Laws of motion and Friction

Assignment 1

Question 1

(i). A body of mass m moves along the positive x-axis, it starts at velocity v_0 at t = o and it is the origin initially. It is acted by the force such that

F = -kv

find the time in which it will come to rest

(a) $t \rightarrow \infty$

(b) t = kt/m

(c) t = mt/k

(d) none of the above

(ii) Find the velocity of body as a function of time

(a) v_0 exp (-kt/m)

(b) v_0 exp (-mt/k)

(c) v_0 exp (-t)

(d) none of the above

(iii). Find the value of x at which it velocity become 0

(a) mv_0/k

(b) mv_0/k^2

(c) m/kv_0

(d) none of the above

(iv) Find the velocity as a function of distance

(a) v_0 + kx/m

(b) v_0 - kx/m

(c) v_0 - x/m

(d) none of the above

Question 2 : Matrix match type-

Column A

A boy of weight W is standing in an elevator. find the force of the boy feel

(a) when the elevator stand still

(b) when the elevator moving with constant velocity (v m/s) downward

(c) when the elevator moving with constant velocity (v m/s) upward

(d) moving up with acceleration (a m/s^2)

(e) moving down with acceleration (a m/s^2)

Column B

(P) F = W

(Q) F>W

(R) F< W

(S) no appropriate match

Question 3
(i). A 6 kg object is subject to three forces
F1 = 20i + 30j N
F2 = 8i - 50j N
F3 = 2i + 2j N
find the acceleration of object
(a) 5i + 3j
(b) 5i - 3j
(c) 3i + 5j
(d) 3i - 5j

(ii). which of the following expression is correct if at t = 0, object is at origin and velocity is $v_0 = i + j$
(a) $r = i(2.5\ t^2 + t) + j(t - 1.5t^2)$
(b) $r = i(2.5\ t^2 - t) + j(t + 1.5t^2)$
(c) $r = it - jt^2$
(d) none of the above

Question 4
A particle of weight W resting a smooth(frictional less) inclined plain AB with the help of force F acting on the particle at angle θ with the line AB.
find the forceF and normal reaction
(a) (Wcosθ)/sinα, [Wcos(α - θ)]/cosθ
(b) (Wsinα)/cosθ, [Wcos(α + θ)]/cosθ
(c) (Wsinα)/cosθ, [Wsin(α + θ)]/cosθ
(d) none of the above

Question 5 : Match the column
Column A
(a) S_1
(b) S_2
(c) S_3
(d) S_4
Column B
(P) $\Sigma F \neq 0$
(Q) $\Sigma F = 0$
(R) a = 0
(S) $a \neq 0$

Question 6
A boy pushes a mass with a force F. Confident of friction between body and floor is μ_m and between boy shoe and floor is μ_B. There mass are M(block) and m(boy) respectively.
(i). What maximum force boy can apply without slipping
(a) $\mu_m mg$
(b) $\mu_m Mg$
(c) $\mu_B mg$

(d) none of the above

(ii). What is the condition required to move the block without slipping
(a) $\mu_B/\mu_m > M/m$
(b) $\mu_B/\mu_m > m/M$
(c) $\mu_B/\mu_m < M/m$
(d) $\mu_B/\mu_m < m/M$

Answers
Question 1
(i) (a)
(ii) (a)
(iii) (a)
(iv) (b)
Question 2
(a) = (P)
(b) = (P)
(c) = (P)
(d) = (Q)
(e) = (R)
Question 3
(i) (b)
(ii) (a)
Question 4 (b)
Question 5
(a) → (Q), (R)
(b) → (Q), (R)
(c) → (Q), (S)
(d) → (Q), (S)
Question 6
(i) (c)
(ii) (a)