PHYSICS

BOOKS - MAXIMUM PUBLICATION

GRAVITATION

Example

1. Is it possible to shield a body from gravitational effect?

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2. Where is the maximum value of g on the surface of Earth. Why?

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3. There is a popular statement regarding Cavendish: "Cavendish weighed the earth". Comment on this statement.

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4. gravitational potential energy at a point, $U = -GM\dfrac{m}{r}$. what is meant by negative sign in the above equation.

5. gravitational potential energy at a point, $U = -GM\dfrac{m}{r}$. what is the value of U at $r = \infty$.

6. Deduce an equation for gravitational potential energy.

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7. moon has no atmosphere. why?

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8. What is the condition for total energy to escape from Earth's gravitational field?

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9. calculate the height of geostationary satellite.

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Exercise

1. If a satellite of mass m is revolving around the earth with distance r from centre, then total energy is

A. $-\dfrac{GMm}{r}$

B. $-\dfrac{2GMm}{r}$

C. $-\dfrac{GMm}{2r}$

D. $+\dfrac{GMm}{r}$

Answer: C

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2. The dimensions of universal gravitational

constant are

A. $\left[M^{-2}L^3T^{-2}\right]$

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

C. $\left[M^{-1}L^3T^{-2}\right]$

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

Answer: C

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3. When a radius of earth is reduced by 1% without changing the mass, then change in the acceleration due to gravity will be

A. increased by 2%

B. decreased by 1.5%

C. increased by 1%

D. decreased by 1%

Answer: A

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4. The kinetic energy of a satellite is 2MJ. What is the total energy of the satellite?

A. $-2MJ$

B. $-1MJ$

C. $-\dfrac{1}{2}MJ$

D. $-4MJ$

Answer: A

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5. If total energy of the satellite is negative, can it escape from the earth's surface? Justify.

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6. Why a man can jump higher on the moon than on earth?

7. How much energy is required by a satellite to keep it orbitting? Neglect air resistance.

8. What would happen to an artificial satellites, if its orbital velocity is slightly decreased due to some defects in it?

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9. Why a tennis ball bounces higher on hills than in plain?

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10. The orbiting velocity of an earth-satellite is $8k\dfrac{m}{s}$. What will be the escape velocity?

11. A comet orbits the sun in a highly elliptical orbit. Does the comet have a constant linear speed?

12. A comet orbits the sun in a highly elliptical orbit. Does the comet have a constant total energy?

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13. A comet orbits the sun in a highly elliptical orbit. Does the comet have a constant angular momentum?

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14. What are the consequences if the angular momentum is conserved?

15. Fill in the blanks R- Radius of earth, g- Acceleration due to gravity, h-Height from surface of earth, d- Depth from surface of earth The value of g at a height is (a)g_h=_____. The value of g decreases with height.

16. The Earth moving round the sun in a circular orbit is acted upon by a force. Name the force acting on the Earth.

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17. The Earth moving round the sun in a circular orbit is acted upon by a force. Obtain a mathematical expression for the force.

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18. The Earth moving round the sun in a circular orbit is acted upon by a force. What is the work done by the force?

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19. Escape velocity of objects in a planet depends on the mass and size of the planet. What is its value on the surface of our planet?

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20. Escape velocity of objects in a planet depends on the mass and size of the planet. What is its value on the surface of our planet?

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21. Escape velocity of objects in a planet depends on the mass and size of the planet. Give the reason why the moon does not have an atmosphere around it.

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22. The acceleration due to gravity is measured using ticker timer and is found to be $9.8ms^{-2}$. What does the value 9.8 for the acceleration implies?

23. The acceleration due to gravity is measured using ticker timer and is found to be $9.8ms^{-2}$. One of your friends argues that the acceleration due to gravity at the centre of earth is infinity. Do you agree with it?

24. A body of mass 'm' falls freely under gravity, near the surface of earth. Will the acceleration of the body change if a part of the mass is thrown away from it?

25. A body of mass 'm' falls freely under gravity, near the surface of earth. What will be the free

fall acceleration if it is falling from a height equal to R, the radius of earth?

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26. A body of mass 'm' falls freely under gravity, near the surface of earth. If the mass is taken to the moon's surface, will the free fall acceleration increase or decrease?

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27. Geo stationary satellites are commonly used for communication purpose. Name one geostationary satellite of earth.

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28. Geo stationary satellites are commonly used for communication purpose. What are the requirements of a geostationary satellite for its orbital motion.

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29. Geo stationary satellites are commonly used for communication purpose. Explain the phenomenon of 'weightlessness' in orbital satellites.

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30. Geo stationary satellites are commonly used for communication purpose. Distinguish between gravitational mass and inertial mass.

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31. What is acceleration due to gravity?

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32. Does a body have the same weight at the equator and at the poles? Explain.

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33. If the value of gravitational constant is $6.6 \cdot 10^{-11} Nm^2 kg^{-2}$ and $g = 9.8 \dfrac{m}{s^2}$, find the mass of the earth. Given, radius is $6.4 \cdot 10^6 m$.

34. Two identical satellites are orbitting in circular orbits around the earth at heights R and 3R respectively from the surface of the earth. The radius of the earth is R. Define orbital velocity.

35. Two identical satellites are orbitting in circular orbits around the earth at heights R and 3R respectively from the surface of the earth. The radius of the earth is R. Define orbital velocity.

36. Two identical satellites are orbitting in circular orbits around the earth at heights R

and 3R respectively from the surface of the earth. The radius of the earth is R. How do you compare the periods of revolution of these two satellites?

37. The uniform acceleration produced in a freely falling body due to gravitational pull of the earth is known as acceleration due to gravity. What is the value of acceleration due to gravity on the surface of earth.

38. The uniform acceleration produced in a freely falling body due to gravitational pull of the earth is known as acceleration due to gravity. Obtain an expression for acceleration due to gravity at a depth 'd' from the surface of earth.

39. The uniform acceleration produced in a freely falling body due to gravitational pull of the earth is known as acceleration due to gravity. What is the value of g at the centre of earth?

40. Earth can be treated as a sphere of radius R and mass M. A is a point at a height h above the Earth's surface and B is another point at a

depth h^1 below the Earth's surface. The acceleration due to gravity at Earth's surface is g. Obtain a formula to evaluate the acceleration due to gravity at A.

41. Earth can be treated as a sphere of radius R and mass M. A is a point at a height h above the Earth's surface and B is another point at a depth h^1 below the Earth's surface. The acceleration due to gravity at Earth's surface is

g. What is the value of acceleration due to gravity at B?

42. Earth can be treated as a sphere of radius R and mass M. The acceleration due to gravity at Earth's surface is g. If we move from equator to pole, the value of g.

A. increase

B. decrease

C. remains the same

D. first increase and then decrease

Answer: A

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43. Acceleration due to gravity on earth changes with depth and height. What is the weight of a body placed at the centre of earth? Why?

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44. For a particle to leave from the earth's field, it should be projected with a minimum velocity. Name the velocity.

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45. For a particle to leave from earth's gravitation field it should be projected with a minimum velocity. Derive an expression for this velocity.

46. For a particle to leave from earth's gravitation field it should be projected with a minimum velocity. What is the magnitude of this velocity when this particle is projected from another planet whose mass and radius is twice that of the earth?

47. Moon is the only satellite of earth. Mass of moon is very much lower than that of earth. Is there any difference in gravitational force of moon and earth? Explain.

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48. Deduce an equation for gravitational potential energy.

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49. Moon is the only satellite of earth. Mass of moon is very much lower than that of earth. A girl argues that even today if we visit moon, we can see the foot steps of Neil Armstrong. What is your opinion?

50. Suppose there existed a planet that went around the Sun twice as fast as the Earth. What would be its orbital size as compared to that of the earth?

51. One of the satellites of Jupiter has an orbital period of 1.769 days and the radius of the orbit is $4.22 \times 10^8 m$. Show that the mass of the Jupiter is about one thousandth that of the Sun.

52. Let us assume that our galaxy consists of 2.5×10^{11} stars each of one solar mass. How long will a star at a distance of 50,000 ly from the galactic center take to complete on revolution? Take the diameter of the Milky way to be $10^5 ly$.

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53. A rocket is fired from the earth towards the Sun. At what distance from the earth's center

is the gravitational force on the rocket zero?

Mass of the $Sun = 2 \times 10^{30} kg$, Mass of the $earth = 6 \times 10^{24} kg$. Neglect the effect of the other planets etc. ($Orbital\ radius = 1.5 \times 10^{11} m$)

54. How will you 'weigh the Sun', that is estimate its mass? The mean orbital radius of the earth around the Sun is $1.5 \times 10^8 km$.

55. A geostationary satellite orbits the earth at a height of nearly $36,000km$ from the surface of the earth. What is the potential due to earth's gravity at the site of this satelite? (Take the potential energy at infinity to be zero). Mass of the $earth = 6 \times 10^{24}kg.$, radius of $earth = 6,400km$.

56. A saturn year is 29.5 times the earth year. How far is the saturn from the sun if the earth is $1.50 \times 10^8\,km$ away from the sun?

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57. A body weighs $63N$ 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?

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58. Weight of a body depends directly on 'g'. The value of 'g' depends on many factors like shape of earth, rotation of earth etc. Choose the correct alternative: 'g increase/decrease with the increasing altitude'

59. Weight of a body depends directly on 'g'. The value of 'g' depends on many factors like shape of earth, rotation of earth etc. Choose

the correct alternative. g is independent of mass of the earth/mass of the body.

60. Weight of a body depends directly on 'g'. The value of 'g' depends on many factors like shape of earth, rotation of earth etc. Choose the correct alternative. g is maximum/minimum at the poles.

61. Weight of a body depends directly on 'g'. The value of 'g' depends on many factors like shape of earth, rotation of earth etc. Choose the correct alternative. g increases/decreases with the increasing depth.

62. Weight of a body depends directly on 'g'. The value of 'g' depends on many factors like shape of earth, rotation of earth etc. State

Newton's law of gravitation. Then write the unit of the gravitational constant (G).

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63. Weight of a body depends directly on 'g'. The value of 'g' depends on many factors like shape of earth, rotation of earth etc. Derive the expression for orbital and escape velocity.

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64. Weight of a body is the force of gravitational attraction experienced by it. It is equal to the product of mass of the body and acceleration due to gravity. Obtain an expression for the acceleration due to gravity of a body in terms of the mass of the earth.

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65. Weight of a body is the force of gravitational attraction experienced by it. It is

equal to the product of mass of the body and acceleration due to gravity. If you imagine the motion of a body from the centre of the earth to the surface of the moon,what changes will you observe in the weight of the body during that motion?(Neglect the effect of all other objects).

66. A person in an artificial satellite of the earth experiences weightlessness. The moon is

a natural satellite of the earth. Can a person on the moon experience weight? Why?

67. A person in an artificial satellite of the earth experiences weightlessness. The moon is a natural satellite of the earth. A satellite is revolving very close to the earth. What is the percentage increase in velocity needed to make it escape from the gravitational field of the earth?

68. A person in an artificial satellite of the earth experiences weightlessness. The moon is a natural satellite of the earth. Acceleration due to gravity 'g' depends on the distance 'r' from the centre of the earth. Draw a graph showing the variation of 'g' with 'r'.

69. Imagine a point mass 'm' maintained at the centre of a shell of uniform density having mass 'M'. If the radius of the shell is R, what will be the gravitational force exerted by the shell on the point mass? Explain.

70. The acceleration of a body due to the force exerted by earth on it is known as acceleration

due to gravity. Why does earth impart same acceleration on all bodies?

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71. The acceleration of a body due to the force exerted by earth on it is known as acceleration due to gravity. Show graphically the variation of gravitational field strength with distance from the centre of the earth outwards.

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72. The value of acceleration due to gravity is maximum at the .... (1)poles (2)equator (3)centre of the earth

    A. poles

    B. equator

    C. centre of the earth

    D.

Answer: A

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73. Find the height at which 'g' is reduced to $\frac{g}{2}$.

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74. A rat and a horse are to be projected from earth into space. State whether the velocity is the same or different in projecting each animal. Justify.

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75. Now a days we are familiar with satellites. Name any two satellites.

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76. Now a days we are familiar with satellites. Differentiate escape velocity from orbital velocity.

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77. Now a days we are familiar with satellites. For an earth satellite show that, Escape Velocity $= \sqrt{2} \cdot OrbitalVelocity$.

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78. The escape speed for an object from the earth is $11.2k\dfrac{m}{s}$. What is meant by escape speed?

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79. The escape speed for an object from the earth is $11.2k\dfrac{m}{s}$. Arrive at an expression for the escape speed. Does it depend on the mass of the object or not?

80. The escape speed for an object from the earth is $11.2k\dfrac{m}{s}$. Arrive at an expression for the escape speed. Does it depend on the mass of the object or not?

81. The escape speed for an object from the earth is $11.2k\dfrac{m}{s}$. The earth contains an atmosphere while the moon does not. Give the reason.

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82. What is acceleration due to gravity?

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83. The uniform acceleration produced in a freely falling body due to gravitational pull of the earth is known as acceleration due to gravity. Obtain an expression for acceleration due to gravity at a depth 'd' from the surface of earth.

84. The acceleration due to gravity (g) on the surface of the the earth is $9.8\dfrac{m}{s^2}$. At what

height 'h' will the value of 'g' be half of that on the surface of the earth?

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85. For a particle to leave from the earth's field, it should be projected with a minimum velocity. Name the velocity.

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86. For a particle to leave from earth's gravitation field it should be projected with a minimum velocity. Derive an expression for this velocity.

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87. For a particle to leave from the earth's field, it should be projected with a minimum velocity. An elephant and an ant are to be projected from earth into space. Whether the

velocities required for doing so are the same or different? Justify your answer.

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88. For a particle to leave from the earth's field, it should be projected with a minimum velocity. Find the period of a simple pendulum, if this experiment is performed inside a satellite?

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89. What is acceleration due to gravity?

90. The acceleration due to gravity (g) on the surface of the earth is $9.8\dfrac{m}{s^2}$. Derive an expression an expression for the variation of g with height (h) above the surface of the earth.

91. The acceleration due to gravity (g) on the surface of the the earth is $9.8\dfrac{m}{s^2}$. At what height 'h' will the value of 'g' be half of that on the surface of the earth?

92. choose the correct alternative: escape velocity is independent of the mass of the earth/ the mass of the body.

93. Earth satellites are object which revolve around the earth. consider a satellite at a height 'h' from the surface of the earth. give an equation for its orbital velocity.

94. Earth satellites are object which revolve around the earth. consider a satellite at a height 'h' from the surface of the earth. obtain an equation for the period of above satellite.

95. Earth satellites are object which revolve around the earth. Consider a satellite at a height 'h' from the surface of the earth. Distinguish between geostationary satellites and polar satellites.

96. The value of acceleration due to gravity is maximum on the surface of the earth. Write the relation between acceleration due to gravity and gravitational constant.

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97. The value of acceleration due to gravity is maximum on the surface of the earth. Obtain an equation for the variation of 'g' with height.

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98. The value of acceleration due to gravity is maximum on the surface of the earth. Draw a graph showing the variation of 'g' with depth and height from the surface of the the earth. assume that the density of the Earth is constant.

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99. The velocity of a satellite in its orbit is called orbital velocity. find the relationship

between orbital velocity and escape velocity.

100. Earth satellites are object which revolve around the earth. Consider a satellite at a height 'h' from the surface of the earth. Distinguish between geostationary satellites and polar satellites.

101. moon has no atmosphere. why?

102. Earth can be treated as a sphere of radius R and mass M. A is a point at a height h above the Earth's surface and B is another point at a depth h^1` below the Earth's surface. The acceleration due to gravity at Earth's surface is g. What is the value of acceleration due to gravity at B?

103. our earth has several artificial satellites but the moon is the only natural satellite. distance to the moon from the Earth is $3.84 \times 10^8 m$ and the time period of moon's revolution is 27.3 days. obtain the mass of earth. (gravitational constant $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$

104. Our earth has several artificial satellites but the moon is the only natural satellite. How do you explain weightlessness in an artificial satellite?

105. For a particle to leave from the earth's field, it should be projected with a minimum velocity. Name the velocity.

106. For a particle to leave from earth's gravitation field it should be projected with a minimum velocity. Derive an expression for this velocity.

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107. Escape velocity of objects in a planet depends on the mass and size of the planet. Give the reason why the moon does not have an atmosphere around it.

108. The acceleration due to gravity (g) on the surface of the earth is $9.8\dfrac{m}{s^2}$. Derive an expression an expression for the variation of g with height (h) above the surface of the earth.

109. The acceleration due to gravity may vary with altitude and depth. Why does satellite

need no fuel to go around a planet in its fixed orbit.

110. choose the correct alternative: escape velocity is independent of the mass of the earth/ the mass of the body.

111. For a particle to leave from the earth's field, it should be projected with a minimum velocity. Name the velocity.

112. For a particle to leave from earth's gravitation field it should be projected with a minimum velocity. Derive an expression for this velocity.

113. For a particle to overcome the gravitational pull of the Earth, it is projected with a minimum velocity. A ball bounces more on the surface of the moon than on the earth. Explain why?

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114. State Kepler's second law of planetary motion.(law of areas)

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115. Earth satellites are object which revolve around the earth. consider a satellite at a height 'h' from the surface of the earth. give an equation for its orbital velocity.

116. Escape velocity of a planet is $20k\dfrac{m}{s}$. Find the orbital velocity of the smallest possible orbit.

117. The escape speed from the surface of the Earth is given by_____

A. $\sqrt{2gR_E}$

B. $\sqrt{gR_E}$

C. $\sqrt{3gR_E}$

D. $\sqrt{g^2 R_E}$

Answer: A

118. An artificial satellite circulating the earth is at a height $3400km$ from the surface of the earth, if the radius of the earth is $6400km$ and $g = 9.8\dfrac{m}{s^2}$. calculate the orbital velocity of the satellite.

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