

SOLUTIONS - PHYSICS

$$5(a) F = \frac{Gm_1m_2}{r^2}$$

$$m_1' = 2m_1 \quad r' = \frac{r}{2} \Rightarrow r'^2 = \frac{r^2}{4}$$
$$m_2' = 2m_2$$

$$\therefore F' = \frac{Gm_1' m_2'}{r'^2}$$

$$\therefore F' = \frac{G \times (2m_1) \times (2m_2)}{r^2/4}$$

$$= 4 \times \frac{Gm_1m_2}{r^2} \times 4$$

$$= 16 \times \frac{Gm_1m_2}{r^2}$$

$$= 16F$$

Thus the gravitational force between the two objects becomes 16 times the original force.

$$(b) F = \frac{Gm_1m_2}{r^2} \quad m_1 = 70\text{kg} \quad m_2 = 70\text{kg} \quad r = 14\text{cm} = 0.14\text{m}$$

$$\Rightarrow F = \frac{6.67 \times 10^{-11} \times 70 \times 70}{(0.14)^2}$$

$$= \frac{6.67 \times 10^{-11} \times 70 \times 70 \times 100 \times 100}{14 \times 14}$$

$$= 6.67 \times 10^{-11} \times 5 \times 5 \times 10^4$$

$$= 166.75 \times 10^{-11} \times 10^4$$

$$= 166.75 \times 10^{-7}$$

$$= \underline{\underline{1.6675 \times 10^{-5} \text{ N}}}$$



### SECTION C

6. (a) The product of mass of an object and its velocity is called momentum of the object

$$\text{Momentum} = \text{mass} \times \text{velocity}$$

$$\underline{\underline{P = mv}}$$

(b) Newton's second law of motion — The rate of change of momentum of a body is directly proportional to the applied unbalanced force and takes place in the direction in which the force acts.

(c) Whether Raju does 'long jump' on sand bed or on road, the change in momentum is the same as initial and final velocity is the same. However when he jumps on a sand bed his time to stop from the fall is more than the time taken for his fall on road. This decreases the rate of change of momentum and hence force when he falls on sand bed. and increases the rate of change of momentum i.e. force when he falls on road. Hence he feels pain in his joints.

7. (a) Newton's Universal Law of Gravitation can be stated as:

Every body in the universe attracts every other body with a force which