

ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

MECHANICAL ENGINEERING DEPARTMENT

Dynamics Worksheet 1

1. Calculate the gravitational attraction between two objects when they are $7.50 \times 10^{-1}m$ apart. Each object has a mass of 50kg.
2. The acceleration due to gravity at sea level is $g=9.81 \text{ m/s}^2$ and the radius of the earth is 6370km. The universal gravitational constant $G=6.67 \times 10^{-31} \text{ Nm}^2/\text{kg}^2$. Use this information to determine the mass of the earth.
3. Consider two iron spheres, each of diameter 100mm, which are just touching. At what distance d from the center of the earth will the force of mutual attraction between the contacting spheres be equal to the force exerted by the earth on one of the spheres?
4. The three 100mm diameter spheres constructed of different metals are located at the vertices of an equilateral triangle in deep space. Determine the resultant $\mathbf{R}$ of the gravitational forces which the aluminum and cast-iron spheres exert on the copper sphere.

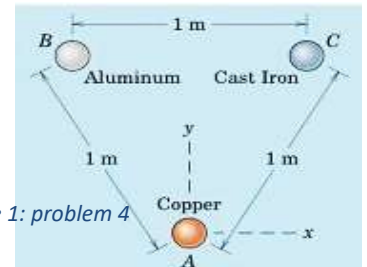


Figure 1: problem 4

5. Calculate the gravitational field strength on the surface of the Earth.
6. At what altitude h above the North Pole is the weight of an object reduced to 10% of its Earth's surface value? Assume spherical Earth of radius R_E and express h in terms of R_E .
7. Determine the absolute weight and the weight relative to the rotating earth of 90kg man if he is standing on the surface of the earth at a latitude of 40° .
8. A mountain climber has a mass of 80kg. Determine his loss of weight in going from the foot of Mount Everest at an altitude of 2440 meters to its top at an altitude of 8848m. Mount Everest has latitude of 28°N , and the mean radius of the earth is 6371km.
9. Calculate the distance d from the center of the earth at which a particle experiences equal attractions from the earth and from the moon. The particle is restricted to the line through the centers of the earth and the moon. Justify the two solutions physically.

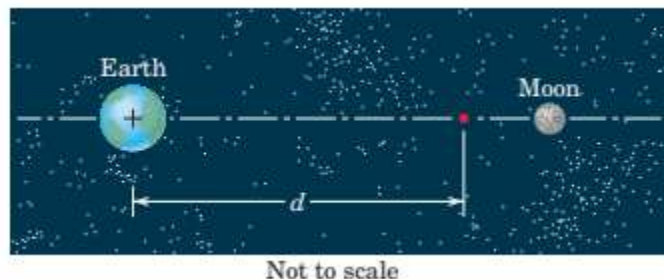


Figure 2:- problem 9