Chapter 13 (Gravitation)

1- A uniform spherical shell is made of copper. Its inner and outer radii are 0.50 m and 0.75 meter, respectively. The gravitational force exerted by this shell on a particle of mass m:
a. is zero if it is placed at 0.4 m from its center, **b**. is zero if it is placed in contact with its outer surface, **c**. is maximum if it is placed at its center, **d**. is maximum if it is placed in contact with its inner surface, **e**. is zero if it is placed at a point 0.65 m from the center

2- Three particles with equal mass M = 1.0 kg are located at (0,0), (4,0) and (0,4) where the x and y coordinates are in meters. Find the magnitude of the gravitational force exerted on the particle located at the origin by the other two particles. (A: 5.9×10^{-12} N)

3- A moon is moving in a circular orbit around a planet with a period of 10^4 s. Find the mass of the planet if the radius of the orbit is 10^7 m. (A: 5.9×10^{24} kg)

4- Three particles with equal mass M = 1.0 kg are located at (0,0), (4,0) and (0,4) where the x and y coordinates are in meters. Find the potential energy of the system.
(A: -4.5×10^{-11} J)

5- A rocket is fired vertically from Earth's surface. It reaches a maximum altitude h = 4.0 Re (Re = radius of Earth) above the surface of Earth. Find the initial speed of the rocket (Re = 6.37×10^6 m and mass of Earth Me = 5.98×10^{24} kg). (A: 10 km/s)

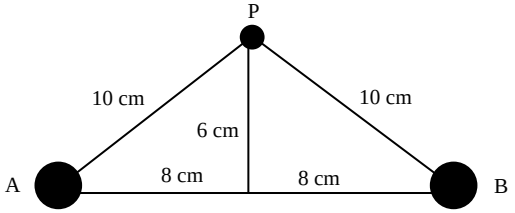
6- At what altitude (in Earth's radii) above the surface of the Earth would the acceleration of gravity be 1/8 of that on the surface? (A: 1.83 Re)

7- A satellite is observed to orbit a large planet close to its surface with a period of 6.0 hours. Find the average mass density of the planet. Assume the planet is spherical.
(A: $303 kg/m^3$)

8- A 100 kg spaceship is in circular orbit of radius 1.38 x 10^7 m around the Earth. How much energy is required to transfer the spaceship to a circular orbit of radius 1.92×10^7 m? (A: 4.08×10^8 J)

9- The planet Mars has a satellite which travels in a circular orbit of radius 9.4×10^6 m, with a period of 2.754×10^4 s. Calculate the mass of Mars from this information. (A: 6.48×10^{23} kg)

10- Two spheres, each of mass 6.4 kg, are fixed at points A and B. Find the Magnitude and direction of the initial acceleration of a sphere of mass 0.01 kg if released from rest at point p and acted only by forces of gravitational attraction of the spheres A and B.
(A: -0.5×10^{-7} J m/s^2)



Summary of Chapter 13 topics

1- Understanding the Newton’s law, Principle of superposition, Gravitation near Earth
2- Understanding the Gravitation Inside Earth, Gravitational potential energy.
3- Understanding the Kepler's laws, Satellites.