1) A student pills a box of books on a smooth horizontal floor with a force of 100 N on a direction of 37° above the horizontal surface. If the mass of the box & the books is 40 kg. what is the acceleration of the box & the normal force on the box by the floor?

Ans- Since there is no friction, net force will be equal to F·cosθ.

F cosθ = ma & we get Fcosθ by resloving it:

$\Rightarrow 100 \times \cos 37° = 40a$

$\Rightarrow 100 \times 0.7986 = 4a$

$\Rightarrow a = 1.99 \text{ m/s}$

$= 2 \text{ m/s}^2$

$m = 40 \text{ kg}$

$F = 100 \text{ N}$

Angle $\theta = 37°$

$\sin 37° = 3/5$

$F_N = mg - F\sin\theta$

$F_N = 40 \times 9.8 - 100 \times \sin 37$

$F_N = 392 - (100 \times \frac{3}{5}) = 392 - 60 = 332 \text{ N}$

2. a) Does the earth exert a force on every particle near its surface?
Yes

b) Is this a long range force / contact force?
Long range force

c) What is the magnitude of the force on a particle of mass m? What is the direction of the force?
The magnitude of mass m is $g = (9.80\ m/s^2)$
Direction of the force = downwards.

d) Two object A & B having respective masses 2 kg & 10 kg, are both dropped from a tower & fall while interacting solely with the earth (since air resistance is negligible)

a) What then is the gravitational force on A by the earth? What is gravitational force on B by the earth
Gravitational force on A by the earth → 20 N
Gravitational force on B by the earth → 98 N

b) What is the acceleration of the falling object A & what is the acceleration of the falling object B?
Both have same acceleration $9.8\ m/s^2$.