:① A Sled of mass 7·5 kg is pulled alo
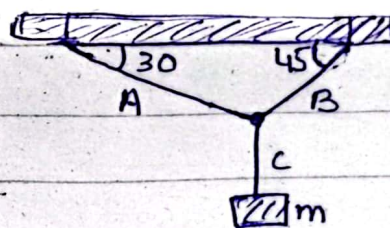a frictionless horizontal surface by a chord.
A constant force of 21N is applied to
cord. Analyze the motion if a) cord is
horizontal b) cord makes an angle of
15° with horizontal.

Note: (calculate Normal force & acceleration)

Ans:  a)   $N = 74N$          $a = 2.8 \, m/s^2$
      b)   $N = 69$           $a = 2.7 \, m/s^2$


2) In given figure



a block of mass 15 kg hanging from
three strings. What are the tensions in
strings?

Ans:   $T_A = 108 \, N$       $T_B = 132N$, $T_C = 147 N$


3): A package tied to a string hangs from
the ceiling of an elevator. What is
the tension in the string when a)
elevator is ascending with constant velocity
b) descending with an acceleration
of $3.2 \, m/s^2$

Ans:  a) $T = 24N$          b)  $T = 31N$

4) A block of mass 10 kg on a frictionless surface (horizontal). The block is pulled by a string of negligible mass that is attached to a hanging block of mass 30 kg. The string passes over a frictionless pulley. Find tension and acceleration of system.

Ans: $a = 7.35 \, m/s^2$         $T = 73.5 \, N$

5) Consider an automobile moving along a straight horizontal road with a speed $V_o = 27 \, m/s$. The driver brakes and brings the car to rest without skidding. If the co-efficient of static friction b/w tires and road is $\mu_s = 0.60$. What is the shortest distance in which the automobile can be stopped?

Formulae ( $f_s = \mu_s N$ ),

Ans: $d = 62 \, m$.

6) In the given system, a block of mass $m_1 = 9.5 \, kg$ slides on a plane with co-efficient of friction of 0.15 inclined at an angle of 34°. The block is attached to second block ($m_2 = 2.6 \, kg$). The system is released from rest. Find acceleration and tension.
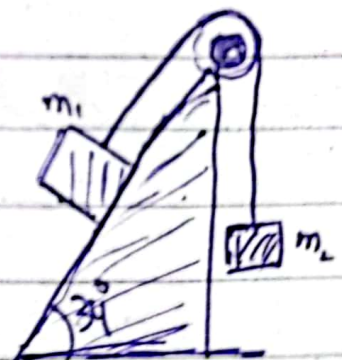
Ans: $a = -1.2 \, m/s^2$        $T = 29 \, N$.

2) In a damped oscillator, let $m = 250g$ $K = 85 \, N/m$ and $b = 0.070 \, kg/s$. In how many periods of oscillations will the mechanical energy of oscillator drops to one half of its initial value?

Formulae $\quad T = 2\pi\sqrt{\dfrac{m}{K}} \quad , \quad \overset{\text{damped}}{E = Kx_o^2 \, e^{-bt/2m}}$

Ans: $t = 2.5s$

3) A simple harmonic oscillation is represented by;

$$X = 0.34 \cos(3000t + 0.74)$$

where x and t are in mm and sec. respectively. Determine i) the amplitude ii) the frequency and angular frequency iii) the time period.

Ans; i) $0.34_{mm}$ ii) $\dfrac{1500}{\pi}$ iii) $\dfrac{\pi}{1500}$

4) The equation of SHM is given as

$$x = 6 \sin 10\pi t + 8 \cos 10\pi t$$

Find i) Period ii) amplitude iii) initial phase

Ans i) $0.2s$ ii) $x_o = 10 cm$ iii) $53.12°$

3) A particle in SHM is described by the displacement function

$$X = X_0 \cos(\omega t + \phi)$$

If the initial position of particle is 1 cm and its initial velocity is $\pi$ cm/s. What are the amplitude and phase angle.

the angular frequency of particle is $\pi$ Hz.

Ans $X_0 = \sqrt{2}$ cm $\qquad \phi = 3\pi/4$

6) A mass of 0.5 kg connected to a light spring of force constant 20 N/m oscillates on a horizontal frictional surface.

i) Calculate the total energy and maximum speed if amplitude of motion is 3cm.

ii) What is the velocity of the mass when displacement is equal to 2cm.

iii) Find the KE and PE when displacement is 2cm.

Ans i) $9 \times 10^{-3}$ J     ii) 0.14 m/s     iii) $5 \times 10^{-3}$ J, $4 \times 10^{-3}$ J

7) A small bob of mass 50g oscillates as a simple pendulum with an amplitude 5cm and time period 2s. Find the velocity of the bob and tension in the supporting thread when velocity of bob is maximum.

(5)

i) What force should be applied to the block along the inclined so that block moves down without any acceleration.

ii) What force should be applied to the block along the incline so that block moves up without any ~~aceller~~ acceleration →

Ans: i) 11N

ii) 30.6N.

1) A certain spring hangs vertically. When a body of M = 1.65 kg is suspended from it, its length increased by 7.33 cm. The spring is then mounted horizontally. and a block of mass m = 2.43 kg is attached to spring. The block is free to slide along frictionless horizontal surface.

a) What is force constant

b) What is magnitude of horizontal force requ to stretched the spring by distance of 11.6 cm

c) When block is displace to 11.6 cm and release what will be period of oscillation?

d) What will be total energy?

e) What will be the maximum speed?

f) If block is released at t = 0 what are its position, velocity and acceleration at t = 0.215 s?

Ans; 
a) 221 N/m  
b) F = 25.6 N  
c) 0.659 s  
d) 1.49 J  
e) 1.11 m/s  
f) −0.0535 u,  
  −0.981 m/s  
  4.87 m/s$^2$