



## PHYSICS

### BOOKS - NAVNEET SCIENCE (HINGLISH)

#### NUMERICAL EXAMPLES

#### Gravitation

1. The time taken by the earth to complete one revolution around the sun is  $3.156 \times 10^7 s$ . The distance between the earth and the sun is  $1.5 \times 10^{11}$  m. Find the speed of revolution of the earth.

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2. Assuming that the earth performs uniform circular motion around the Sun, find the centripetal acceleration of the earth. [ Speed of the earth =  $3 \times 10^4$  m/s. distance between the earth and the Sun =  $1.5 \times 10^{11}$  m ]

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3. The masses of the earth and moon are  $6 \times 10^{24}$  kg and  $7.4 \times 10^{22}$  kg , respectively , The distance between them is  $3.84 \times 10^5$  km. Calculate the gravitational force of attraction between the two. Use  $G = 6.7 \times 10^{-11} \text{ N} \cdot \text{m}^2 \text{kg}^{-2}$

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4. The mass of the earth is  $6 \times 10^{24}$  kg. The distance between the earth and the sun is  $1.5 \times 10^{11}$  m. If the gravitational force between

the two is  $3.5 \times 10^{22}$  N, what is the mass of the Sun ? Use

$$G = 6.7 \times 10^{-11} \text{ N} \cdot \text{m}^2 \text{kg}^{-2} \text{gt}$$

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5. Find the magnitude of the acceleration due to gravity at the surface of the earth. (  $M = 6 \times 10^{24}$  Kg,  $R = 6400$  Km)

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6. The radius of planet A is half the radius of planet B . If the mass of A is  $M_A$ , what must be the mass of B so that the value of  $g$  on B is half of its value on A ?

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7. What would be the value of  $g$  on the surface of the earth if its mass was twice and its radius half of what it is now ?

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8. An object takes 5 s to reach the ground from a height of 5 m on a planet. What is the value of  $g$  on the planet ?

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9. A stone thrown vertically upwards with initial velocity  $u$  reaches a height  $h$  before coming down. Show that the time taken by it to go up is the same as the time taken to come down.

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10. An object thrown vertically upwards reaches a height of 500 m.

What was its initial velocity ?

How long will the object take to come back to the earth ? Assume

$$g = 10\text{m} / \text{s}^2$$

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11. A ball falls off a table and reaches the ground in 1 s. Assuming  $g = 10\text{m} / \text{s}^2$ , calculate its speed on reaching the ground (2 marks) and the height of the table.

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12. A metal ball of mass 5 kg falls from a height of 490 m. How much time will it take to reach the ground ?

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13. A body is released from the top of a building of height 19.6 m. Find the velocity with which the body hits the ground .

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14. If the weight of a body on the surface of the moon is 100 N, what is its mass ? ( $g = 1.63 \text{ m/s}^2$ )

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15. The mass and weight of an object on the earth are 5 kg and 49 N respectively. What will be their values on the moon ? Assume that the acceleration due to gravity on the moon is 1/6th of that on the earth.

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16. Find the gravitational potential energy of a body of mass 10 kg when it is on the earth's surface. [M(earth) =  $6 \times 10^{24} \text{ kg}$ , R (earth) =  $6.4 \times 10^6 \text{ m}$ ,  $G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2$ ]

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17. If the body in Ex. (26) performs uniform circular motion around the earth at a height of 3600 km from the earth's surface, what will be its gravitational potential energy?

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18. A body of mass 200 kg is at rest on the earth's surface. (i) Find its gravitational potential energy. (ii) Find the kinetic energy to be provided to the body to make it free from the gravitational influence of the earth. ( $g = 9.8 \text{ m/s}^2$ ,  $R = 6400 \text{ km}$ )

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19. Find the escape velocity of a body from the earth.

$$[M(\text{earth}) = 6 \times 10^{24} \text{ kg}, R(\text{earth}) = 6.4 \times 10^6 \text{ m.}]$$

$$G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2]$$



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20. Calculate the escape velocity of a body from the moon.

$$[g(\text{moon}) = 1.67 \text{ m/s}^2, R(\text{moon}) = 1.74 \times 10^6 \text{ m}]$$



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21. The mass of a planet is four times that of the earth and its radius is double the radius of earth. The escape velocity of a body from the earth is  $11.2 \times 10^3 \text{ m/s}$ . Find the escape velocity of a body from the planet.





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## Effects Of Electric Current

1. An electric is connected to a source of 250 volts. The current passing through it is 0.27 A. what is the power of a the bulb ?

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2. What will be the resistance of a bulb of power 40 W which is connected to a voltage source of 220V?

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3. Heat energy is being produced in a resistance in a circuit at the rate of 100 W. The current of 3 A is flowing in the circuit. What must be the value of the resistance ?

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4. Two tungsten bulbs of wattage 50 W and 60 W power work on 220 potential difference. If they are connected in parallel, how much current will flow in the main conductor ?

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5. Who will spend more electrical energy ? 500 W TV set in 30 minutes, or 600 W heater in 20 minutes ?

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6. Calculate the number of units consumed by a TV in a leap year which is rated at 100 W if it is used 6 hours per day.

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7. An electric iron of 1100 W is operated for 2 hours daily. What will be the electrical consumption expenses for that in the month of April ? (The electric company charges ₹ 5 per unit of energy.)

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8. Find the heat produced in joule if a current of 0.1 A is passed through a coil of resistance  $50 \Omega$  for two minutes. Keeping other conditions the same if the length of the wire is reduced to  $\frac{1}{4}$  th the original length ( by cutting the wire), what will be the heat produced ?

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9. Calculate the heat produced in calorie when a current of 0.1 A is passed through a wire of resistance  $41.8\Omega$  for 10 minutes.

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1. State the law of conservation of energy. If water of mass 80 g and temperature  $45^{\circ}C$  is mixed with water of mass 20 g and temperature  $30^{\circ}C$ , what will be the maximum temperature of the mixture ?

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2. Find the heat needed to raise the temperature of a silver container of mass 100 g by  $10^{\circ}C$ , ( $c = 0.056\text{cal/g}^{\circ}C$ )

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3. Liquid ammonia is used in ice factory for making ice from water. If water at  $20^{\circ}C$  is to be converted into 2 kg ice at  $0^{\circ}C$ , how many grams of ammonia are to be evaporated ?

(Given : The latent heat of vaporization of ammonia =  $341\text{cal/g}$ )

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4. A thermally insulated pot has 150 g ice at temperature  $0^{\circ}C$ . How much steam of  $100^{\circ}C$  has to be mixed to it , so that water of temperature  $50^{\circ}C$  will be obtained ? ( Given : Latent heat of melting of ice = 80 cal/g, latent of vaporization of water = 540 cal/g, spcific heat of water =  $1\text{cal}/g.^{\circ}C$ )

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5. Equal heat is given to two objects A and B of mass 1g. The temperature of A increases by  $3^{\circ}C$  and that of B by  $5^{\circ}C$ . Which object has more specific heat? And by what factor ?

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6. A calorimeter has mass 100 g and specific heat  $0.1 \text{ kcal/kg} \cdot ^\circ \text{C}$ . It contains 250 g of liquid at  $30^\circ \text{C}$  having specific heat of  $0.4 \text{ kcal/kg} \cdot ^\circ \text{C}$ . If we drop a piece of ice of mass 10 g at  $0^\circ \text{C}$  into it, what will be the temperature of the mixture?

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7. If steam of mass 100g and temperature  $100^\circ \text{C}$  is released on an ice slab of temperature  $0^\circ \text{C}$ , how much ice will melt?

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## Refraction Of Light

1. If the speed of light in a medium is  $1.5 \times 10^8 \text{ m/s}$ . what is the absolute refractive index of the medium?

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2. What will be the speed of light in water if it is given that the refractive index of water is  $\frac{4}{3}$  and the speed of light in air is  $3 \times 10^8$  m/s?

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3. The speed of light in water is  $2.2 \times 10^8$  m/s and that in glass is  $2 \times 10^8$  m/s. What is the refractive index of (i) water with respect to water ?

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4. If the absolute refractive indices of glass and water are  $\frac{3}{2}$  and  $\frac{4}{3}$  respectively, what is the refractive index of glass with respect to water ?

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## Lenses

1. The focal length of a convex lens is 20 cm. If an object of height 2 cm is placed at 30 cm from the lens, find (i) the position and nature of the image (ii) the height of the image (iii) the magnification produced by the lens.

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2. When a pin of height 3 cm is fixed at 10 cm from a convex lens, the height of the virtual image formed is 12 cm. Find the focal length of the lens.

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3. A convex lens forms a real and inverted image of a pencil at a distance of 60 cm from the lens. The image formed is of the same size as the object. Find the focal length and power of the lens. At what distance is the pencil placed from the lens. ?

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4. Doctor has prescribed a lens having power + 1.5D. What will be the focal length of the lens ? What is the type of the lens and what must be the defect of vision ?

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5. Identify the type of lens which has a power of 0.5D

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6. Surabhi from Std. X uses spectacles. The power of the lenses in her spectacles is 0.5 D .

Identify the defect of vision Surabhi is suffering from.

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7. Find the focal length of the lenses used in spectacles of a person if the power of the spectacles is 0.5D.

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8. An object of height 4 cm is placed in front of a concave lens of focal length 40 cm. If the object distance is 60 cm, find the position and height of the image.

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9. An object kept at 60 cm from a lens gives a virtual image at 20 cm in front of the lens. What is the focal length of the lens ?

It it a converging lens or diverging lens ? Also find the magnification produced.

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10. The power of a convex lens is 2.5 dioptries. Find the focal length.

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11. Calculate the focal length of a corrective lens having power + 2.5 D .

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12. Three lenses having powers 2 D, 2.5 D and 1.7 D are kept touching in a row. What is the total power of the lens combination ?

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13. Two convex lenses of equal focal lengths are kept in contact with each other. If the power of their combination is 20 D, find the focal length of each convex lens.

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14. If a convex lens of focal length 10 cm and a concave lens of focal length 50 cm are kept in contact with each other , (i) what will be the focal length of the combination ? (ii) What will be the power of the combination? (iii) What will be the behaviour of the combination ( behaviour as a convex lens / concave lens ) ?

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## Space Missions

1. If the mass of a Planet is eight times the mass of the earth and its radius is twice the radius of the earth, what will be the escape velocity for that planet ?

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2. How much time would a satellite in an orbit at a height of 35780 km above the earth's surface take to complete one revolution around the earth , if the mass of the earth were four times its original mass ?

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3. If the height of a satellite completing one revolution around the earth in  $T$  seconds is  $h_1$  metres, then what would be the height of a satellite taking  $2\sqrt{2}T$  seconds for one revolution ?

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4. Calculate the critical velocity ( $v_c$ ) of the satellite to be located at 35780 km above the surface of the earth .

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5. In the above example (4) how much time will the satellite take to complete one revolution above 35780 km around the earth ?

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1. A satellite of mass 1000 Kg revolves around the earth in a circular path. If the distance between the satellite and the centre of the earth is 40000 km, find the gravitational force exerted on the satellite by the earth.

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2. The masses of two spheres are 10 kg and 20 kg respectively. If the distance between their centres is 100 m, find the magnitude of the gravitational force between them.

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3. Find the acceleration due to gravity at a distance of 20000 km from the centre of the earth.

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4. What is the weight of a body of mass 100 kg at the south pole ?

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5. What is the weight of a body of mass 20 kg at the equator ?

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6. A body is throw vertically upward with a velocity of 9.8 m/s.

Calculate the maximum height attained by the body.

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7. A particle of mass  $10^{-6}$  kg performs uniform cicular motion. Its period is 10 s and the radius of the circle is 2m. Find (i) the speed of



the particle (ii) The centripeta acceleration of the particle (iii) The centripetal force on the particle.

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**8.** Find the gravitational potential energy of a body of mass 200 kg on the earth's surface.

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**9.** If the current passing through a bulb is 0.15 A and ther power of the blb is 30 W, find the voltage applied across the bulb.

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**10.** An electric appliance rated 400 W is used 5 hours per day in the month o June. If the cost of a unit is ₹3.00 , find the energy bill for

June.

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**11.** Two electric bulbs rated 60 W and 40 W respectively are used 5 hours per day for 20 days. If the cost of a unit is ₹ 4.00 , find the cost of the energy used.

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**12.** Find the heat produced in joule if a current of 0.1 A is passed through a coil of resistance  $25\Omega$  for one minute.

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**13.** Calculate the heat produced in calorie when a current of 0.1 A is passed through a wire of resistance  $41.8\Omega$  for 5 minutes.



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14. If water of mass 60 g and temperature  $60^{\circ}C$  is mixed with water of mass 60 g and temperature  $40^{\circ}C$  , what will be the maximum temperature of the mixture ?

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15. Find the heat needed to raise the temperature of a piece of iron of mass 500 g  $20^{\circ}C$ . ( $c = 0.110\text{cal/g.}^{\circ}C$ )

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16. The absolute refractive index of a transparent medium is  $5/3$ . Find the speed of light in the medium.

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17. The refractive index of water and glass with respect to air is 1.3 and 1.5 respectively, what will be the refractive index of glass with respect to water?

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18. An object is kept at 20 cm in front of a convex lens and its real image is formed at 60 cm from the lens. Find (1) the focal length of the lens (2) the image if the height of the object is 6 cm.

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19. An object is kept at 10 cm in front of a convex lens. Its image is formed on the screen at 15 cm from the lens. Calculate (1) the focal length of the lens (2) the magnification produced by the lens.

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**20.** An object of height 2 cm is kept in front of a concave lens of focal length 20 cm. If the object distance is 30 cm, find the position and the height of the image.

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**21.** If a convex lens of focal length 20 cm and a concave lens of focal length 30 cm are kept in contact with each other (i) what will be the focal length of the combination ? (ii) what will be the power of the combination ? (iii) what will be behaviour of the combination ?

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**22.** A concave lens of focal length 12 cm and a convex lens of focal length 20 cm are kept in contact with each other. (i) Find the focal length of the combination. (ii) What will be the behaviour of the combination ?



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