1 i) Write any two methods to reduce friction.

Friction can be reduced by following methods.1) The irregularities of the surface are smoothened by rubbing to avoid interlocking. It reduces the friction.2) When a lubricant (oil on grease) is spread over the surface, fills the irregularities and avoids interlocking. So friction is reduced.3) if we convent sliding friction into rolling friction then friction can be minimised.4) If a body can be streamlined by shape then fluid friction can be minimized . It is the only cause of Pin-Pointed Shapes of aeroplanes , rockets etc.

(ii) Obtain the condition for maximum horitzontal range.

we know $R = U^2 \sin 2\theta / g$

It means horizontal range depends upon velocity of projection & angle of projection. Fore a fixed value of u , R depends only on value of θ. Range will be maximum if sin2θ is maximum

$\sin 2\theta = 1 = \sin 90°$

$\theta = 45°$

$\boxed{R_{max} = u^2/g}$ Maximum horizontal Range

(iii) if $\vec{A} = 2\,\hat{\imath} - 3\hat{\jmath} + 4\,\hat{k}$ & $\vec{B} = \hat{\imath} + 2\,\hat{\jmath} + 4\,\hat{k}$ then find $\vec{A}.\vec{B}$.

$\vec{A}.\vec{B} = (2\times1) + (-3\times2) + (4\times4) = 12$

(iv) Write the dimensional formula of force & acceleration.

$[M^1L^1T^{-2}]$ & $[L^1T^{-2}]$ respectively for force and acceleration

(V) Stale triangle law of vector addition

It states that if two vectors acting at a point simultaneously be represented in magnitude and direction by the two sides of a triangle taken in order then their resultant vector is represented by the third side of the triangle taken in opposite order.

(vi) State principle of homogeneity.

It States that the dimensional formula of every term on the two sides of a correct relation must be homogeneous.

2) Answer any two questions. [05x02=10]

(i) Derive the equation of trajectory for a projectile fired at an angle θ .

consider a Particle thrown with a velocity at an angle with horizontal. The projectile rises to a a height and comes back to C on the level of Projection.

Let $\vec{u}$ - velocity of projection.

θ Angle of projection.

$\vec{v}$ velocity of Projectile at position A.

(x,y) co-ordinate of A

T - Time at which the projectile is at A.

g - Acceleration due to gravity.

T→ Time taken to reach from O to B = Time of ascent = Time of descent

v_(x ,) v_y- component of velocity of projectile along x-axis & y-axis respectively.

Now $\vec{u}$ is broken into ucosθ along x-axis and usinθ along y axis

We know $\vec{v} = \vec{u} + \vec{a}\vec{t}$

then vx = ucosθ + 0t = ucosθ equation 1

vy = usinθ – gt equation 2

v2 = v_x^2 〖+ v〗 _y^2

Again $\vec{s} = \vec{u}\vec{t} + 1/2\ a +^2$

Or x = ucosθ· t + 1/2 x0x+²

x = ucosθ t

or t = x/ ucosθ equation 3

simllarly y = usinθ t - 1/2g +²

using the value of equation -3 in above equation we can write

y = usinθ ×x/ucosθ – gx2/(ucosθ ×ucosθ)

or y = tanθ. x + (g/(2 ucosθ ucosθ)) x2

or y = ax + bx2 equation 4

This is the equation of Parabola.

It is known as equation of trajectory.

where a = tanθ & b = (-g)/(2 ucosθ ucosθ)

(ii) Write the laws of limiting friction.

LAWS OF LIMITING FRICTION

The laws of limiting friction are as follows.

i) The direction of force of friction always opposite to the direction of motion.

ii) The force of limiting friction depends upon the nature and State of Polish of the surfaces in contact and acts tangentially to the interface between the two surfaces.

iii) The magnitude of limiting friction F varies directly to the magnitude of normal reaction R between the two Surfaces in contact.

Mathematically $F \propto R$

(iv) The magnitude of limiting friction between two surfaces is independent of the area and shape of the surfaces in contact so long as the normal reaction remains the same.

(Iii)Check the correctness of the formula using dimensional analysis. $V^2 - U^2 = 2as$

Dimensional formula of U , V ,a & s are $[L^1T^{-1}]$, $[L^1T^{-1}]$, $[L^1T^{-2}]$ & $[L^1]$ respectively.

LHS $[L^1T^{-1}][L^1T^{-1}] - [L^1T^{-1}][L^1T^{-1}]$

$[L^2T^{-2}] - [L^2T^{-2}]$

RHS $[L^1T^{-2}][L^1]$

$[L^2T^{-2}]$

LHS is homogeneous to RHS. Hence the equation is dimensionally correct.