Work sheet-Class XI, Chapter-8, Gravitation -2/3

(2/3: Acceleration due to gravity and its variation with altitude and depth. Gravitational Potential Energy and Gravitational potential)

1. Where does a body weigh more – at the surface of the earth or in a mine?
2. If the earth is regarded as a hollow sphere , then what is the weight of an object below the surface of the earth?
3. A particle is to be placed in turn, outside four objects, each of mass m. (i) a large uniform solid sphere (ii) a large uniform spherical shell (iii) a small uniform solid sphere (iv) a small uniform shell. In each situation, the distance between the particle and the centre of the object is d. Rank the objects according to the magnitude of the gravitational force they exert on the particles, greatest first.
4. Where is the gravitational potential energy maximum?
5. What is the amount of work done in bringing a mass from the surface of earth on one side to a point diametrically opposite on the other side?
6. The gravitational potential energy of a body of mass m is 10^{-7} J. What energy is required to project the body out of the gravitational field of earth?
7. If earth shrinks to half of its present radius , its mass remaining the same, the weight of an object on the earth will increase ….. times. Fill in the blank.
8. What is the dimensional formula of universal constant of gravitation?
9. Two particles of masses m_1 and m_2 attract each other gravitationally and are set in motion under the influence of gravitational force. Will the centre of mass move?
10. If the radius of earth shrinks by 1.5% (mass remains the same) then how would the value of acceleration due to gravity change?
11. If the diameter of the earth becomes two times the present value and its mass remains the same, then how would the weight of an object on the surface of the earth be affected?
12. Why a body weighs more at poles and less at equator?
13. Derive the relation: $g = \frac{4\pi GR\rho}{3}$, where ρ is the mean density of earth, R is the radius of the earth, g is the acceleration due to gravity and G is the gravitational constant.
14. Why a tennis ball bounces higher on hills than in plains?
15. Why a man can jump higher on the moon than on the earth ?
16. The acceleration due to gravity at the moon's surface is 1.67 m/s^2. If the radius of the moon is $1.74*10^6$m, calculate the mass of the moon. [$7.58*10^{22}$ kg]
17. A man can jump 2.0 m high on the earth. Calculate the approximate height he might be able to jump on a planet whose density is one quarter that of the earth. And whose radius is one third of that of the earth's radius. [24 m]
18. The Mount Everest is 8848 m above the mean sea level. Estimate the acceleration due to gravity at this height , given that mean g on the surface of the earth is 9.8 m/s^2. And mean radius of the earth is $6.37*10^6$m. [9.77 m/s^2]
19. What will be the value of g at the bottom of sea 7 km deep ? Diameter of earth is 12800 km and g on the surface of the earth is 9.8 m/s^2. [9.789 m/s^2]
20. How much faster than the present rate should the earth rotate about its axis so that the weight of a body at the equator becomes zero? Also calculate the new length of the day. What would happen if the rotation becomes still faster.
    [17 times, 1.4 hour, objects kept loose on the equator will start leaving the earth's surface.]