Chapter 14 (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 1.38×10^7 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: $- 0.5 \times 10^{-7}$ j m/s^2)