Some Used Formula

$a_x = a\sin\theta$ $\quad a_y = a\cos\theta$ $\quad \vec{a}\cdot\vec{b} = ab\cos\phi$ $\quad |\vec{a}\times\vec{b}| = a\,b\,\sin\phi$

$\vec{a}\cdot\vec{b} = a_xb_x + a_yb_y + a_zb_z$

$a = \sqrt{a_x^2 + a_y^2}$ $\quad \tan\theta = \dfrac{a_y}{a_x}$ $\quad \vec{a}\times\vec{b} = (a_yb_z - b_ya_z)\hat{i} + (a_zb_x - b_za_x)\hat{j} + (a_xb_y - b_xa_y)\hat{k}$

$\Delta x = x_2 - x_1$ $\quad v = \dfrac{dx}{dt}$ $\quad v_{avg} = \dfrac{\Delta x}{\Delta t} = \dfrac{x_2 - x_1}{t_2 - t_1}$ $\quad v = v_o + at$ $\quad x - x_o = v_ot + \dfrac{1}{2}at^2$

$S_{avg} = \dfrac{total\,distance}{\Delta t}$ $\quad a = \dfrac{dv}{dt} = \dfrac{d^2x}{dt^2}$ $\quad a_{avg} = \dfrac{\Delta v}{\Delta t} = \dfrac{v_2 - v_1}{t_2 - t_1}$ $\quad v^2 = v_o^2 + 2a(x - x_o)$

$\dfrac{d}{dx}x^m = mx^{m-1}$ $\quad$ for free fall, $a = -g = -9.8\ m/s^2$ $\quad x - x_o = \dfrac{1}{2}(v_o + v)t = vt - \dfrac{1}{2}at^2$

$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ $\quad x - x_o = (v_o\cos\theta_o)\,t$ $\quad v_y = v_o\sin\theta_o - g\,t$

$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$ $\quad y - y_o = (v_o\sin\theta_o)\,t - \dfrac{1}{2}gt^2$ $\quad v_y^2 = (v_o\sin\theta_o)^2 - 2\,(y - y_o)$

$v_{avg} = \dfrac{\Delta\vec{r}}{\Delta t}$ $\quad y = (\tan\theta_o)x - \dfrac{gx^2}{2(v_o\cos\theta_o)^2}$ $\quad R = \dfrac{v_o^2}{g}\sin 2\theta_o$ $\quad H = \dfrac{(v_o\sin\theta_o)^2}{2g}$

$\Sigma\vec{F} = 0$ Newton's 1st law $\quad \Sigma\vec{F}_{net} = m\vec{a}$ Newton's 2nd law

$\vec{F}_{A\,on\,B} = -\vec{F}_{B\,on\,A}$ Newton's 3rd law $\quad F_{net,x} = ma_x$ $\quad F_{net,y} = ma_y$ $\quad F_{net,z} = ma_z$

$\Sigma\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3} + \cdots$

$f_k = \mu_kF_N$ $\quad f_{s,max} = \mu_sF_N$ $\quad a_{rad} = \dfrac{v^2}{R} = \dfrac{4\pi^2R}{T^2}$ $\quad F = \dfrac{mv^2}{R}$ $\quad W = F_g = mg$

$W = \vec{F}\cdot\vec{d} = Fd\cos\varphi$ $\quad P = \vec{F}\cdot\vec{v} = Fv\cos\phi$ $\quad W_s = -\dfrac{1}{2}kx^2$ $\quad \vec{F}_x = -k\vec{x}$

$K = \dfrac{1}{2}mv^2$ $\quad W = K_f - K_i = \Delta K$ $\quad P_{avg} = \dfrac{W}{\Delta t}$ $\quad W_s = \dfrac{1}{2}k{x^2}_i - \dfrac{1}{2}k{x^2}_f$

$U = mgy$ $\quad U(x) = \dfrac{1}{2}kx^2$ $\quad E_{mec} = K + U$ $\quad K_2 + U_2 = K_1 + U_1$

$\vec{p} = m\vec{v}$ $\quad \vec{F}_{net} = \dfrac{d\vec{p}}{dt}$ $\quad \vec{J} = \Delta\vec{p} = \vec{F}_{avg}\Delta t$ $\quad \vec{r}_{com} = \dfrac{1}{M}\sum_{i=1}^{n} m_i\vec{r}_i$ $\quad \vec{v}_{com} = \dfrac{1}{M}\sum_{i=1}^{n} m_i\vec{v}_i$

$m_A\vec{v}_{A1} + m_B\vec{v}_{B1} = m_A\vec{v}_{A2} + m_B\vec{v}_{B2}$

$\vec{v}_{A2} = \dfrac{m_A - m_B}{m_A + m_B}\vec{v}_{A1}$ $\quad \vec{v}_{B2} = \dfrac{2m_A}{m_A + m_B}\vec{v}_{A1}$ $\quad \vec{a}_{com} = \dfrac{1}{M}\sum_{i=1}^{n} m_i\vec{a}_i$ $\quad \vec{F}_{net} = M\vec{a}_{com}$

$1\,rad = \dfrac{360°}{2\pi} = 57.3°$ $\quad a_{tan} = \alpha\,r$ $\quad \omega = \dfrac{d\theta}{dt}$ $\quad \omega_{av} = \dfrac{\Delta\theta}{\Delta t} = \dfrac{\theta_2 - \theta_1}{t_2 - t_1}$

$s = \theta\,r$ $\quad v = \omega\,r$ $\quad a_{rad} = \dfrac{v^2}{r} = \omega^2r$ $\quad \alpha = \dfrac{d\omega}{dt} = \dfrac{d^2\theta}{dt^2}$ $\quad \alpha_{av} = \dfrac{\Delta\omega}{\Delta t} = \dfrac{\omega_2 - \omega_1}{t_2 - t_1}$

$|\vec{\tau}| = |\vec{r}\times\vec{F}| = r\,(F\sin\phi) = F_{tan}r$ $\quad |\vec{L}| = |\vec{r}\times\vec{p}| = |\vec{r}\times m\vec{v}| = mvr\sin\phi$ $\quad \vec{\tau} = \dfrac{d\vec{L}}{dt}$

4. A block of mass 3.5 Kg slides on horizontal surface the coefficient of kinetic friction is 0.47, the kinetic friction force between the block and the surface is :
A) 13N B) 16N C) 15N D) 11N

5. The coefficients μ_s and μ_k :
A) both opposite to each other B) are vectors
C) have no units D) always parallel to the surface

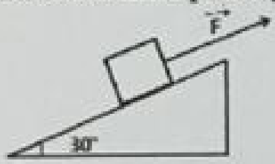
6. The centripetal force accelerates a body by changing the direction of the body's .... without changing the body's speed.
A) acceleration B) displacement C) velocity D) path

7. The components of a car's position as a function of time are given by $r_x = 2t + 3$, and $r_y = 4t - 1$. The position vector at t= 2s is :
A) $\vec{r} = 5\hat{i} + 3\hat{j}$ B) $\vec{r} = 11\hat{i} + 15\hat{j}$ C) $\vec{r} = 9\hat{i} + 11\hat{j}$ D) $\vec{r} = 7\hat{i} + 7\hat{j}$

8. In Newton's First law , If no net force act on a body ....:
A) the body's velocity cannot change , that is, the body can accelerate
B) the body's velocity can change , that is, the body can accelerate
C) the body's velocity can change , that is, the body cannot accelerate
D) the body's velocity cannot change , that is, the body cannot accelerate

Use the following to answer questions 9-10:

A 5 Kg box is held at rest on a frictionless inclined plane by a force $\vec{F}$

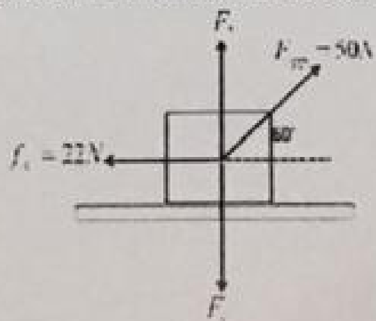


9. The magnitude of $\vec{F}$ is :
A) zero B) 100 N C) 24.5 N D) 50 N

10. The normal force $\vec{F}_N$ on the box is:
A) $mg \sin 30^\circ$ B) 0 C) $mg \cos 30^\circ$ D) mg

11. The SI unit of weight is :
A) Kilogram B) gram C) pound D) Newton

12. In the figure a 2Kg mass slide over a horizontal frictional plane ,the object ....



A) accelerates at 1.5 m/s^2 (right)
B) dose not accelerate
C) accelerates at 3 m/s^2 (right)
D) accelerates at 10 m/s^2 (right)

1. A force of 50N is:
A) 50 kg.m/s B) 50 kg. m^2/s C) 50 g.m/s^2 D) 50 kg.m/s^2

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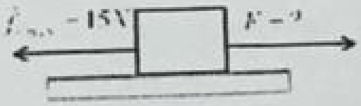
2. In the figure the block will move on the floor if F equals



A) 13N
B) 14N
C) 15N
D) 16N

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3. You are standing on the floor ,the push on you from the floor is
A) Gravitational force B) Tension C) Friction D) Normal force

13. Three forces $\vec{F_1} = 3\hat{i}$, $\vec{F_2} = 4\hat{j}$ and $\vec{F_3}$ act on a body which is moving with a constant velocity . $\vec{F_3}$ is:

A) $\vec{F_3} = -3\hat{i} - 4\hat{j}$ B) $\vec{F_3} = -3\hat{i} + 4\hat{j}$ C) $\vec{F_3} = 3\hat{i} + 4\hat{j}$ D) $\vec{F_3} = 3\hat{i} - 4\hat{j}$

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14. The coefficient of static friction between a 5kg block and horizontal surface is 0.4.The maximum static frictional force is :

A) 49N B) 5.5N C) 10N D) 19.6N

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15. Two forces $\vec{F_1} = 8\hat{i} + 6\hat{j}$ and $\vec{F_2} = 4\hat{i} + 10\hat{j}$ act on a particle of mass 2Kg .The acceleration is :

A) $4\hat{i} + 3\hat{j}$ B) $2\hat{i} + 5\hat{j}$ C) $6\hat{i} + 8\hat{j}$ D) $2\hat{i} + 2\hat{j}$

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16. A man of mass m stands on a scale (ميزان) in an elevator, the general solution for the scale reading is :

A) $F_N = m(-a_y - g)$ B) $F_N = ma_y$

C) $F_N = m(a_y - g)$ D) $F_N = m(a_y + g)$

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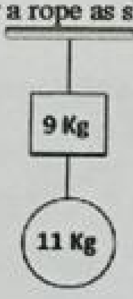
17. Two blocks are suspended (معلق) by a rope as shown , the tension in the top rope is:



A) 196 N
B) 88.2 N
C) 19.6 N
D) 107.8 N

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18. From Newton's 2nd law

A) $\vec{F_1} - \vec{F_2} - \vec{F_3} = 0$ B) $\vec{F_1} - \vec{F_2} - \vec{F_3} = ma$

C) $\vec{F_1} + \vec{F_2} + \vec{F_3} = ma$ D) $\vec{F_1} + \vec{F_2} + \vec{F_3} = 0$

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19. A 22 kg mass is sliding horizontally on a frictionless surface,the normal force F_N is :

A) 334N B) 215.6N C) 121N D) 204N

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20. Two bodies A and B interact , the magnitude of the forces on the bodies from each other are :

A) $F_{AB} \langle F_{BA}$
B) $F_{AB} = F_{BA}$
C) $F_{AB} = F_{BA} = 0$
D) $F_{AB} \rangle F_{BA}$

Q.1 A car moves along the x-axis with constant speed, the acceleration of the car is:

(A) Increasing (B) Decreasing (C) Zero (D) 9.8 m/s2

Q.2 The Newton's Second Law is given by:

(A) $\vec{w} = m\vec{g}$ (B) $\vec{F}_N = -m\vec{g}$ (C) $\vec{p} = m\vec{v}$ (D) $\vec{F}_{net} = m\vec{a}$

Q.3 A car travels north at constant velocity, the net force on the car is:

(A) less than zero (B) zero (C) 9.8 N (D) greater than zero

Q.4 A constant force $\vec{F} = (24\text{ N})\hat{i} + (18\text{ N})\hat{j}$ acts on an object of mass 6 kg. The magnitude of the acceleration of the object is:

(A) 6.0 m/s^2 (B) 5.0 m/s^2 (C) 4.0 m/s^2 (D) 3.0 m/s^2

Q.5 The acceleration of gravity on the moon is 1.67 m/s^2. A person of weight 93.5 N on the moon. His mass is:

(A) 61 Kg (B) 73 Kg (C) 64 Kg (D) 56 Kg

Q.6 A man of mass 55 kg. His weight is:

(A) 588 N (B) 637 N (C) 539 N (D) 686

Q.7 An electron (mass = 9.11×10^{-31} kg) leaves one end of a TV picture tube with zero initial speed and travels in a straight line to the accelerating grid, which is 1.8 cm away. It reaches the grid with a speed of 3.00×10^{6} m/s. If the accelerating force is constant, (ignore the gravitational force on the electron) the net force on it is:

(A) 1.6×10^{-16} N (B) 2.28×10^{-16} N (C) 2.73×10^{-16} N (D) 3.2×10^{-16} N

Q.8 A light cable from the ceiling suspends a ball of weight 440 N in static equilibrium. The tension in the cable is:

(A) 380N (B) 400 N (C) 420 N (D) 440 N

Q.9 A block of mass m is suspended from the ceiling by a light cable in static equilibrium. If the tension in the cable is 29.4 N, the mass of the block is:

(A) 6 Kg (B) 3 Kg (C) 5 Kg (D) 4 Kg

Q.10 A 1200 kg elevator is moving up with zero acceleration. The tension in the cable is:

(A) 10780 N (B) 7840 N (C) 11760 N (D) 8820 N

Q.11 In the figure a 9 kg box is pushed at a constant speed up the frictionless ramp by a horizontal force F. The magnitude of F is:

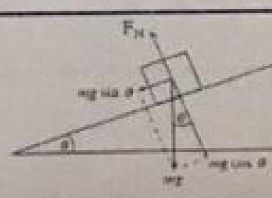
(A) 53.9 N (B) 44.1 N (C) 63.7 N (D) 58.8 N

Q.12 A1000 kg elevator is moving up with acceleration 5 m/s^2. The tension in the cable is:

(A) 11800 N (B) 12800 N (C) 14800 N (D) 13800 N

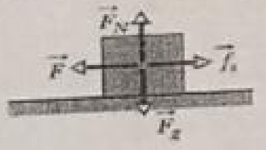
Q.13 A mass m is placed on incline that makes an angle θ with respect to the horizontal. The normal force is:

(A) m g sinθ (B) m g cosθ (C) m g (D) m g tanθ



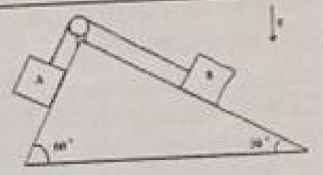
Q.14 Refer to **Q13**, If the coefficient of friction between the mass and the incline is μ, the friction force is:
(A) μ m g sin θ (B) μ m g (C) μ m g cosθ (D) μ m g tanθ

Q.15 The frictional force on a moving body is proportional to the:



(A) force causing the motion (B) normal force on the body
(C) acceleration of the body (D) weight of the body

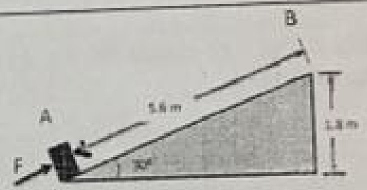
Q.16 Two blocks A and B (m_A=100 kg and m_B= 50 kg) connected by a cord passing over a small, frictionless pulley rest on frictionless planes. The acceleration of the blocks is:



A) 4m/s^2 B) 4.6 m/s^2 C) 3.1 m/s^2 D) 4.3 m/s^2

Q.17 A particle moves 10 m in the positive x direction while being acted upon by a constant force F=$(3\hat{i} + 4\hat{k})$ N. The work done on the particle by this force is:
(A) 45 J (B) 51 J (C) 36 J (D) 30 J

Q.18 force F causes the 5 kg box to slide up from point A to point B. The work done by the normal force on the box is:



(A) 98 J (B) zero (C) 49 J (D) 58 J

Q.19 An object that has kinetic energy must be:
(A) moving (B) falling (C) at rest (D) non of these

Q.20 A moving particle of mass 3 kg, has kinetic energy of 15 J. Its speed is:
(A) 3.37 m/s (B) 2.58 m/s (C) 3.16 m/s (D) 2.83 m/s

Q.21 A particle of mass 4 kg moves with a speed of 3 m/s, its kinetic energy is:
(A) 45 J (B) 36 J (C) 27 J (D) 18J

Q.22 A man of mass 85 kg climbs a stair of 4 m height at constant speed. The work done by the man is:
(A) 3332 J (B) 5831 J (C) 4165 J (D) 4998 J

Q.23 A 80 kg runner runs up the stairs to the top of 400 m tall tower. To lift himself to the top in 10 minutes, what must be his average power output?
(A) 174 W (B) 348 W (C) 523 W (D) 261 W

Q.24 A force acts on a spring with length 30 cm. This force compressed it to be 25 cm. If the spring constant is 50 N/m, the work done by the spring is:
(A) -0.0625 J (B) -0.0900 J (C) -0.1225 J (D) -0.1600 J

Q.25 If the work done on a particle is 40 J in 5 s. The power is:
(A) 11 W (B) 10 W (C) 9 W (D) 8 W

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Physics Dept.
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3

Home Work # 3	Display Date: **27/10/1439H**	Chapters Covered: **Ch.4 & Ch.5**
Student Name:	ID:	Section:

Q.1 A 2.49×10^4 N Rolls-Royce Phantom traveling in the +x-direction makes an emergency stop; the x-component of the net force acting on it is -1.83×10^4 N. What is its acceleration?

Q.2 An elevator and its load have a combined mass of 800 kg. The elevator is initially moving downward at 10.0 m/s; it slows to a stop with constant acceleration in a distance of 25.0 m. What is the tension T in the supporting cable while the elevator is being brought to rest?

Q.3 You want to move a 500-N crate across a level floor. To start the crate moving, you have to pull with a 230-N horizontal force. Once the crate starts to move, you can keep it moving at constant velocity with only 200 N. What are the coefficients of static and kinetic friction?

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4

Home Work # 4	Display Date: **10/11/1439H**	Chapters Covered: **Ch.6 & Ch.7**
Student Name:	ID:	Section:

Q.1 Suppose the sled's initial speed *v*1 is 2.0 m/s. if W_{tot} = 10 kJ, what is the speed of the sled after it moves 20 m?

Q.2 A woman weighing 600 N steps on a bathroom scale that contains a stiff spring. In equilibrium, the spring is compressed 1.0 cm under her weight. Find the force constant of the spring and the total work done on it during the compression.

Q.3 We want to slide a 12-kg crate up a 2.5-m-long ramp inclined at 30°. A worker, ignoring friction, calculates that he can do this by giving it an initial speed of 5.0 m>s at the bottom and letting it go. But friction is *not* negligible; the crate slides only 1.6 m up the ramp, stops, and slides back down. Find the magnitude of the friction force acting on the crate, assuming that it is constant.