PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

UNIVERSE

Illustration Type

1. Find the distance of the moon from the earth if the parallactic angle as measured from two places located 6.4×10^6m apart is 1°.

Watch Video Solution

2. The moon subtends an angle of 57 minutes at the base line equal to radius of earth. What is the distance of moon from earth. Given radius of earth is 6400 km.

Watch Video Solution

3. The parallax of a heavenly body measured from two points diametrically opposite on equator of earth is 1.0 minutes. If the radius of the earth is 6400 km, find the distance of the heavenly body from the centre of the earth in AU. Given $1AU = 1.5 \times 10^{11}$m.

Watch Video Solution

4. The distances of the satellites of Mars are 25" for phobos and 62" for Deimos at mean opposition when Mars is $0.524AU$ from earth. Calculate distances of theh two satelife for Mars in astonomical units and in meters.

View Text Solution

5. Assuming that the orbit of the planet Mercury around the sun to be a circle, Copernicus detrmined the orbital radius to be $0.38AU$. From this determine the angle of maximum elongation for Mercury and its distance from the earth when the elongation is maximum .

Watch Video Solution

6. In case of venus, the angle of maximum elongation is found to be approximately 47°. Determine the distance between venus and sun $(r_{ve}$. and the distance between venus and earth $(r_{ve}$.

Watch Video Solution

7. If the distance of venus from sun is 0.73 AU, find out the orbital period of the venus in days.

Watch Video Solution

8. Suppose there existed a planet that went around the sun twice as fast as the earth. What would by its orbital size?

Watch Video Solution

9. A Saturn year is 29.5 times that earth year. How far is the Saturn from the sun if the earth is 1.50×10^8 km away from the sun ?

Watch Video Solution

10. A rada signal is sent towards a planet and its echo is received after 600 seconds. Find the distance of the planet from the earth.

Watch Video Solution

11. When planet Jupiter is at a distance of 824.7 million km from earth, its angular diameter is measured to be 35.72'' of

arc. Calculate the diameter of Jupiter.

Watch Video Solution

12. The sun's angular diameter is measured to be 1920''. The distance of the sun from the earth is $1.496 \times 10^{11} m$. What is the diameter of the sun?

Watch Video Solution

13. It is a well known fact that during a total solar eclipes the disc of the moon almost completely covers the disc of the sun. From this fact and from the information you can gather from Solved Examples 3 and 4 on page 1//44, determine the approximate diameter of the moon.

Watch Video Solution

Watch Video Solution

14. One of the satellite 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 mass of jupiter is about one thousandth times that of the mass of the sun. (Take 1 year $= 365.15$ mean solar day).

Watch Video Solution

15. Period of revolution of the moon is 27.32 days and its mean distance from earth is $384, 400 km$. Use the equation

$$M_1 + M_2 = \frac{4\pi^2}{G} \cdot \frac{a^3}{T^2}$$

to calculate the sum of the masses of the earth and moon. Further, using the known fact that the earth moon system lies ate $4.75 \times 10^6 m$ from earth's centre, calculate the mass of each.

Watch Video Solution

16. For the moon $M = 7.349 \times 10^{22} kg$ and $R = 1.738 \times 10^{6} m$, calculate the mean density and acceleration due to gravity at its surface. What will be the weight of a man on the moon if he weighs $60 kg$ on the earth? Take $G = 6.668 \times 10^{-11} Nm^{-2} kg^{-2}$.

Watch Video Solution

17. The mass of planet Jupiter is $1.9 \times 10^{7} kg$ and that of the Sun is $1.9x10^{30} kg$. The mean distance of Jupiter from the Sun is 7.8×10^{11}m. Calculate te gravitational force which Sun exerts on Jupiter. Assuming that Jupiter moves in circular

orbit around the Sun, also calculate the speed of Jupiter $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

Watch Video Solution

18. Talking the mass and radius of the earth as the units of mass and distance respectively, the mass of Mars turns out to be 0.107 unit and radius 0.53 units. What is the acceleration due to gravity on the Mar's surface? What will be the weight of a person on Mars if he weighs $98kg$ on earth.

Watch Video Solution

19. Assuming that earth's orbit around the sun is a circle of radius $R = 1.496 \times 10^{11} m$ compute the mass of the sun. $\left(G = 6.668 \times 10^{-11} Nm^2 kg^{-2}\right)$

Watch Video Solution

20. The earth receives at its surface radiation from the sun at the rate of $1400 W m^{-2}$. The distance of the centre of the sun from the surface of the earth is $1.5 \times 10^{11} m$ and the radius of the sun is $7 \times 10^{8} m$. Treating the sun as a black body, it follows from the above data that its surface temperature is .....K

Watch Video Solution

21. The surface temperature of the sun is $6000 K$. If we consider it as a perfect black body, calculate the energy radiated away by the sun per second. Take radius of the sun $= 6.92 \times 10^{5} km$ and $\sigma = 5.67 \times 10^{-8} J m^{-2} s^{-1} K^{-4}$

Watch Video Solution

22. Suppose the sun was located at the position occupied by the star nearest to us, namely α- Centauri, which is at a distance of about 14 from us. By what factor would the radiation received per unit area per second at the earth be reduced?

Watch Video Solution

23. Calculate the value of solar constant at the distance of Jupiter, which is $5.2AU$ away from the sun. Hence calculate the temperature of a black body on Jupiter's Stefan's law.

Watch Video Solution

24. Compute the surface temperature of the sun from the following data:

Distance of earth from the sun $R = 1.469 \times 10^{11} m$

Radius of the sun $r = 6.928 \times 10^{8} m$

Solar constant $S = 1.39 \times 10^{3} W m^{-2}$

Stefan's constant $\sigma = 5.73 \times 10^{-8} W m^{-2} K^{-4}$

Watch Video Solution

25. Suppose the sun shrank from its present size so that its radius is halved. What would be the change in its gravitatioinal potential energy? (Calculate the acutal number in joules)

Watch Video Solution

26. There are certain types of stars called variable stars which undergo periodic change in their light output. If such a star doubles its light output, how much does its magnitude change?

Watch Video Solution

27. The phenomenon of a nova involves the sudden outburst of a star. The star then beocmes much brighter than usual, for a few days or weeks. In 1975 a nova appeared in the constellation of Cygnus (The Swan). In two days the magnitude of the star changed from $+15$ to $+2$. By what factor did its brightness increase?

Watch Video Solution

28. Assume that the dimmest star visible to the naked eye has a magnitude of $+6$. Compare its brightness with that of planet Venus of magnitude -4

Watch Video Solution

29. The luminousity of a star is 10,000 times that of the sun and its surface temperature is $3000K$. Assuming the surface of temperature of the sun to be $6000K$, compare the radius of the star with that of the sun.

Watch Video Solution

30. Calculate the temperature of a star which has maximum energy emission at 4500Å. Given temperature of the sun is

$6000K$ and it has maximum energy emission at 5000Å.

Watch Video Solution

31. Work out the ranges of temperature corresponding to which a star will appear blue and red respectively. Given

Wavelength range of blue colour: 4500Å to 5000Å

Wavelength range for red colour: 6500Å to 7000Å

Watch Video Solution

32. Consider a binary star system consisting of two stars of masses M_1 and M_2 separated by a distance of $30AU$ with a period of revolution equal to 30 years. If one of the two stars is 5 times farther from the centre of mass than the other,

show that the masses of the two stars are 5 and 25 times that of the sun.

Watch Video Solution

33. Consider a white dwarf and a neutron star each of one solar mass. The radius of the white dwarf is same as that of the earth (=6400km) and the radius of the neutron star is 10 km. Determine the densities of the two types of the stars. Take mass of the sun $= 2.0 \times 10^{30}$kg.

Watch Video Solution

34. The two components of Procyon have a separation of 4.55'' and period o 40.6 uears. If the distance of the binary is 11.3 light years, calculate the sum of the masses of the two

stars in solar units. If the ratio of their masses is $3:1$, find the mass of each star.

Watch Video Solution

35. Let us consider that our galaxy consists of 2.5×10^{11} stars each of one solar mass. How long will this star at a distance of $50,000$ light year from the galastic entre take to complete one revolution? Take the diameter of the Milky way to be $10^5 ly$. $G = 6.67 \times 10^{-11} Nm^2 Kg^{-2}$. $\left(1ly = 9.46 \times 10^{15} m\right)$

Watch Video Solution

36. Certain characteristic wavelength in the light from a galaxy in the constellation virgo are observed to be increased in wavelength, as compared with terrestrial sources, by about

$0.4\,\%$. What is the radial speed of this galaxy with respect to earth ? Is it approacing or receding ?

Watch Video Solution

37. What is known as the K-line of singly ionized calcium has a wavelength of $393.3nm$ as measured on earth. In the spectrum of one of the observed galaxies, this spectrial lines is located to $401.8nm$. Determine the speed with which this galaxy is moving away from us.

Watch Video Solution

38. Consider a galaxy moving away from us with a speed of $6480kms^{-1}$. It is a at a distance of 430 million light year from

us, determine Hubble's constant H and corresponding age of universe t_0

Watch Video Solution

Problem Type

1. In a double star, two stars one of mass m_1 and another of mass m_2, with a separation d, rotate about their common centre of mass. Find

(a) an expression for their time period of revolution.

(b) the ratio of their kinetic energies.

(c) the ratio of their angular momenta about the centre of mass.

(d) the total angular momentum of the system.

(e) the kinetic energy of the system.

Watch Video Solution

2. A planet of mass m moves along an ellipse around the sun so that its maximum and minimum distance from the sun are equal to r_1 and r_2 respectively. Find the angular momentum of this planet relative to the centre of the sun. mass of the sun is M.

Watch Video Solution

3. Two satellites S_1 and S_2 revolve round a planet in coplaner circular orbit in the same sense. Their period of revolution are 1 hour and 8 hour respectively. The radius of the orbit of S_1 is $10^4 km$. When S_2 is closest to S_1, find

(a) The speed of S_2 relative to S_1,

(b) The angular speed of S_2 actually observed by an astronaut is S_1

Watch Video Solution

4. Taking moon's period of revolution about earth as 20 days and neglecting the effect of the sun and the effect other planet on its motion, calculate its distance from the earth. Given $G = 6.67 \times 10^{-11} Nm^{-2} kg^{-2}$ and mass of the earth $= 6 \times 10^{24} kg.$

Watch Video Solution

5. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmsphere? [Given, mass of oxygen molecule (m) =

2.76×10^{-26} kg, Boltzmann's constant $k_B = 1.38 \times 10^{-23} J \cdot K^{-1}$]

Watch Video Solution

6. The mass M of a planet earth is uniformly distributed over a spherical volume of radius R. Calciulate the energy needed to de assemble the planet against the gravitational pull amongst its constitutent particles. Given $MR = 2.5 \times 10^{31} kg$ and $g = 10 ms^{-2}$.

Watch Video Solution

Others

1. Find the distance of a heavenly object from the earth if the parallactic angle as measured from two places at a distance of $6.284 \times 10^6 m$ apart is 2°.

Watch Video Solution

2. The moon is observed from two diametrically opposite points A and B on earth. The angle θ substended at the moon by the two directions of observation is $1^\circ 54'$. Given the diameter of earth to be about $1.276 \times 10^7 m,$ calculate the distance of moon from earth.

Watch Video Solution

3. Assuming that a planet goes round the sun in a circular orbit of radius $0.5AU$ determine the angle of maximum elongation for the planet and its distance from the earth when elongation is measured.

Watch Video Solution

4. Find the period of revoluition of planet Mars about the sun if mean distance of the Mars from the sun is 1.52AU.

Watch Video Solution

5. Calculate the period of revolution of Neptune around the sun, given that diameter of its orbit is 30 times the diameter

of earth's orbit around the sun, both orbits being assumed to be circular.

Watch Video Solution

6. The distance of Venus form the sun as determine by radar echo method is found to be $1.082 \times 10^{11} m$. The period of its revolution is 224.633 days. If the period of revolutin of the earth around the sun is 365.257 days, compute the distance of the earth from the sun.

Watch Video Solution

7. In the echo method of estimating distnces, a radar signa was sent towards the Mars. If the echo was received after 8

minute 20 second, how far wat the Mars from the earth at that instant?

Watch Video Solution

8. The angular diameter of the sun is 1920". If the distance of the sun from the earth is 1.5×10^{11}m, what is the linear diameter of the sun ?

Watch Video Solution

9. The diameter of the planet Jupiter is $3580km$. What is its angular diameter when it is at a distance of $8.25 \times 10^{8}km$ from the earth?

Watch Video Solution

10. Given that the mass of the earth is 81.5 times the mass of the moon and the diameter of the moon is 0.27 times that of the earth . Calculate the value of acceleration due to gravity at the surface of the moon . Given 'g' on the earth = $9.8ms^{-2}$

Watch Video Solution

11. Calculate the mass and mean density of the earth from the following data :

$$\begin{aligned} &\text{Gravitational constant} && (G) && = 6.6 \times 10^{-11} Nm^2 kg^{-2} \\ &\text{Radius of the earth} && (R) && = 6.37 \times 10^6 m \\ &\text{Acceleration due to gravity} && (g) && = 9.8ms^{-2} \end{aligned}$$

Watch Video Solution

12. Calculate the mass and mean density of the earth from the following data :

Gravitational constant	(G)	$= 6.6 \times 10^{-11} Nm^2 kg^{-2}$
Radius of the earth	(R)	$= 6.37 \times 10^6 m$
Acceleration due to gravity	(g)	$= 9.8 ms^{-2}$

Watch Video Solution

13. Phobo is a satellite of Mars. The period of its revolution around Mars is 0.319 days and its mean distance from Mars is $9.519 \times 10^6 m$. Assuming that the mass of Phobos is negligible compared to that of Mars, calculate the mass of Mars. Take $G = 6.668 \times 10^{-11} Nm^{-2} kg^{-2}$

Watch Video Solution

14. A satellite of Jupiter has a period of 1.77 day and orbital radius of $4.22 \times 10^8 m$. Find the mass of Jupiter.

Watch Video Solution

15. The period of revolutions of Mars around th esun is 1.881 year and its mean distance from the sun is $1.524 AU$. Calculate the mass of sun $\left(1AU = 1.496 \times 10^{11} m\right)$.

View Text Solution

16. Estimate the mass of the sun, assuming the orbit of Earth around the sun to be a circle. The distance between the sun and the Earth is $1.49 \times 10^{11} m$, and $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

Watch Video Solution

17. The total luminosity of the sun is $3.9 \times 10^{26} W$. The mean distance of the sun from the earth is $1.496 \times 10^{11} m$. Calculate the value of solar constant.

Watch Video Solution

18. Calculate the solar constant on a planet which is approximately 5 A.U. from the sun. Assume the solar constant on earth as $1400 W m^{-2}$.

Watch Video Solution

19. Compute the surface temperature of the sun from the following data:

Distance of Mars form the sun $= 1.524 \forall U$

Solar constant of Mars $= 5.976 \times 10^{2} W m^{-2}$

Stefan's constant $= 5.735 \times 10^{-5} W m^{-2} T^{-4}$

Radius of the sun $= 6.928 \times 10^{8} m$

Watch Video Solution

20. The dimmest star visible to the naked eye has a magnitude of 6.5. Compare its brightness with that of planet Mars having magnitude -2.

Watch Video Solution

21. Venus is about 10^4 times brighter than the dimmest visible star. If the magnitude of the dimmest star $+6$, what is the magnitude of Venus?

Watch Video Solution

22. The phenomenon of a nova involves the sudden outburst of a star. The star then beocmes much brighter than usual, for a few days or weeks. In 1975 a nova appeared in the constellation of Cygnus (The Swan). In two days the magnitude of the star changed from $+15$ to $+2$. By what factor did its brightness increase?

Watch Video Solution

23. A fainter of the two stars of a binary system revolves around the brighter one in an orbit of semimajor axis $20AU$ with a period of 35 euars. Calculat the usm of the masses of the two stars of the binary system.

View Text Solution

24. Sirius A and Sirius B are two components of Sirius binary. The distance between the two components is $20.3AU$ and the period of revolution about their common centre of mass is 49.9 years. If the ratio of the masses of two components os 2.356, find the mass of the two components.

View Text Solution

25. The angular separation betwenteh two components of a binary star system is of $3.5''$ whereas the distance of the binary is 10.2 light years. If the two components of the binary revolve with a period of 45 years, calculate the sum of the masses of the two components in solar units.

Watch Video Solution

26. Energy emitted per second per unit area by Rigal star in Constellation Orion is 17000 times that emited by the sun. What is the surface temperature of that star if that of the sun is $6000K$?

Watch Video Solution

27. The $6563 Å H_2$ line emitted by hydrogen in a star is found to be red shifted by $15 Å$. Estimate the speed with which the star is receding from earth.

Watch Video Solution

28. When the light coming form a galaxy in the constellation Ursa Major was spectro graphically anaylised, it was found to contain a line in the calcium absorption spectrum at a wavelenth of $4170 Å$, the wavelength of same line as observed on the earth is $3970 Å$. Is the galacy receidng away from us? What is the velocity of recession?

Watch Video Solution

29. When the light emitted by a distant galaxy is spectrographically analysed, it is found to contain the characteristic patterns of radiation emitted by famoliar elements, but their wavelength show a red shift of $2\,\%$. How fast is the galaxy receding away from us? Using Hubble's law estimate the distance of galaxy in light year.

Take Hubble's constant $H = 17kms^{-1}$ for every million light year.

Watch Video Solution