PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

GRAVITATION

Exercise

1. State Kepler's Laws of planetary motion.

OR

State kepler's law of orbit and law of equal areas.

OR

Any one law can be asked for

OR

State Kepler's law of equal areas.

OR

State Kepler's Law of period.

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2. Explain Kepler's law of orbit

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3. State Kepler's Laws of planetary motion.

OR

State kepler's law of orbit and law of equal areas.

OR

Any one law can be asked for

OR

State Kepler's law of equal areas.

OR

State Kepler's Law of period.

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4. State and explain Newton's law of gravition.

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5. Express Newton's law of gravition in vector form.

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6. State S.I. unit and obtain dimension of universal gravitational constant?

OR

What is gravitional constant?

OR

What are dimension of Universal constant?

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7. Three 5 kg masses are kept at the vertices of an equilateral triangle each side of 0.25 m.

Find resultant gravitational force on any one mass. $G = 6.67 \times 10^{-11}$ S.I. units.

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8. Explain the method of measuring Gravitional constant G using Cavendish balance.

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9. Derive the relation between the universal gravitational constant and the gravitional acceleration on the surface of the earth.

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10. What is the variation in acceleration due to gravity with altitude?

OR

Derive an expression for the gravitational acceleration at an altitude h above the earth.

OR

Show that the gravitional acceleration at a height h above the surface of the earth is (in usual notations) $g_h = g\left(\frac{R}{R+h}^2\right)$

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11. Discuss the variation of g with depth and derive the necessary formula.

OR

Show that the gravitational acceleration due to the earth at a depth d from its surface is

$g_d = g\left[1 - \frac{d}{R}\right]$, where R is the radius of the earth and g is the gravitional acceleration at the earth's surface.

OR

Discus the variation of acceleration due to gravity with depth 'd' below the surface of the earth

OR

Derive an expression for acceleration due to gravity at depth 'd' below the surface of earth

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12. .Derive an expression for the gravitational acceleration on the earth's surface at a latitude λ

OR

Explain the variation of acceleration due to gravity due to the rotational motion of the earth

OR

Explain the effect of latitude on the value of acceleration due to gravity

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13. At which place on the earths surface in the gravitational acceleration maximum? Why?

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14. At which place on the earth's surface the gravitational acceleration in minimum? Why?

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15. As we go from equator to pole, what happens to value of 'g'?

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16. Draw the graph showing variation of gravitational acceleration due is depth and altitude from the earth's surface

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17. If the earth were a perfect sphere of radius 6.4×10^6 m rotating its axis with the perod of one day $\left(8.64 \times 10^4 s\right)$. What is the difference in accelaration due to gravity from poles to equator?

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18. State the formula for acceleration due to gravity at depth 'd' and altitude 'h'. Hence,

show that their ratio in equal to $\left[\frac{R-d}{R-2h}\right]$ by assuming $h\langle R \rightarrow$ radius of earth.

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19. Calculate the K.E, P.E, Total energy and Binding energy of an artificial satellite of mass 2000kg orbiting at a height of 3600 km above the surface of the earth

Given: G = $6.67 \times 10^{-11} Nm^2/kg$

R= $6400km = 6.4 \times 10^6$m

M= 6×10^{24} kg

m = 2000 kg

h = 3600 km =3.6×10^6 m

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20. Define escape velocity. Derive an expression for the escape velocity of an object from the surface of the earth.

OR

Define escape velocity of a body at rest on the earth's surface. Obtain an expression for the same and show that it is independent of the

mass of the body.

OR

Define escape velocity of the body. Obtain an expression for the escape velocity when the body is at rest on the surface of the earth and show that it is independent of the mass of the body.

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21. Obtain the relation between escape velocity and critical velocity when satellite is

orbiting very close to earth.

OR

Show//prove that the escape velocity of a satellite orbiting round the earth is equal to $\sqrt{2}$ time its critical velocity.

OR

Show that $V_e = \sqrt{2}.\, V_c$ for a satellite orbiting round the earth.

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22. On which factors does the escape speed of a body from the surface of the earth depend?

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23. Show that the escape velocity of a body from the surface of a planet of radius R and mean density ρ is $R\frac{\sqrt{8}\pi\rho G}{3}$

OR

Show that the escape velocity of a body from the surface of the earth is $2R\frac{\sqrt{2}\pi\rho G}{3}$, where

R is the radius of the earth and `rho is the mean density of the earth.

OR

Obtain formula of escape velocity of a body at rest on the earth's surface in terms of mean density of erth.

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24. What do you mean by geostationary satellite ?

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25. What is a geostationary satellite? State its two uses.

OR

What is a communication satellite? Give any two of its uses.

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26. State uses of geostationary (communication) satellite.

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27. What is a polar Satellite?

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28. Draw a neat labelled diagram to show different trajectories depending upon the tangential projection speed

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29. Discus different causes of projection of satellite

OR

State the conditions for various possible orbits of satellite depending upon horizontal speed of projection.

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30. Why is it necessary to have a minimum two stage launching system to put a satellite into

desired circular orbit?

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31. What is time period of polar satellite?

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32. Define critical velocity and derive an expression for the same.

OR

What is critical velocity? Derive an expression

for critical velocity of a satellite orbiting at a certain height. Also discuss the formula when satellite is very close to the earth's surface.

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33. Prove that the critical $velocity$ or $Orbital$ velocity for a satellite orbiting. each in terms of density of the earth is $2R\sqrt{\frac{2\pi\rho G}{3}}$, where ρ is the density and R is radius of earth and G is gravitational constant.

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34. Find the gravitational force between the Sun and the Earth.

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35. Why is weightlessness caused in a spaceraft?

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36. As we go from one planet to another planet, how will the mass and weight of body change?

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37. Obtain an expression for the period of a satellite in a circular orbit round the earth

OR

Show that the square of the period of revolution of satellite is directly proportional

to the cube of the orbital radius.

OR

Show that period of the satellite revolving around the earth depends upon mass of the earth

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38. Derive an expression for time period of a satellite orbiting very close to earth's surface in terms of mean density

OR

A satellite is in a low-altitude circular orbit around a spherical planet of mean density ρ. Show that the period of revolution of the satellites is $\sqrt{3\pi / \rho G}$

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39. Define binding energy. State its units and dimensions.

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40. Derive an expression for binding energy of a body at rest on the earth's surface.

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41. Define binding energy and obtainan expression for binding energy of a satellite revolving in a circular orbit round the earth.

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42. Where Binding Energy of a satellite will be maximum?

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43. How much will be the work done to keep the satellite in orbit?

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44. What happens to K.E. of satellite as it moves away from the surface of the earth?

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45. Define Latitude.

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46. Calculate the speed and period of revolution of a satellite orbiting at a height of

700 km above the earth's surface. Assume the orbit to be circular. Take radius of earth as 6400 km and g at the centre of earth to be $9.8m/s^2$

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47. An artificial satellite makes two revolutions per day around the earth. If the acceleration due to gravity on the surface of the earth is $9.8m/s^2$ and the radius of the earth is 6400

km, calculate the distance of satellite from the surface of the earth

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48. A satellite is going in a circular orbit of radius 4×10^4 km around the earth has a certain speed.

(a) What will be the radius of a circular orbit of the same satellite when it moves around the planet Mars with the same speed?

The masses of earth and Mars are in the ratio $10:1$ and their radii are in the ratio $2:1$

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49. A satellite is going in a circular orbit of radius 4×10^5 km around the earth has a certain speed.

(b) What will be the ratio of the weight of a body on the surface of Mars to tyhe weight of the same body on the surface of the earth?

The masses of earth and Mars are in the ratio $10:1$ and their radii are in the ratio $2:1$

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50. A satellite is revolving in a circular orbit very close to the surface of earth. Find the period of revolution of the satellite

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51. Determine the binding energy of satellite of mass1000 kg revolving in a circular orbit around the earth. Hence, find kinetic energy and potential energy of the satellite,[mass of earth = $6xlO^{24}$ kg, radius of earth = 6400 km, gravitational constant G = $6.67xlO^{-11}Nm^2/kg^2$]

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52. According to Kepler's Law, the areal velocity of planet around the Sun, always

A. Increases

B. decreases

C. remains constant

D. first increases then decreases

Answer:

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53. Choose the incorrect statement about gravitational force

A. It forms action- reaction pair.

B. It is a central force.

C. It is conservative force.

D. It depends upon nature of medium between the masses.

Answer:

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54. Two bodies of different masses reach simultaneously on ground from height h in vacuum because

A. acceleration of both bodies is same

B. acceleration is independent of mass

C. in vaccum there is no frictional force

D. statement itself wrong

Answer:

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55. A satellite of the earth is revolving in a circular orbit with uniform speed V. If the gravitational force suddenly disappears, the satellite will

A. continue to move with velocity V along the original orbit.

B. move with a velocity, tangentially to the original orbit

C. fall down with increasing velocity

D. ultimately come to rest somewhere on the original orbit.

Answer:

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56. If a small part separatesfrom an orbiting satellite, the part will

A. fall on the earth directly

B. move in a spiral and reach the earth after a few rotations

C. continue to move in the same orbit as the satellite.

D. move further away from the earth gradually.

Answer:

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57. Two satellites Aand B move round the earth in the same orbit. The mass of B' is twice the mass of A

A. Speed of A and B are equal.

B. The potential energy of earth + A is same as that of earth + B

C. The kinetic energy of A and B are equal.

D. The kinetic energy of earth + A is same as that of earth + B

Answer:

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58. The earth (mass=6×10^{24} kg) revolves around the Sun with angular velocity $2 \times 10^{-7} rad/s$ in a circular orbit of radius 1.5×10^{8} km. The force exerted by the Sun on the earth in Newton is

A. zero

B. 18×10^{25}

C. 27×10^{39}

D. 36×10^{21}

Answer:

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59. For a satellite orbiting close to earth's surface, expression for period is

A. $T = 2\pi\sqrt{\frac{GM}{R}}$

B. $T = 2\pi\sqrt{R}/g$

C. $T = 2\pi \frac{R}{\sqrt{R^3}/GM}$

D. $T = 2\pi\sqrt{g}/R$

Answer:

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60. The height of a communication satellite from the earth's surface is about

A. 3.6×10^4m

B. 3.6×10^6m

C. $3.6 \times 10^7 \text{m}$

D. $306 \times 10^8 \text{m}$

Answer:

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61. Persons sitting in an artificial satellite orbiting around the earth have

A. zero mass

B. zero weight

C. infinite weight

D. infinite mass

Answer:

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62. A geostationary satellite has an orbital period of

A. 2 hours

B. 6 hours

C. 12 hours

D. 24 hours

Answer:

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63. The value of acceleration due to gravity is maximum at

A. the equator of the earth

B. the centre of the earth

C. the pole of the earth

D. slightly above the surace of the earth

Answer:

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64. The gravitational potential due to the earth is minimum at

A. centre of the earth

B. surface of the earth

C. a point inside the earth

D. infinite distance but not at the centre

Answer:

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65. Dimensions of gravitional potential are

A. $\left[M^1T^{-2}\right]$

B. $\left[L^1T^{-2}\right]$

C. $\left[L^2T^{-2}\right]$

D. $\left[M^1L^2T^{-1}\right]$

Answer:

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66. Select and write the most appropriate answer from the given alternatives for each subquestion

The masses and radii of two planets A and B are both in the ratio $1:2$.The ratio g_A/g_B of the gravitational acceleration on the planets is

(a) $1:8$

(b) $1:2$

(c) $2:1$

(d) $8:1$

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67. Select and write the most appropriate answer from the given alternatives for each subquestion

A satellite in a circular orbit around the earth has a total energy E (E < 0). Its potential

energy is

(a)-2E

(b)$-E$

(c)E

(d) 2E

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68. Draw a diagram showing different stages of projection for an artificialsatellite.

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69. The escape velocity of a body from the surface of the earth is 11.2 km/s. If a satellite were to orbit close to the earth's surface, what would be its critical velocity?

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70. State Kepler's law of orbit and law of equal areas.

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71. Derive an expression for binding energy of a body at rest on the earth's surface.

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72. State the SI unit and obtain the dimensions of the universal gravitational constant.

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73. Derive an expression for the acceleration due to gravity at a depth d below the earth'ssurface

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74. What is a geostationary satellite? State its two uses.

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75. Obtain an expression for critical speed of a satellite

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76. State the factors on which escape speed of a satellite depend

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