Gravitation

1. **Assertion (A):** Two satellites A and B are in the same orbit around the earth, B being behind A. Satellite B can overtake satellite A by increasing its speed.
   Reason (R): Orbital speeds of two satellite in same orbit may different
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** At the centre of the earth, a body has centre of mass, but no centre of gravity.
   Reason (R): Acceleration due to gravity is zero at the centre of the earth.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. **Assertion (A):** The mechanical energy of earth–moon system remains same when another heavenly body passes nearby the earth–moon system.
   Reason (R): Force exerted by heavenly body on the earth–moon system is non-conservative.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** An astronaut in an orbiting space station above the earth experiences weightlessness.
   Reason (R): An object orbiting around the earth under the influence of the earth's gravitational force is in a state of free fall.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** Gravitational potential of earth at every place upon it is negative.
   Reason (R): Every body on earth is bound by the attraction of earth.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** For a system of masses at some finite distance, gravitational field can be zero but gravitational potential can not be zero.
   Reason (R): Gravitational field is a scalar quantity while gravitational potential is a vector quantity.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7. **Assertion (A):** Period of revolution of satellite in circular orbit around earth is inversely proportional to cube of its orbital speed.
   Reason (R): Period of revolution in uniform circular motion is given by $T = \dfrac{2\pi r}{v}$ where r is radius of orbit and v is speed.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

8. **Assertion (A):** Assuming zero potential at infinity, the gravitational potential at a point can never be positive.
   Reason (R): The magnitude of gravitational force between two particles has inverse square dependence on the distance between two particles.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

9. **Assertion (A):** Gravitational field of a uniform spherical shell outside it is same as that of particle of same mass placed at its centre of mass.
Reason (R): For the calculation of gravitational force between any two uniform spherical shells, they can always be replaced by particles of same mass placed at respective centres.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** The force of attraction between a hollow spherical shell of uniform density and a point mass situated out side is just as if the entire mass of the shell is concentrated at the centre of the shell.
Reason (R): Gravitational forces caused by the various regions of the shell have components along the line joining the point mass to the centre as well as along a direction perpendicular to this line.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** The gravitational force between two finite bodies is necessarily along the line joining their centre of mass.
Reason (R): The gravitational force between two particles is not central.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** If the law of gravitation, instead of being inverse square law becomes an inverse cube law then planets will still have elliptical orbits.
Reason (R): In that case also, $T^2 \propto r^3$ (symbols having usual meanings)
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** Gravitational potential energy of any mass particle may not be zero at earth centre.
Reason (R): Gravitational field intensity at earth centre is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** If the product of surface area and density is same for two planets, escape velocities at surface will be same for both planets.
Reason (R): For given mass of a planet $v_e \propto R^{-1/2}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** When planet moves in elliptical orbit around Sun. Its angular momentum about sun remains conserved.
Reason (R): Total mechanical energy of planet – sun system remains conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Moon revolving around earth does not come closer despite earth's gravitational attraction.
Reason (R): A radially outward force balances earth's force of attraction during revolution of moon.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** Earth has an atmosphere but the moon does not.
Reason (R): Moon is small in comparison to earth.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** Potential energy of a planet increases as it moves from perihelion to aphelion.
Reason (R): As planet moves from perihelion to aphelion work done by gravitational pull of sun on planet is negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** An artificial satellite of earth releases a packet. It will hit the earth exactly below the satellite.
Reason (R): Packet will move along a straight line towards earth's centre with respect to satellite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** Charged particles experience both electrical and gravitational force. But gravitational force is ignored.
Reason (R): Gravitational force is due to mass of particles while electrical force is due to charge of particles.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** If earth stops rotating about its axis, then the value of acceleration due to gravity increases every where, except at the poles.
Reason (R): The value of acceleration due to gravity is maximum at the poles
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** Even when orbit of a satellite is elliptical, its plane of rotation passes through the centre of earth.
Reason (R): According to law of conservation of angular momentum plane of rotation of satellite always remain same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** The radius vector from the sun to a planet sweeps out equal areas in equal times interval.
Reason (R): Transverse (perpendicular to radius vector) acceleration of the planet is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** Earth is continuously pulling moon towards its centre but moon does not fall to earth,
Reason (R): Attraction of sun on moon is greater than that of earth on moon.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** An artificial satellite is moving in a circular orbit of the earth. If the gravitational pull suddenly disappears, then it moves with the same speed tangential to the original orbit.
Reason (R): The orbital speed of a satellite decreases with the increase in radius of the orbit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** If a body is taken from earth to moon, its gravitational mass becomes one-sixth on moon.
Reason (R): Gravitational mass depends upon acceleration due to gravity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** A person in an artificial satellite revolving around the earth feels weightlessness.
Reason (R): There is no gravitational force on the satellite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** A spherically symmetric shell produces no gravitational field anywhere.
Reason (R): The field due to various mass elements cancel out, everywhere for a spherically symmetric shell.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** The plane of the orbit of an artificial satellite must contain the centre of the earth.
Reason (R): For the orbital motion of satellite, the necessary centripetal force is provided by gravitational pull of earth on satellite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** Escape velocity of a satellite is greater than its orbital velocity.
Reason (R): Orbit of a satellite is within the gravitational field of planet whereas escaping is beyond the gravitational field of planet.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** Escape velocity from surface of a planet is V_e. If a tunnel is made inside the surface, the escape velocity from a point inside the tunnel must be greater than V_e.
Reason (R): Gravitational force is a conservative central force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** Total energy is conserved in moving a satellite to higher orbit.
Reason (R): Sum of change in potential energy and kinetic energy is same in magnitude and opposite in nature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	4	1	4	1	1	3	1	2	3	3	4	4	2	2	2	3	2	1	4	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32								
Ans.	2	1	1	2	2	4	3	4	1	1	2	4								