum of the body in the time interval **[2, 6]** is equal to .... kg m/sec.

(a) 72 **(b)** $\frac{360}{49}$ **(c) 74** **(d) 75**

---

(39) A body of mass **500** gm is projected vertically upwards from a point on the ground surface with velocity **14.9** m/sec, then its potential energy after one second from projection = ... joule

(a) 5 (b) 49 (c) 500 (d) 14

---

(40) A body is suspended in a hook of a spring scale fixed at the top of a lift moving vertically upwards and the apparent weight of the body is twice the actual weight, then the acceleration a =....... m / sec^2

(a) g **(b) 2g** **(c) $\frac{1}{2}g$** **(d) $\frac{3}{2}g$**

---

(41) In an instant, the momentum of a body is **112** kg.m/sec and its kinetic energy is **80** kg.wt.m then the mass of the body = ... kg

(a) $\frac{10}{7}$ **(b) 14** **(c) 78.4** **(d) 8**

---

(42) The vertical distance between two bodies connected by the end of a light string passing over a smooth pulley fixed and suspended vertically is 100 cm after 2 seconds from the beginning of the motion. Then the velocity of each on that instant = ...cm/sec

(a) 25 **(b) 50** **(c) 75** **(d) 100**

---

(43) A body of mass **200** gm is projected vertically upwards with velocity **49** m/sec, then its potential energy at the maximum height the body reaches = ...joule

(a) 241.1 **(b) 240100** **(c) 4.9** **(d) 49**

---

(44) A ship of mass **441** tons moves with velocity **72** km/h, then its kinetic energy equales .... kilowatt.h

(a) 176.4×10^6 **(b) 24.5** **(c) 176.4×10^3** **(d) 88.2×10^6**

---

(45) An engine does work of magnitude **15000** kg.wt.m during **10** seconds, then the power of the engine in horse ....

(a) 1.5×10^4 **(b) 1500** **(c) 20** **(d) 14700**

---

(46) A force of magnitude **80** newtons acts in the direction of **30°** northeast, then the work done by this force during a displacement of magnitude **40** m towards north is equal to ....joule

(a) 1600 **(b) $1600\sqrt{3}$** **(c) -1600** **(d) $-1600\sqrt{3}$**

---

(47) A body of mass **140** gm is projected vertically upwards from the top of a tower whose height is **25** m above the ground then the change in the kinetic energy of the body from the instant it is projected until it reaches the ground in joule is equal to ……

(a) 34.3 **(b) – 34.3** **(c) 34300** **(d) - 34300**

---

(48) A missile of mass **1** kg is launched at velocity **300** m/sec. towards a tank of mass moving towards the mortar at velocity **36** km/h then the magnitude of the momentum of the missile with respect to the tank is …… newton.sec

(a) 310 **(b) 3038** **(c) 290** **(d) 2842**

---

(49) If A ball of mass **300** gm moving on horizontal ground with velocity **60** cm/sec directly collides with a vertical wall and the wall acts on the ball with impulse of magnitude **48000** dyne.sec then the velocity of the ball's rebound from the wall equals …… cm/sec.

(a) 100 **(b) 120** **(c) 220** **(d) 500**

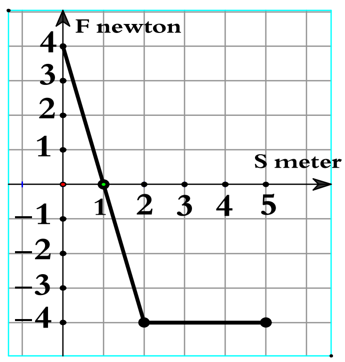
---

(50) If A particle moves in a straight line under the action of the force F(newton) where $\mathbf{F = \sin 2\,S}$ where **S** is measured in meter, then the work done by the force F when the particle moves from $s = \frac{-\pi}{2}$ to $s = \frac{\pi}{2}$ is ……

(a) zero **(b) -1** **(c) 2** **(d) -2**

---

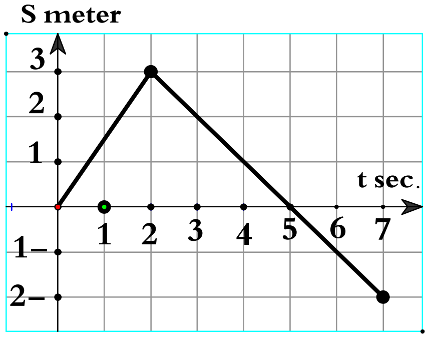
(51) The opposite figure illustrates the action of a force component on a body of mass **2** kg.in the direction of the motion. If its initial velocity equals 4 m/sec then the kinetic energy of the body when $\mathbf{x = 2}$ is …. joule



(a) 4 **(b) zero**
(c) 16 **(d) 32**

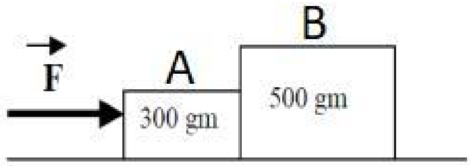
---

(52) The opposite figure illustrates the position-time graph of a particle moving in a straight line then the the incorrect statement is ………



(a) The distance coverd on [0 , 5] is 6m.
(b) The velocity of the particle at t= 4sec. is -1m/sec.
(c) The particale change its direction at t=2 sec.
(d) The average velocity on [0 , 7] is $\frac{1}{4}$m/sec.

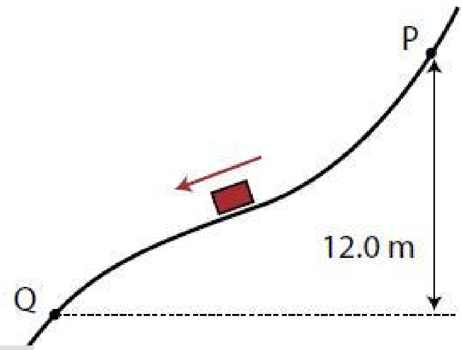
(53) A small block (A) with mass 300 gm.And a large block (B) with mass 500 gm. are pused by a force F as shown. The blocks accelerated together with an acceleration of 200 cm/sec^2.The frictional forces are 1.2 newton on the small block and 2 newton on the large block. Then the force by which the block (A) exert on the block (B) is …… newton.



(a) 1.6 **(b) 3** **(c) 4** **(d) 5**

---

(54) The opposite figure a small block passes through the point P at a speed of 2 m/sec. and slides down a smooth curved track then the velocity of the block at Q is …… m/sec.



(a) 15.5 **(b) 15.3**
(c) 10 **(d) 24**

Producing answers questions

(1) A particle moves in a straight line such that its position x at any time t is given by the relation $\overrightarrow{x}(t) = (4t - t^2 - 3)\overrightarrow{c}$ where x is measured in meter, t in sec and $\overrightarrow{c}$ is the unit vector in the direction of the motion of the body find:

(a) the average velocity vector of the particle when t∈[0, 3]
(b) the velocity vector of the particle when t = 4
(c) when the particle moves forward and moves backwards.
(d) At what time does the particle change the direction of its motion
(e) when the particle moves in an acceleration motion.
(f) At what time does the velocity of the particle increase? Decrease?
(g) the distance covered by the particle during the time interval [0, 3]
(h) the average velocity of the particle when t∈[0, 3]

---

(2) A metal ball of mass 9 gm moves in a straight line within a dusty medium such that the dust sticks to its surface at a rate of 1 gm per second. If the displacement of this ball at the end of a time interval is $\overrightarrow{S} = (\frac{1}{3}t^3 + 3t + 5)\overrightarrow{c}$ where $\overrightarrow{c}$ is a unit vector in the direction of its motion, find the force acting upon the ball at any moment t and calculate its magnitude when t =1 seconds given that the magnitude of the displacement is measured in cm.

---

(3) A tennis ball of mass 40 gm moves horizontally with velocity of 50 cm/sec to collide with the bat and rebounds in the opposite direction with velocity of 110 cm/sec . Find the impulse magnitude of the bat on the ball. What is the magnitude of the impulsive force of the bat on the ball. If the contact time of the ball with the bat is $\frac{1}{49}$ of a second?

---

(4) A car at rest, of mass 1 ton is pushed in the direction of its motion with a force of 200 kg.wt for 5 seconds, then it is released freely to become at rest again after 15 seconds. Find the magnitude of the resistance supposing it is constant in the two cases. Then find the maximum velocity that the car reached.

---

(5) A body of weight 10 kg.wt is placed on a rough horizontal plane. A force of magnitude 37 newtons acts on this body to move it on the horizontal plane with a uniform acceleration of magnitude **$1.25\ cm/sec^2$** , Find the coefficient of the kinetic friction between the body and the plane.

(6) A force of magnitude 60 gm.wt and its direction making an angle of measur $30°$ to the vertical upwards acts on a body of mass 392 gm.wt at rest placed on a smooth horizontal table. Find the acceleration of the body generated from this action , the perpendicular reaction of the table and the distance coverd during the fourth second.

----

(7) A ball of mass 100 gm is let to fall down of a height 3.6 m on horizontal ground to collide with it and rebounds vertically upwards. If the loss in the kinetic energy of the ball due to the collision with the ground is 1.96 Joules, calculate the distance by which the ball rebounded back after it collided with the ground.

----

(8) A ball of mass 500 gm fell down from a height of 2.5 m on a viscous liquid surface to embed in a distance 3.5 m. with uniform velocity during 2 sec. Calculate the impulse of the liquid on the ball.

----

(9) Two smooth balls each of mass 200 gm move in a straight line on a smooth horizontal plane; the first with velocity 4 m/ sec and the second with velocity 6 m/sec in the same direction of the first ball. If the two balls collide, identify the velocity for each of them directly after collision given that the impulse magnitude of the second ball on the first is equal to 5×10^4 dyne.sec.

----

(10) A variable force F (measured in dyne) acts upon a body where F is given by the relation: $F = 4s^3 - 2s + 1$, S The algebraic measured of displacement at measured in with cm find the work done by this force in the interval from S = 0 to S = 4

----

(11) A body of mass 1 kg moves with a uniform velocity of magnitude 12 m/sec. A resistance force of magnitude $6x^2$ (newton) where x is the distance which the body travels under the action of the resistance (meter) acts on it.

(a) Find the work done by the resistance when x = 4

(b) Find the velocity of the body and its kinetic energy when x = 2

----

(12) A body of mass 1.5 kg is projected with velocity 18 m/sec on the line of the greatest slope to an inclined plane inclined at $30°$ to the horizontal upwards the plane.if the resestance of the plane is 2.1 newotn then find the distance coverd until its velocity becomes 4 m/sec.

----

(13) The boxes at a factory are transported by sliding them on an inclined plane of length 15 m and height 9 m. Find the velocity of the box which starts it motion from rest at the top of the plane at the base of the plane if the plane is smooth and the coefficient of the kinetic friction is equal to $\frac{1}{4}$

----

(14) A locomotive of mass 150 tons and force 60 ton.wt pulls a number of wagons each of mass 18 tons to ascend a slope inclined at $\sin^{-1}\frac{1}{20}$ to the horizontal with a uniform acceleration 19.6 cm/sec^2 . How many cars are there if the resistance to the motion of the engine and cars is 30kg.wt per each ton of mass?

----

(15) A ball of mass 200 g moves with velocity 9 m/ sec collides with a rested ball of mass 400gm and both move together as one body a distance 9m until it come to reast find:

(a) The common velocity for both balls directly after collision.
(b) The kinetic energy lost by collision.
(c) The resistance of the plane in newton.

----

(16) To identify the magnitude of the gravitational acceleration in a place, a body of mass 1.5 kg is suspended in the hook of a spring scale fixed at the top of a lift. If the scale reading recorded 16.5 newtons when the lift was ascending with acceleration a m/sec^2 and 12.75 newtons when it was descending with acceleration a m/sec^2, calculate the gravitational acceleration in this place and the acceleration of the lift.

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(17) A body is suspended in a spring scale fixed at the top of a lift to record 17 kg.wt. When the lift moves up with a uniform acceleration 1.5 a m/ sec^2 and the scale records 16 kg.wt as the lift moves down with a the acceleration negative uniform of magnitude a m/sec^2. Find the mass of the body and the magnitude of a.

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(18) A bullet is fired on a target of thickness 9 cm and exits from the other side with half velocity before it enters the target. What is the least thickness needed for a target of the same material in order the bullet not to exit from if it is fired with its previous velocity?

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(19) A ring of mass $\frac{1}{2}$ kg slides on rough vertical cylindric pool. If its velocity is 6.3 m/sec after it traveled 4.8 m from the beginning of its motion, use the work-energy principle to calculate the work done by the resistance during the motion.

(20) A train of mass 625 tons ascends a slope inclined at an angle of sine 0.02 to the horizontal with a uniform velocity. If the work done by the train engine is equal to 3×10^7 kg.wt.m unit the train reaches the top of the slope and the work done against resistances is 5×10^6 kg.wt.m find:

(a) The slope length **(b)** The work done by the weight.

(c) The engine force. **(d)** The resistance per each ton of the train's mass

----

(21) A car of mass **6** tons moves with maximum velocity of magnitude **27** km/h ascending a slope inclined at an angle of sine $\frac{1}{10}$, to the horizontal , then the car starts to descend the same road with maximum velocity of magnitude **135** km/h. Identify the magnitude of the resistance force of the road to the motion supposing it did not change along the time, then find the power of the car's engine.

----

(22) Car's engine does work at a constant rate of magnitude **5** kilowatt and the car's mass is**1200** kg. If the car moves on a horizontal road against a constant resistance of magnitude **325** newtons, find:

(a) The magnitude of the car's acceleration when its velocity is **8**m/sec.

(b) The car's maximum velocity.

----

(23) A body of mass **60** kg ascends from rest on the line of the greatest slope to an inclined plane of length **20** m and height **12** m. If the body starts its motion from the highest point on the plane and the coefficient of kinetic friction between the body and the plane is $\frac{3}{16}$, find the kinetic energy of the body when it reaches the plane base.

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(24) A hammer of mass 1 ton falls down from height 4.9 m vertically on an iron body of mass 400 kg to embed it vertically in the ground for a distance of 10 cm. Identify the common velocity for both the hammer and the body after collision directly. Identify the kinetic energy lost due to collision and the magnitude of the ground resistance supposing it is constant.

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(25) A force of magnitude 48 gm.wt acts on a rested body placed on a horizontal plane for a time interval to acquire kinetic energy of magnitude 18900 gm.wt.cm by the end of this interval. Its momentum reaches 176400 gm.cm/sec at the instant, then the force is ceased and the body gets rested once again after it traveled a distance of 10.5 m from the instant of ceasing the force. Find the mass of the body and the magnitude of the plane resistance to its motion supposing it is constant and then find the action time of the force.

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(26) A a body descends a slope from rest. The length of 50 m, it is height of 2.5 m. If it is given that $\frac{3}{4}$ of the potential energy is lost due to overcoming the resistances against motion and these resistances remain constant during the motion of the body, find the velocity of the body at the end of the inclined plane.

---

(27) Two bodies of masses 5 kg and 3 kg are connected by the ends of a string passing over a smooth small pulley and the system is kept in equilibrium and the two parts of the string are vertical. If the system is let to move, find the magnitude of its acceleration, and the pressure exerted on the pulley, then identify the velocity of the body whose mass is 5 kg when is lands 40 cm.

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(28) A light string passes over a smooth small pulley. A body of mass 800 gm is suspended at an end of the string and a spring scale of mass 400 gm, is connected by a body of mass m gm is suspended at the other end of the string. If the system moves from rest and the scale reading during the motion is 160 gm.wt, find the value of m.

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(29) A body of mass 200 gm is placed on a rough horizontal table and the coefficient of the kinetic friction between them is equal to $\frac{1}{2}$. It is then connected by a light string passing over a smooth pulley fixed at the edge of the table and a body of mass 200 gm is suspended from the other end of the string and a height of 1 meter above the ground surface. If the system moves from rest, calculate:

(a) The pressure on the pulley in newton.
(b) The velocity of the impact of the suspended mass against the ground surface.
(c) The distance which the mass, placed on the table, moves until it rests.

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(30) Two bodies of mass 260 gm and 230 gm are connected by the ends of a string passing over a smooth small pulley and suspended vertically in one horizontal plane at a height of 62.5 cm above the ground surface. If the system moves from rest and the string is cut after a second from the beginning of the motion, calculate the velocity by which each of the two bodies reach the ground surface.

---

(31) A body of mass 4 kg is placed on a rough plane inclined at **30°** to the horizontal and connected with a string passing over a smooth small pulley at the top of the plane. A body of mass m suspends from the other end of the string. If the mass 4 kg moves from rest on the plane upwards for a distance of 560 cm in 2 seconds. Find the magnitude of m given that the coefficient of the kinetic friction between the body and the plane is equal to $\frac{\sqrt{3}}{2}$. Then find the magnitude of the pressure on the axis of the pulley.

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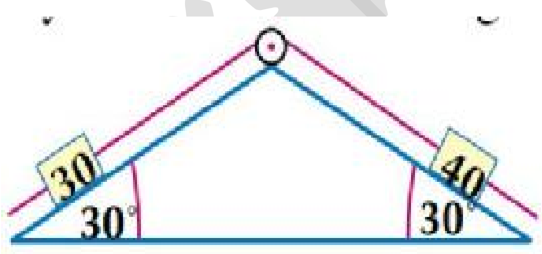
(32) In the opposite figure, two masses of 40 gm, 30 gm connected by the two ends of a light string passing over a smooth small pulley fixed at the top of two smooth opposite planes inclined at 30° to the horizontal as shown in the figure.The system is being kept in equilibrium when the two bodies are on one horizontal line and the two parts of the string are tensioned. If the system is let to move from rest, find the acceleration and the vertical distance between the two bodies after one second from the beginning of the motion.



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(33) A worker whose job is to load boxes each of mass 30 kg on a truck. If the height of the truck is 0.9 meter, calculate the number of boxes which the worker can load in time of magnitude 1 minute if his average power is equal to **352.8** watt.

----

(34) A train of mass (m) ton moves on a horizontal road with the maximum velocity of magnitude 60 km/h. The last car of mass 15 tons is separated from the train and the maximum velocity of the train increases at a magnitude of 7.5 km/h. Find the power of the engine in horse and the mass of the train given that the resistance is equal to 9 kg.wt per each ton of mass.

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(35) A car of mass 5 tons moves with uniform velocity of magnitude 36 km/h ascending a slope inclined at an angle of sine $\frac{1}{40}$ to the horizontal against the resistance equivalent to **2.5%** of the car's weight. Find the power of the engine in horse. If the power of engine suddenly increases to 50 horses, find the magnitude of the car's acceleration directly after this increase.

----

(36) A body of mass 1 kg is let to fall vertically downwards from rest under the action of the gravitational acceleration against resistances of magnitude $\frac{24}{25}x$ (newtons) where x is the distance between the body and the falling point in meter at any instant. Find the work done by the body against the resistance from the instant of falling until the body travels a distance of 10m under the falling point and find its velocity at this instant.

----

(37) A constant force of magnitude F Newton inclined at an angle of tangent $\frac{4}{3}$ pulls a stalled car of mass 1400 kg with uniform velocity of magnitude 22.5 m/sec on a rough horizontal road and the coefficient of kinetic friction between the road and the car is 0.3, find

(a) The force power in this case.

(**b)** The work done by this force to move the car for a minute.

----

(38) A particle of mass the unity moves under the action of the force $\vec{F} = (2t-1)\hat{i} + (5t+2)\hat{j}$ where its displacement vector is given as a function of time by the relation $\vec{S} = (3t^2-1)\hat{i} + 4t\ \hat{j}$, if F is measured in newton, S in meter and t in seconds, find:

(a) The work done during the third, fourth and fifth seconds

(b) The average power during the third, fourth and fifth seconds.

----

(39) A locomotive of mass 30 tons starts to move from rest on a horizontal plane with a uniform acceleration against resistances $\frac{1}{100}$ of its weight. When its velocity reaches 90 km/h, its magnitude becomes 441 kilowatt. Find:

(a) The force of the engine in kg.wt.

(b) The magnitude of the uniform acceleration

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(40) A car of mass 1800 kg, its engine power is constant and equals 75 horses Find the time needed to accelerate from rest to 63 km/hr

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(41) A body moves in a straight line under the action of a parallel force to this straight line its magnitude F where $F = 3s^2 + 2s + c$, where s is the distance between the body and a constant point O on this straight line and c is constant, if the work done by this force to move the body from the point O to the point at which $s = 2$ equales **22** work unit, then find the needed work to move the body from $s = 2$ to $s = 6$.

----

(42) A force F acts on a body of mass **10**kg , moves in a straight line beginning its motion with velocity **3** m/sec. and $F = \frac{5}{3v+2}$ where v is the velocity after time t when does the velocity of the body equals **7** m/sec.

---

(43) A body moves with uniform velocity in a straight line under the effect of the following forces $\overrightarrow{F_1}$, $\overrightarrow{F_2} = 3\hat{i} + 2\sqrt{3}\,\hat{j}$, $\overrightarrow{F_3} = -4\hat{i} + 3\sqrt{3}\,\hat{j}$ and $\overrightarrow{F_4} = 6\hat{i} - 10\sqrt{3}\,\hat{j}$ if the magnitudes of all these forces are in newton. Find the magnitude and the direction of $\overrightarrow{F_1}$ given that $\hat{i}$ and $\hat{j}$ are two perpendicular unit vectors.

---

(44) A body of mas **10** kg moves in straight line such that its acceleration a m/sec^2 is given as a function of time (t sec) by the relation $a = 6t^2 - 14t$. Calculate the change of the momentum of the body in the time interval **[1 , 5]**.

---

(45) A particle moves in a straight line with initial velocity of magnitude 2m/sec from a fixed point on the straight line such that $a = e^x$ find v^2 in terms of x then find v when x=4 metres and x when v = 20 m/sec.

---

(46) A particle moves in a straight line such that the relation between v , x is $v^2 = 7(4 - x^2)$ where v measured in m/sec , x is measured in meter. Find the acceleration when the velocity vanishes.

Final answers

(1)	c	**(2)**	a	**(3)**	d	**(4)**	a	(5)	d
(6)	b	**(7)**	a	**(8)**	a	**(9)**	c	(10)	c
(11)	b	**(12)**	d	**(13)**	d	**(14)**	b	(15)	d
(16)	b	**(17)**	c	**(18)**	b	**(19)**	b	(20)	c
(21)	c	**(22)**	c	**(23)**	b	**(24)**	d	(25)	b
(26)	a	**(27)**	c	**(28)**	b	**(29)**	b	(30)	c
(31)	a	**(32)**	b	**(33)**	b	**(34)**	a	(35)	c
(36)	c	**(37)**	b	**(38)**	a	**(39)**	b	(40)	a
(41)	d	**(42)**	b	**(43)**	a	**(44)**	b	(45)	c
(46)	a	**(47)**	a	**(48)**	a	**(49)**	a	(50)	a
(51)	c	**(52)**	c	**(53)**	b				

Producing answers questions

(1) (a) $-2\hat{c}$ (b) $-4\hat{c}$ (c) $t \succ 2$ and $t \prec 2$ (d) $t = 2$
(e) acc. $t \succ 2$, dec. $t \prec 2$ (f) dec. (g) 5 (h) $\frac{5}{3}$ m/sec.

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(2) 24 dyne
(3) 313600 dyne
(4) 50 N
(5) $\frac{1}{4}$
(6) 2625 cm
(7) 1.6 m
(8) 2.625 N.sec.
(9) 3.5 m/sec
(10) 244 erg.
(11) -128 joule , $4\sqrt{7}$ m/sec. , 56 joule.
(12) $\frac{220}{9}$ m
(13) $2.5\sqrt{15}$ m/sec.
(14) 25
(15) 3 m/sec. , 5.4 joule , 0.3 N
(16) g = 9.75 m/sec^2 , a=1.25 m/sec^2
(17) a = 1.4 m/sec^2 , m = 1.4 kg.
(18) 12 cm
(19) -13.5975 joule.
(20) 2000 m , 4 kg.wt per ton
(21) $\frac{108}{23}$ km/hr.
(22) $\frac{1}{4}$ m/sec^2 , $\frac{200}{13}$ m/sec.
(23) 5292 joule
(24) 7 m/sec. , 36400 kg.wt.
(25) 48 gm. , 18 gm.wt. , 6 sec.
(26) $16\frac{2}{3}$ m
(27) 1.4 m/sec.
(28) $\frac{400}{3}$ gm.
(29) 1.47 N , $70\sqrt{10}$ cm/sec. , 50 cm.
(30)
(31) 8.6 kg. , 60.23 N
(32) 32 cm.
(33) 80 boxes.
(34) 270 horses
(35) $33\frac{1}{3}$ horses.
(36) 10 m.
(37) 90 horses. , 405000 kg.wt.
(38) 657 joule. , 219 watt.
(39) 1800 kg.wt. , 0.49 m/sec^2
(40) 5 sec.
(41) 260 unit of work.
(42) 136 sec.
(43) 120
(44) 800 kg.m/sec.
(45) 5.29
(46) ± 14