



PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

GRAVITATION

One Mark Questions And Answers

1. What solar model did Ptolemy propose?



2. What solar model did Aryabhatta propose?

3. What solar model did Nicholas Copernicus (1473 - 1543) propose?

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4. Who recognised that all the bodies irrespective of their masses accelerate towards the centre of the earth with a constant acceleration?



5. Based on whose collection of astronomical data did Johannes

Kepler (1571 - 1640) extract the three laws of planetary motion?



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7. State Kepler's I law of planetary motion (Law of orbits).
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8. State Kepler's II law of planetary motion (law of areas)
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9. State Kepler's III law of planetary motion (law of periods)
9. State Repler's III law of planetary motion (law of periods)

10. How is the speed of a planet , related to the position of the

planet?



11. Draw a neat diagram to show the position of apchelion perihelion and foci in a planetary model.

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12. State the universal law of gravitation .



13. Define universal gravitational constant.

14. Mention the dimensional formula for universal gravitational constant 'G'.

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15. Mention the . SI unit of universal gravitational constant.	

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16. Give the expression for the attractive force on the mass 'm' due

to another M.



17. How are $\overrightarrow{F_{12}}$ and $\overrightarrow{F_{21}}$ related.



20. Write the expression for the period of revaluation of a planet

revolving in a circular orbit.



21. Write the relation between acceleration due to gravity and universal gravitational constant and explain the terms.

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22. Give the expression for acceleration due to gravity at an altitude
above the surface of the Earth.
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23. Mention the expression for acceleration due to gravity at a

depth below the surface of the Earth.



24. What is the value of acceleration due to gravity at the centre of

the Earth ?



27. What will be the acceleration due to gravity at the poles ?



31. Give the expression for the gravitation potential at a point 'h' above the surface of the Earth.



centre of the Earth .



34. Give the expression for the gravitational energy on a body of mass (m) , on the surface of the Earth.

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35. What is the value of universal gravitational constant ?
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36. How does acceleration due to gravity vary with mass and radius
of the planet ?
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37. Give the expression for the amount of work done on a mass body (m) to shift it from one orbit to another orbit above the



38. If v_i and v_f represent the initial and final speeds of projection,

then represent the difference of K.E in terms of difference of P.E.



39. Give the expression for the escape speed of an object.

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40. Give the expression for the K.E of an orbiting satellite.

41. Obtain the expression for total energy of a circularly orbiting

satellite.

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42. What is the orbiting speed of an artificial satellite close to the surface of the Earth .

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43. At what distance from the centre of the Earth do all the geostationary satellites orbit?



44. Write the expression for the energy of a particle of mass 'm',

orbiting round a massive body M.

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45. What are polar synchronous satellites ?
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46. What is weightlessness ?
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47. why geostationary satellites are called so ?
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depend on the mass of the body?



2. If 'R' is the distance of the Moon from the Earth and 'T ' is the period of revolution of the Moon , then obtain the formula to calculate the mass of the Earth.



3. Name the group of geostationary satellites widely used for telecommunication in India. It is an acronym for Indian Satellites.

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4. Mention a few applications of the polar satellites.



5. What is meant by gravitational field intensity at a point due to

the Earth ?



3. If $\overrightarrow{r_1}$ and $\overrightarrow{r_2}$ are the position vectors of mass bodies M_1 and M_2 then represent force between them in a vector from.



5. Obtain an expression for the average density of the Earth.



6. Show that
$$V_0=\sqrt{gr}$$



7. Arrive at the expression for escape speed of the body from the

surface of earth.



3. Write a few characteristics of gravitational force.



7. Derive an expression for the gravitational potential energy of a body . Give the difference between gravitational potential and gravitational potential energy.

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Numericals With Solutions

1. Assuming the distance of the Moon from the Earth $R=3.84 imes10^8m$ and Moon's period of revolution as 27.3 days, calculate the mass of the Moon.



2. Calculate the average density of Earth.

3. Calculate the height of a geostationary satellite.

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4. Assuming the Earth to be a sphere of uniform mass density , how
much would a body weight half way down to the centre of the Earth

if it weighed 250N on the surface ?



5. A rocket is fired vertically with a speed of $5kms^{-1}$ From the Earth surface . How far from the Earth does the rocked go , before returning back ?

6. The escape speed of a projectile on the Earth 's surface i.e $11.2kms^{-1}$.A body is project with thrice this speed .what is the speed of the body far away from the Earth ? Ignore the pressure of sun and other places.

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7. A satellite orbits the Earth at a height of 400 km above the surface . How much energy must be expected to Rocket the satellite out of Earth 's gravitational influence ? Mass of the satellite = 200 kg , mass of Earth $= 6.0 \times 10^{24} kg$, radius of Earth $= 6.4 \times 10^6 m$, $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$



8. Two states each of one solar mass $(2 \times 10^{30} kg)$ are approaching each other for a head on collision. When they are at a distance 10^9 their speeds are negotiable. What is the speed with which they collide ? The radius of each star is 10^4 assume the stars to remain undistorted unit thye collide.



9. Two heavy spheres each of mass 100 kg and radius 0.10m are placed 1. Om apart on a horizontal table. What is the gravitational field and potent at the mid point of the line joining the centre of the spheres ? $(M_E=6.0 imes10^{24}kg,R_E=6.4 imes10^6m)$

10. Find the gravitational potential at the site of a geostationary satellites . Assume the height of the satellite to be 4200 km from the centre of Earth.

(Mass of Earth $\,= 6.0 imes 10^{24} kg)$.

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11. In a sub - stage lunch of a satellite, the first stage brings the satellite to a height of 150 km and the second stage gives it the necessary critical speed to put . It in a circular orbit around the Earth , which stage requires more expenditure of fuel ?

(Given

 $M_E = 6.0 imes 10^{24} kg, R = 6.4 imes 10^6 m, G - 6.67 imes 10^{-11} Nm^2 kg^{-2}).$

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12. A star , 2 .5 times the mass of sum , collapse to a size of 12 km with a speed of 1.2 rps . T the object placed on the surface remains stuck to the surface due to gravity ? [mass of sun $=2 imes10^{30}kg$]

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13. A rocket is fired vertically from the surface of $2kms^{-1}$. If 20% of its internal energy is lost due to the Martian atmospheric resistance , how far will the rocket go from the surface of Mars before returning back ? Mass of Mars = $6.4 \times 10^{24} kg$, radius of Mars = 3395 km , $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$

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14. Light from a massive star suffers ' gravitational red - shift 'i.e It's wavelength changes towards the red end to the gravitational

attraction of the star. Obtain the formula for this gravitational red shift using the simple consideration that a photon of frequency 'v' has energy 'hv' and mass $\frac{hv}{c^2}$. Estimate magnitude of the red - shift for light of wavelength 5000Å from a star of mass 10^{32} kg and radius 10^6 km.

$$ig(G=6.67 imes 10^{-11} Nm^2 kg^{-2}, c=3.00 imes 10^8 ms^{-1}ig)$$

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15. A body weighs 63 N on the surface of the Earth . What is the gravitational force on it due to the Earth , at a height equal to half the radius of the Earth ? (Given that the radius of Earth = 6400 km).

