

Prepp

Your Personal Exams Guide



NDA



CDS



SSC CGL



CBSE UGC NET



IAS



SSC CHSL



CTET



MPSC



AFCAT



CSIR UDC NET



IBPS PO



UP POLICE



SSC MTS



SBI PO



BPSC



UP TET



IBPS RRB



IBPS CLERK



IES



UPSC CAPF



SSC Stenogr..



RRB NTPC



SSC GD



RBI GRADE B



RBI Assistant



DSSSB

RRB ALP 2019 (CBT 2) (Physics and Maths) Previous Year Papers (21 Jan 2019) Shift 3

Total Time: 1 Hour

Total Marks: 75

Instructions

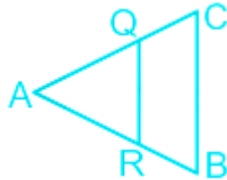
Sl No.	Section Name	No. of Question	Maximum Marks	Negative Marks	Positive Marks
1	Part B	75	75	0.33	1

- 1.) A total of 60 minutes is allotted for the examination.
- 2.) The server will set your clock for you. In the top right corner of your screen, a countdown timer will display the remaining time for you to complete the exam. Once the timer reaches zero, the examination will end automatically. The paper need not be submitted when your timer reaches zero.
- 3.) There will, however, be sectional timing for this exam. You will have to complete each section within the specified time limit. Before moving on to the next section, you must complete the current one within the time limits.

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Part B

1. For a pair of similar triangles shown in the figure, the ratio of the corresponding sides of the two triangles is $\sqrt{2} : 1$. If the area of BAC is 1000 cm^2 , then what is the area of RAQ in sq. cm? (+1, -0.33)



- a. 500
- b. 4
- c. 100
- d. 5
-
2. In a right-angled triangle, right angled at A, the angle formed B is 45° . If the length of side AB is 5m, then what is the length of the side AC? (+1, -0.33)
- a. 2.5 m
- b. 3 m
- c. 5 m
- d. 5.5 m
-
3. If a force of 250 N acts on a body at rest, the momentum required is 125 kg m/s. The time for which the force acts on the body is (+1, -0.33)
- a. 0.5 s

- b. 0.2 s
- c. 0.1 s
- d. 0.3 s

4. Two isolated open pipes, filled with a gas, of lengths 20 cm and 20.1 cm produces 5 beats/s when sounded together in their fundamental modes. The velocity of sound in the gas is: (+1, -0.33)

- a. 402 m/s
- b. 330 m/s
- c. 360 m/s
- d. 420 m/s

5. A crown glass prism with refracting angle 6° is to be achromatized for red and blue light with a flint glass prism. The angle of the flint glass should be (Given $\mu_r = 1.513$, $\mu_b = 1.523$ for crown glass and $\mu_r = 1.645$, $\mu_b = 1.665$ for flint glass) (+1, -0.33)

- a. 1.5°
- b. 2.4°
- c. 3°
- d. 4.5°

6. Tungsten is used for making bulb filaments of incandescent lamps because: (+1, -0.33)

- a. Tungsten has the highest boiling point.
- b. Tungsten takes a long time to reach its melting point
- c. Tungsten becomes extremely bright when it glows for long hours.
- d. Tungsten has the highest melting point and does not melt even while it is glowing for long hours .

7. A freely falling body takes 4 s to reach the ground. One second after release, the percentage of its potential energy, that is still retained is (+1, -0.33)

- a. 25%
- b. 37.5%
- c. 93.75%
- d. 6.25%

8. What would be the common difference in the following A.P. series? (+1, -0.33)
 $3, 3 + 3\sqrt{3}, 3 + 6\sqrt{3}, 3 + 9\sqrt{3}, 3 + 12\sqrt{3} \dots$

- a. $3\sqrt{3}$
- b. $3 - 3\sqrt{3}$
- c. $3 + 3\sqrt{3}$
- d. $3 + \sqrt{3}$

9. In a triangle the length of the sides AB and BC are both 1.5 m. What is the length of AC, if the angle formed at B is 60° ? (+1, -0.33)

- a. 1.25 m
 - b. 1.5 m
 - c. 2.25 m
 - d. 1 m
-

10. In a triangle PQR, the length of the side PQ is 4m, the angle of R is 60° and the angle at Q is 30° , what is the length of side PR? (+1, -0.33)

- a. $4\sqrt{2}$ m
 - b. $4 / \sqrt{3}$ m
 - c. $4\sqrt{3}$ m
 - d. $\sqrt{3} / 2$ m
-

11. The S.I. Unit of Resistivity is: (+1, -0.33)

- a. ohm
 - b. ohm/m
 - c. V/m
 - d. ohm-m
-

12. 1 ampere = _____ (+1, -0.33)

- a. 1 coulomb \times 1 second
- b. 1 volt / 1 second

- c. 1 second / 1 coulomb
 - d. 1 coulomb / 1 second
-

13. In a right-angled triangle ABC, the angle A is 90° , What the value of sec B, if BC is 5 cm and AB is 3 cm. (+1, -0.33)

- a. 1.5
 - b. 1.07
 - c. 1.67
 - d. 1.73
-

14. The length of a board is 12 cm and its breadth is 3 cm. The board needs to be taped around its sides covering all four sides. How long the tape should be? (+1, -0.33)

- a. 15 cm
 - b. 3 cm
 - c. 12 cm
 - d. 30 cm
-

15. Form the quadratic equation whose roots are 3 and 4 (+1, -0.33)

- a. $x^2 + 3x + 4 = 0$
- b. $x^2 - 3x + 4 = 0$
- c. $2x^2 - 7x - 12 = 0$

d. $x^2 - 7x + 12 = 0$

16. A bullet of mass 20 gm is fired from a rifle of mass 8 kg with a velocity of 100 m/s. The velocity of recoil of the rifle is: (+1, -0.33)

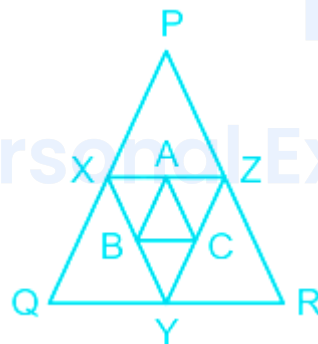
a. 250 m/s

b. 2.5 m/s

c. 25 m/s

d. 0.25 m/s

17. PQR is a triangle X, Y, Z are the mid points of PQ, QR and RP respectively, similarly A, B, C are the mid points of the sides XY, YZ, ZX respectively. What is the ratio of areas of ΔXYZ to ΔABC ? (+1, -0.33)



a. 4 : 1

b. 2 : 3

c. 1 : 4

d. 3 : 4

18. A body is thrown with a velocity 20 m/s at an angle of 30° with the horizontal. The time taken to reach the maximum height is: (+1, -0.33)
(Take $g = 10 \text{ m/s}^2$)

- a. 2 s
- b. 5 s
- c. 4 s
- d. 1 s

19. When a current carrying conductor is kept in a magnetic field, it experiences a force. The direction of this force depends on which of the following? (+1, -0.33)

- (a) The direction of current through the conductor
- (b) The direction of the magnetic field in which the conductor is placed
- (c) Both (a) and (b)
- (d) Neither (a) nor (b)

- a. (b)
- b. (d)
- c. (a)
- d. (c)

20. Let $y = x / 6$ and $4x + 12y = 48$. What is the value of x and y ? (+1, -0.33)

- a. $x = 3$ and $y = \frac{2}{3}$
- b. $x = 3$ and $y = \frac{4}{3}$

c. $x = 9$ and $y = 3$

d. $x = 8$ and $y = 1\frac{1}{3}$

21. Which of the following can be produced during nuclear fission and nuclear fusion? (+1, -0.33)

a. Electron

b. Proton

c. Neutron

d. Deuteron

22. Sum of first 25 terms in the following series would be (+1, -0.33)

7, 11, 15, 19, 23, ...

a. 1325

b. 1258

c. 1375

d. 1296

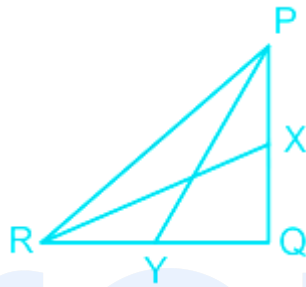
23. A stone placed at the bottom, of water tank appears raised by 80 cm. If refractive index of water is $\frac{4}{3}$. The actual depth of water in tank. (+1, -0.33)

a. 480 cm

b. 320 cm

- c. 400 cm
- d. 200 cm

24. In the following figure PY and RX are the medians of the right angled triangle PQR, if PR = 8 cm, then $PY^2 + RX^2 = ?$ (+1, -0.33)



- a. 128 cm
- b. 96 cm
- c. 64 cm
- d. 80 cm

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25. Two lenses of power -15 D and +5 D are placed in contact with each other. The focal length of the combination is: (+1, -0.33)

- a. -10 cm
- b. +10 cm
- c. -20 cm
- d. +20 cm

26. Which of the following are characteristics of a good fuel? (+1, -0.33)

- a. Fewer residues after burning
 - b. Less smoke
 - c. High calorific value
 - d. Low density
-

27. Which of the following is not a source of magnetic field? (+1, -0.33)

- a. Electric current
 - b. Static charges
 - c. A rotating magnet
 - d. A galvanometer carrying current
-

28. Divide $(-12x + 48) / (x - 4)$, when $x \neq 4$ (+1, -0.33)

- a. -12
 - b. $(x - 4)$
 - c. $12(x - 4)$
 - d. $12(x) / (x - 4)$
-

29. A ray of light incident on a transparent block at an angle of incidence 60° . (+1, -0.33)
If μ of block is $\sqrt{3}$ then the angle of deviation of the refracted ray is:

- a. 30°
- b. 25°

c. 15°

d. 45°

30. A shot is fired at 30° with the vertical from a point on the ground with kinetic energy K . If air resistance is ignored, the kinetic energy at the top of the trajectory is: (+1, -0.33)

a. $K/4$

b. K

c. $K/2$

d. $3K/4$

31. If two hemispheres of curved surface area $8\pi \text{ cm}^2$ each are joined together to form a sphere. What is the total surface area of the sphere? (+1, -0.33)

a. $4\pi \text{ cm}^2$

b. $32\pi \text{ cm}^2$

c. $8\pi \text{ cm}^2$

d. $16\pi \text{ cm}^2$

32. A spacecraft of mass 2000 kg moving with a velocity of 600 m/s suddenly explodes into two pieces. One piece of mass 500 kg is left stationary. The velocity of the other part must be (in m/s) (+1, -0.33)

a. 1000

b. 600

c. 800

d. 1500

33. Two plane mirrors are at 45° to each other. If an object is placed between them, then the number of images will be **(+1, -0.33)**

a. 5

b. 8

c. 7

d. 9

34. Reduce to linear form: $(15x + 3) / 6x = 2 / 3$ **(+1, -0.33)**

a. $11x + 3 = 0$

b. $11x - 3 = 0$

c. $11x - 2 = 0$

d. $33x + 4 = 0$

35. When objects at different distances are seen distinctly by the eye, which of the following remains constant: **(+1, -0.33)**

a. The object distance from the eye lens

b. The focal length of the eye lens

c. The image distance from the eye lens

d. The radius of curvature of the eye lens

36. A ladder resting on the wall is grounded 3 metres away from the base of the wall. If the length of the ladder is 5m, what is the height at which it is resting on the wall? **(+1, -0.33)**

a. 2 m

b. 5 m

c. 3 m

d. 4 m

37. When the momentum of a body is doubled, by keeping its mass unchanged, the kinetic energy is : **(+1, -0.33)**

a. halved

b. becomes three times of the original

c. becomes four times of the original

d. doubled

38. A car moving with a speed of 50 km/hr can be stopped by brakes after travelling at least 6 m. If the same car is moving at a speed of 100 km/hr, the minimum stopping distance is : **(+1, -0.33)**

a. 18 m

b. 12 m

c. 24 m

d. 6 m

39. Roots of the following equation are $6x^2 + 4x - 2 = 0$ (+1, -0.33)

a. 1, -1/3

b. 1/3, -1/3

c. 1, 1/3

d. -1, 1/3

40. Find the mean of the following numbers (+1, -0.33)

0.125, 0.225, 0.182, 0.156, 0.196, 0.220

a. 0.182

b. 0.192

c. 0.189

d. 0.184

41. If, $x = a + bt + ct^2$ (+1, -0.33)

and x is in meters and t is in seconds, then the unit of 'a' is:

a. ms^{-1}

b. ms^{-2}

c. m

d. m^2s

42. The dimensional formula of speed (+1, -0.33)

- a. $[MLT^{-1}]$
- b. $[M^0LT^{-1}]$
- c. $[ML^0T^{-1}]$
- d. $[MLT^{-2}]$

43. Evaluate $(0.2 \times 0.36 + 0.8 \times 0.36) / 0.18$ (+1, -0.33)

- a. 0.3
- b. 2
- c. 0.2
- d. 1.28

44. A dice is rolled, what is the probability of even numbered outcomes: (+1, -0.33)

- a. $\frac{1}{2}$
- b. $\frac{1}{5}$
- c. $\frac{1}{3}$
- d. $\frac{2}{3}$

45. Let 'K' be the area swept by the line joining the earth and the sun during Feb 2012. The area swept by the same line during the first week of that month is (+1, -0.33)

- a. $7K/30$
- b. K
- c. $K/4$
- d. $7K/29$

46. Which of the following is an irrational number? (+1, -0.33)

- a. 2
- b. $7i$
- c. $\sqrt{3} - 3$
- d. $2/3$

47. Frame the quadratic equation one of whose roots is $\sqrt{3} - 1$ (+1, -0.33)

- a. $x^2 - 2x + 2 = 0$
- b. $x^2 + 2x + 2 = 0$
- c. $x^2 - 2x - 2 = 0$
- d. $x^2 + 2x - 2 = 0$

48. Which one of the following is not a characteristic of sound wave? (+1, -0.33)

- a. Amplitude
- b. Wave length
- c. Frequency

d. Brightness

49. Nidhi looks at the base of a tree from her balcony. This formed a right-angled triangle with an angle of depression of 30° . If the base of tree is 10 m away from the base of the wall of the house, what is the distance between her eye and the base of the tree? (+1, -0.33)

- a. $20\sqrt{3}$ m
- b. $20 / \sqrt{3}$ m
- c. $2 / \sqrt{3}$ m
- d. $\sqrt{3} / 2$ m

50. Triangles PQR and ABC are similar triangles. (+1, -0.33)

Triangle ABC have the following sides

AB = 36 cm

AC = 20 cm

CB = 48 cm

Triangle PQR have the following sides:

PQ = 9 cm

PR = 5 cm

What is the length of side RQ = ?

- a. 30 cm
- b. 3 cm

- c. 15 cm
 - d. 12 cm
-

51. What is the radius of a circle where the central angle of 90° intercepts an arc of length 13 cm? (+1, -0.33)

- a. $4 / \pi$ cm
 - b. $12 / \pi$ cm
 - c. 26π cm
 - d. $26 / \pi$ cm
-

52. Which of the following is a rational number? (+1, -0.33)

- a. $4 / 15$
 - b. $\sqrt{5}$
 - c. $4\sqrt{7}$
 - d. $\pi / \sqrt{3}$
-

53. If A(15, 14), B(30, 15), C(27, 5) and D(10, 5) are the vertices of a quadrilateral, find the area of the quadrilateral ABCD (in terms of sq. units) (+1, -0.33)

- a. 65
 - b. 150
 - c. 85
 - d. 175
-

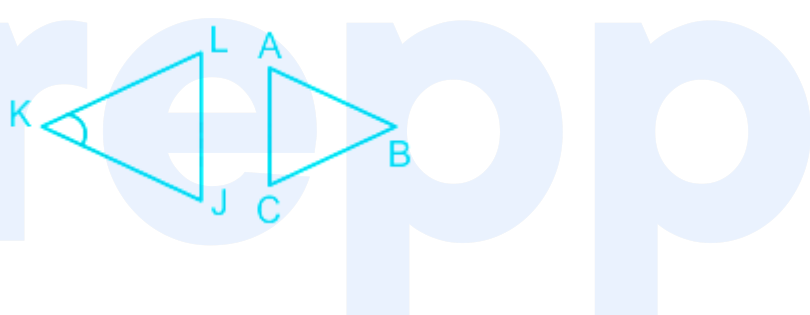
54. Light year is the unit of

(+1, -0.33)

- a. length
- b. time
- c. mass
- d. area

55. What is the angle at B in the triangle ABC , if the angle made at K is 30° and the triangles shown in the figure are similar?

(+1, -0.33)



- a. 30°
- b. 60°
- c. 70°
- d. 20°

56. Circular areas of same size have been marked to drill holes in a road. If the radius of one of the holes to be drilled is 21cm, and there are 10 holes to be drilled along the road, what is the total area in sq.cm of all the 10 circles marked to be drilled? ($\pi = 22 / 7$)

(+1, -0.33)

- a. 13860
- b. 1836

c. 1386

d. 11836

57. What would be the seventh term in the following series: (+1, -0.33)

2, 11, 20, 29, 38,

a. 65

b. 54

c. 56

d. 67

58. A farmer is marking his field to sow seeds if he marks a rectangular area of (+1, -0.33)
his field in the ratio of length : width 3 : 1.

Write a expression that will give the total area.

a. 3

b. $3x^2 - 3$

c. $3x^2$

d. $3x^2 + x$

59. Find the zeros of the function $f(x) = (x - 3)(x - 2)$. (+1, -0.33)

a. 3, 2

b. 0, -2

c. -3, -2

d. 0

60. 1 kWh = _____ J

(+1, -0.33)

a. 3.6×10^4 J

b. 3.6×10^5 J

c. 3.6×10^6 J

d. 3.6×10^3 J

61. The minute hand of a watch is 2 cm long. How far does its tip move in 10 minutes?

(+1, -0.33)

a. $\pi / 3$ cm

b. $\pi / 4$ cm

c. $2\pi / 3$ cm

d. $4 / \pi$ cm

62. The near point of a person with hypermetropia is 50 cm from the eye. The power of the lens required to enable the person to read clearly a book held at 25 cm from the eye is

(+1, -0.33)

a. 2 D

b. 8 D

c. 1 D

d. 4 D

63. A farmer wants to fence his rectangular field of length 200 m and area 3000 m². If the cost of fencing per metre is 5 rupees, what is the total cost of fencing in rupees? (+1, -0.33)

a. 1000

b. 500

c. 2500

d. 2150

64. Five cards-the ten, jack, queen, king and ace of hearts, are well-shuffled with their face downwards. One card is then picked up at random. What is the probability that the card is the Ace? (+1, -0.33)

a. 1 / 5

b. ¼

c. 4 / 5

d. 2 / 5

65. $24 \times (15 + 45) \div 6 + (45 + 5) - 5 = ?$ (+1, -0.33)

a. 285

b. 240

c. 275

d. 280

66. If the points $P(15, 15)$, $Q(50, 25)$ and $R(\beta, 35)$ are collinear then what would be β . (+1, -0.33)

- a. 24
- b. -25
- c. 85
- d. -82

67. S.I. Unit of universal gravitational constant is (+1, -0.33)

- a. Nkg^2/m^2
- b. kg^2/Nm^2
- c. Nm^2/kg^2
- d. $\text{N}^2\text{m}^2/\text{kg}^2$

68. A 10 N force is applied on a body which produces in it an acceleration of 2 m/s^2 . The mass of the body is: (+1, -0.33)

- a. 5 kg
- b. 10 kg
- c. 15 kg
- d. 20 kg

69. When white light passes through a hollow prism, then (+1, -0.33)

- a. there is both dispersion and deviation
- b. deviation but no dispersion
- c. there is no dispersion and no deviation
- d. dispersion but no deviation

70. A planet moves around the sun in elliptical orbit. When earth is closest from the sun, it is at a distance y having a speed v . When it is at a distance $4y$ from the sun its speed is : (+1, -0.33)

- a. $v/4$
- b. $4v$
- c. $2v$
- d. $v/2$

71. What would be the point which divides the line segment connecting the points $P(12, 16)$, $Q(8, 13)$ in the ratio $2 : 7$ internally (+1, -0.33)

- a. $(64 / 9, 134 / 9)$
- b. $(64 / 7, 134 / 7)$
- c. $(100 / 7, 138 / 7)$
- d. $(100 / 9, 138 / 9)$

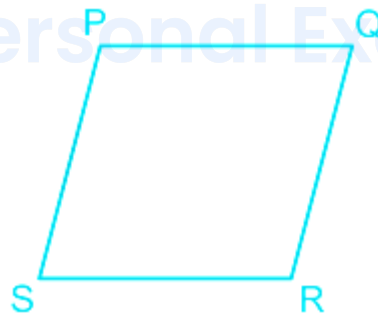
72. A particle starts moving from rest under uniform acceleration. It travels a distance 'x' in the first two seconds and a distance 'y' in the next two seconds. If $y = nx$, then $n =$ (+1, -0.33)

- a. 1
- b. 3
- c. 2
- d. 4

73. If v = image distance, u = object distance then linear magnification, m = (+1, -0.33)

- a. $m = \frac{v}{u}$
- b. $m = -\frac{v^2}{u}$
- c. $m = -\frac{v}{u}$
- d. $m = m = -\frac{v}{u^2}$

74. PQRS is a rhombus that what would be $PQ^2 + QR^2 + RS^2 + SP^2 = ?$ (+1, -0.33)



- a. $2(PR^2 + QS^2)$
- b. $(PR^2 + QS^2)$
- c. $2PQ \cdot RS$
- d. $4(PR^2 + QS^2)$

75. Find the least value of * for which the number 82178342*52 is divisible by 11. (+1, -0.33)

- a. 0
- b. 2
- c. 5
- d. 7

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Answers

1. Answer: a

Explanation:

Given:

For a pair of similar triangles shown in the figure, the ratio of the corresponding sides of the two triangles is $\sqrt{2} : 1$, and the area of BAC is 1000 cm^2 .

Concept Used:

In this type of question, if two triangles are similar then their corresponding areas are in proportion of square of their respective sides.

Calculation:

Using the above concept, we get

$$\Rightarrow \text{ar}\Delta\text{BAC} / \text{ar}\Delta\text{RAQ} = (\sqrt{2})^2 / (1)^2$$

$$\Rightarrow \text{ar}\Delta\text{RAQ} = 1000 / 2 = 500 \text{ sq. cm}$$

$$\therefore \text{ar}\Delta\text{RAQ} = 500 \text{ sq. cm}$$

2. Answer: c

Explanation:

Given:

In a right-angled triangle, right angled at A, the angle formed B is 45° and the length of side AB is 5 m.

Formula Used:

For a given right angled triangle, $\text{Cot } \theta = B / P$;

P = perpendicular, B = base

Calculation:

using the above formulae, we get

$$\Rightarrow \text{Cot } 45^\circ = AB / AC$$

$$\Rightarrow 1 = 5 / AC$$

$$\Rightarrow AC = 5 \text{ m}$$

\therefore Length of the side AC = 5 m.

3. Answer: a

Explanation:

CONCEPT:

- Newton's Second law of motion : The rate of change of momentum of any object is directly proportional to the applied force on the body.

$$\text{Force (F)} = \frac{\Delta P}{\Delta t}$$

Where ΔP = Change in momentum and Δt = change in time taken

$$\Rightarrow \Delta P = P_2 - P_1$$

Where P_2 = final momentum and P_1 = initial momentum of the system

So change in momentum is

$$\Rightarrow \Delta P = \text{Force (F)} \times \text{time taken (t)}$$

CALCULATION:

Given that; Force (F) = 250 N

Final momentum (P_2) = 125 kg m/s

Initial momentum (P_1) = 0 (since initially, the body is in rest)

Time taken (t) = ?

Change in momentum is

$\Rightarrow \Delta P = \text{force} \times \text{time}$

$\Rightarrow \Delta P = 250 \times t = P_2 - P_1 = 125 - 0 = 125$

Time taken (t) = $125/250 = 0.5 \text{ sec.}$

So option 1 is correct.



- The direction of the force is the same as the direction of change of the momentum of the body.

4. Answer: a

Explanation:

CONCEPT:

- **Organ pipe** : The sound-producing device which resonates at a particular pitch is called an Organ pipe .
- **Closed organ pipe** : When one end of an organ pipe is closed and the other end is open then it is called a closed organ pipe.

- **Open organ pipe** : When both the ends of the organ pipe are open then it is called an open organ pipe .

$$\text{Fundamental frequency of an open organ pipe } (f_o) = \frac{v}{2l}$$

$$\text{Frequency of a closed organ pipe } (f_c) = \frac{nv}{4l}$$

Where n = positive integer, v = velocity of sound, and l = length of the organ pipe.

$$\text{Beat frequency } (f) = |f_1 - f_2|$$

Where f_1 and f_2 are two frequencies.

CALCULATION:

Given that:

$$\text{Length of the first organ pipe } (l_1) = 20 \text{ cm} = 0.2 \text{ m}$$

$$\text{Length of the second organ pipe } (l_2) = 20.1 \text{ cm} = 0.201 \text{ m}$$

$$\text{The fundamental frequency of the open pipe } (f) = v/2l$$

$$\text{So } f_1 = v/2l_1 = v/0.4$$

$$f_2 = v/2l_2 = v/0.402$$

$$\text{Beat frequency } (f) = f_1 - f_2 = (v/0.4 - v/0.402) = 5$$

$$\text{So velocity of sound } (v) = (5 \times 0.4 \times 0.402)/0.002 = 402 \text{ m/s}$$

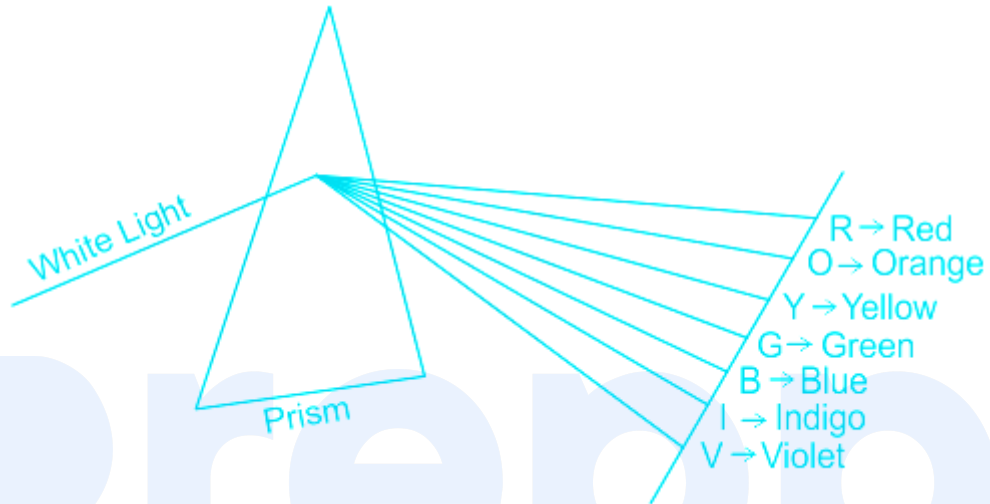
Hence option 1 is correct.

5. Answer: c

Explanation:

CONCEPT:

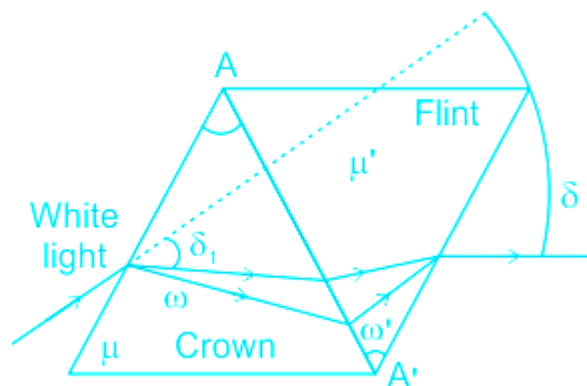
- Dispersion of a Prism: A beam of composite light passes through a prism, it splits into its constituent colours. This phenomenon is called **dispersion**. The band of colours thus obtained on a screen is called the spectrum.
 - If white light is used, seven colours are obtained as shown in the figure. The sequence of colours is VIBGYOR, from bottom to top.



- Deviation without Dispersion (Achromatic Prism): It is possible to combine two prisms of different materials in such a way that each cancels the dispersion due to the other. Thus, the net dispersion is zero but a deviation is produced. The required condition is

$$(\mu_v - \mu_r) A = (\mu'_v - \mu'_r) A'$$

Where for the first prism: μ_v = refractive index of the medium in violet light, μ_r = refractive index of the medium in red light, A = angle of the prism; For the second prism: μ'_v = refractive index of the medium in violet light, μ'_r = refractive index of the medium in red light, A' = angle of prism.)



CALCULATION:

Given that:

$\mu_r = 1.513, \mu_b = 1.523$ for crown glass and $\mu'_r = 1.645, \mu'_b = 1.665$ for flint glass

$A = 6^\circ$

- The required condition for **Achromatic prism** is:

$$(\mu_b - \mu_r) A = (\mu'_b - \mu'_r) A'$$

$$(1.523 - 1.513) \times 6 = (1.665 - 1.645) A'$$

So the **angle of the flint glass (A') = $0.06/0.02 = 3^\circ$**

Hence option 3 is correct.

6. Answer: d

Explanation:

CONCEPT:

Tungsten:

- The metal tungsten is used for the filaments in incandescent bulbs .
- It has a high melting point and retains its strength when heated .
- Filaments of the light bulbs are made up of the Tungsten element.
- Its symbol is 'W' because of its scientific name 'Wolfram' and its atomic number 74 .

EXPLANATION:

- As the resistance is less , heat energy is produced is very low which is not sufficient for an electric bulb to glow so the resistance is kept high .
- **Tungsten** is very resistant to corrosion and has the highest melting point (melting point = 3695 K) and the highest tensile strength of any element.

- **Tungsten** is used for making bulb filaments of incandescent lamps because it has the **highest melting point and does not melt even while it is glowing for long hours**. Therefore option 4 is correct.

NOTE:

- Light bulb filaments aren't resistive because of the tungsten .
- They're resistive because of their very long length , and very thin wire .

7. Answer: c

Explanation:

CONCEPT:

- Potential energy : The energy of an object due to its position is called potential energy. It is denoted by PE.

Mathematically potential energy can be written as

$$\text{P.E of object} = m g h$$

Where m = mass of an object, g = acceleration due to gravity and h = height

The **equation of motion** is given by:

$$S = ut + (1/2) at^2$$

Where S is displacement, u is initial velocity, a is acceleration and t is time taken.

CALCULATION:

$$\text{Acceleration due to gravity (g)} = 10 \text{ m/s}^2$$

The body takes (t) 4 sec to reach the ground:

$$\text{Initial velocity (u)} = 0$$

$$\text{Acceleration (a)} = g = 10 \text{ m/s}^2$$

$$\text{Height of the body (H)} = ut + (1/2) at^2 = 0 + 1/2 \times 10 \times 4^2 = 80 \text{ m}$$

After 1 sec release:

$$S = ut + (1/2) at^2 = 0 + 1/2 \times 10 \times 1^2 = 5 \text{ m}$$

$$\text{Height (h)} = 80 - 5 = 75 \text{ m}$$

$$\text{Potential energy (PE')} = mgh = mg \times 75 = 75mg$$

$$\text{Initial potential energy (PE)} = mgH = 80mg$$

$$\% \text{ PE} = (PE'/PE) \times 100 = (75mg/80mg) \times 100 = 93.75 \%$$

So option 3 is correct.

8. Answer: a

Explanation:

Given:

$$\text{Series} = 3, 3 + 3\sqrt{3}, 3 + 6\sqrt{3}, 3 + 9\sqrt{3}, 3 + 12\sqrt{3} \dots$$

Formula Used:

$$d = (a_2 - a_1); a_2 = \text{second term of A.P.}, a_1 = \text{first term of an A.P.}$$

Calculation:

Using the above formulae, we get

$$\Rightarrow d = (3 + 3\sqrt{3} - 3)$$

$$\Rightarrow d = 3\sqrt{3}$$

$$\therefore \text{Common difference} = 3\sqrt{3}$$

9. Answer: b

Explanation:

Given:

In a triangle the length of the sides AB and BC are both 1.5 m and angle formed at B is 60°

Concept Used:

In this type of question, cosine formulae are used

Formula Used:

$$\cos B = \frac{AB^2 + BC^2 - AC^2}{2(AB \times BC)}$$

Calculation:

Using the above formulae, we get

$$\Rightarrow \cos 60^\circ = \frac{1.5^2 + 1.5^2 - AC^2}{2(1.5 \times 1.5)}$$

$$\Rightarrow 0.5 \times 4.5 = (4.5 - AC^2)$$

$$\Rightarrow AC^2 = 2.25$$

$$\Rightarrow AC = 1.5 \text{ m}$$

\therefore Required length of AC = 1.5 m

10. Answer: b

Explanation:

Given:

In a triangle PQR, the length of the side PQ is 4 m, the angle of R is 60° and the angle at Q is 30°

Concept Used:

In this type of question, since R is 60° and Q is 30° so it is a right-angled triangle right angled at P

Formula Used:

For a given right angled triangle, $\tan \theta = P / B$;

P = Perpendicular, B = base

Calculation:

Using the above formulae, we get

$$\Rightarrow \tan 60^\circ = PQ / PR$$

$$\Rightarrow \sqrt{3} = 4 / PR$$

$$\Rightarrow PR = 4 / \sqrt{3} \text{ m}$$

$$\therefore \text{Length of side PR} = 4 / \sqrt{3} \text{ m}$$

11. Answer: d

Explanation:

CONCEPT:

- Resistivity (ρ) : The property of a conductor that opposes the flow of electric current through them and independent of the shape and size of the materials but depends on the nature and temperature of the materials is called resistivity.
 - The unit for resistivity is the ohm-meter ($\Omega\text{-m}$).
 - The resistivity of a material depends on its nature and the temperature of the conductor.

- Resistance : The property of any conductor that opposes the flow of electric current through it and depends on the shape and size of the materials, temperature, and nature of the materials is called resistance.
 - It is denoted by R and the SI unit is the ohm (Ω).

The resistance is given by:

$$R = \rho L/A$$

where ρ is resistivity, L is the length and A is the area of the cross-section.

EXPLANATION:

- The resistance offered by a wire of unit length and unit area of cross-section is called resistivity or specific resistance (r).

$$\rho = R \cdot \frac{A}{L}$$

- The SI unit of length (L) is m and area (A) is m^2 .

Putting on the respective units, we get:

$$\rho = \text{Ohm} \times \frac{\text{metre}^2}{\text{metre}}$$

The SI unit of $\rho = \text{Ohm-meter} (\Omega\text{-m})$.

- Thus the SI unit of resistivity is $\Omega\text{-m}$. So option 4 is correct.

12. Answer: d

Explanation:

CONCEPT:

- Electric current : The rate of flow of electric charge is called electric current.
 - The SI unit of electric current is Ampere (A)

Hence, Electric current (I) = $Q/t = \text{Charge}/\text{time}$

Electric charge (Q) = Electric current (I) × Time (t)

EXPLANATION:

- **1 ampere** : When 1 C of electric charge flows in 1 second then the current is called 1 ampere.

1 ampere = 1 coulomb/1 second

So option 4 is correct.

13. Answer: c

Explanation:

Given:

In a right-angled triangle ABC, the angle A is 90° , BC is 5 cm and AB is 3 cm.

Formula Used:

$$\sec B = BC / AB$$

Calculation:

Using the above formulae, we get

$$\Rightarrow \sec B = 5 / 3$$

$$\Rightarrow \sec B = 1.67$$

14. Answer: d

Explanation:

Given:

The length of a board is 12 cm and its breadth is 3 cm. The board needs to be taped around its sides covering all four sides.

Concept Used:

In this type of question, perimeter of the rectangular board should be calculated

Formula Used:

$$P = 2 \times (l + b); l = \text{length}, b = \text{breadth}$$

Calculation:

Using the above formulae, we get

$$\Rightarrow P = 2 \times (12 + 3)$$

$$\Rightarrow P = 30 \text{ cm}$$

\therefore Tape should be 30 cm long.

15. **Answer: d**

Explanation:

Formula Used:

Quadratic equation = $x^2 - (a + b)x + (a \times b) = 0$; here 'a' and 'b' are the roots

Calculation:

Using the above formulae, we get

$$\Rightarrow x^2 - (3 + 4)x + (3 \times 4) = 0$$

$$\Rightarrow x^2 - 7x + 12 = 0$$

\therefore Required quadratic equation = $x^2 - 7x + 12 = 0$

16. Answer: d

Explanation:

CONCEPT:

- **Momentum (P)** : The product of mass and velocity is called a momentum of the system.

$$\text{Momentum (P)} = \text{Mass (m)} \times \text{Velocity (V)}$$

- Conservation of momentum: Whenever there is no net external force on the system then the total momentum of the system remains constant.

$$\text{Initial momentum (P 1)} = \text{Final momentum (P 2)}$$

CALCULATION:

- As there is no external force on the pistol and bullet system. So the total momentum of the system will remain constant.

$$\text{Initially the system was in rest so velocity (V)} = 0$$

$$\text{Initial momentum (P 1)} = \text{mass (m)} \times \text{Velocity (V)} = m \times 0 = 0$$

After firing,

$$\text{Velocity of bullet (V b)} = 100 \text{ m/s}$$

$$\text{Mass of bullet (m b)} = 20 \text{ g} = 20/1000 = 0.02 \text{ kg}$$

$$\text{Momentum of bullet (P b)} = m_b \times V_b = 0.02 \times 100 = 2 \text{ kg m/s}$$

$$\text{Let recoil velocity of pistol} = V \text{ m/s}$$

$$\text{Mass of rifle (m r)} = 8 \text{ kg}$$

$$\text{Momentum of rifle (P r)} = m_r \times V = 8 \times V = 8V \text{ kg m/s}$$

$$\text{Total final momentum of the system (P 2)} = \text{Momentum of rifle} + \text{momentum of bullet} = (8V + 2) \text{ kg m/s}$$

According to conservation of momentum;

Initial momentum (P 1) = Final momentum (P 2)

$$0 = 8V + 2$$

$$V = -2/8 = -1/4 = -0.25 \text{ m/s}$$

The negative sign denotes opposite direction. So the **recoil velocity of pistol is 0.25 m/s.**

Hence option 4 is correct.

17. Answer: a

Explanation:

Given:

PQR is a triangle X, Y, Z are the mid points of PQ, QR and RP respectively, similarly A, B, C are the mid points of the sides XY, YZ, ZX respectively

Concept Used:

In this type of question, concept of similarity is used, if two triangles are similar then their corresponding angles are congruent and corresponding areas are in proportion of square of their respective sides.

Formula Used:

$$\text{ar}\Delta XYZ : \text{ar}\Delta ABC = (XY)^2 : (AB)^2$$

Calculation:

Using the above formulae, we get $2AB = XY$

$$\Rightarrow \text{ar}\Delta XYZ : \text{ar}\Delta ABC = (XY)^2 : (XY / 2)^2$$

$$\Rightarrow \text{ar}\Delta XYZ : \text{ar}\Delta ABC = 4 : 1$$

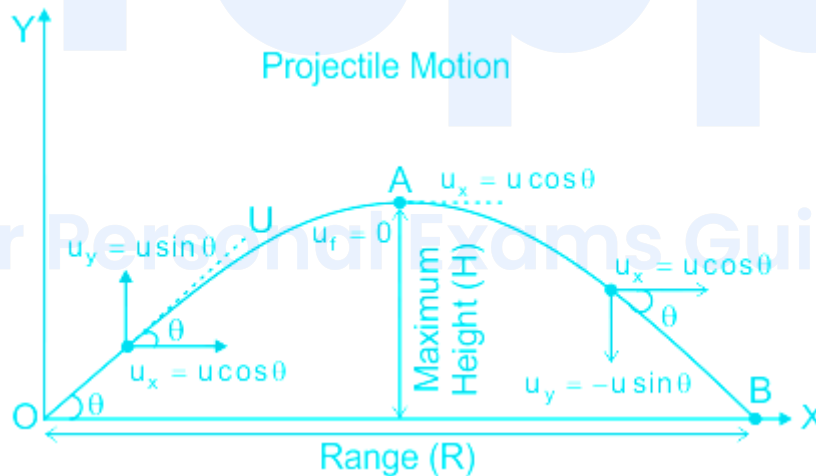
$$\therefore \text{Required ratio} = 4 : 1$$

18. Answer: d

Explanation:

CONCEPT:

- Projectile motion: A kind of motion that is experienced by an object when it is projected near the Earth's surface and it moves along a curved path under the action of gravitational force.
- When a particle moves in projectile motion, its velocity has two components.
 1. vertical component ($u \sin\theta$)
 2. horizontal component ($u \cos\theta$)



- The time of flight of projectile is given by

$$T = \frac{2u \sin\theta}{g}$$

where u is the velocity, makes an angle ' θ ' with the x-axis, and g is the gravitational acceleration.

CALCULATION:

Given that:

Initial velocity (u) = 20 m/s

The angle of inclination (θ) = 30°

Time taken to reach the maximum height is equal to half of the time of flight.

Time of flight (T):

$$T = \frac{2u \sin \theta}{g}$$

$$T = \frac{2 \times 20 \times \sin 30}{10} = 2 \text{ sec}$$

The time taken to reach the maximum height is $T/2 = 1 \text{ sec}$.

So option 4 is correct.

19. Answer: d

Explanation:

CONCEPT:

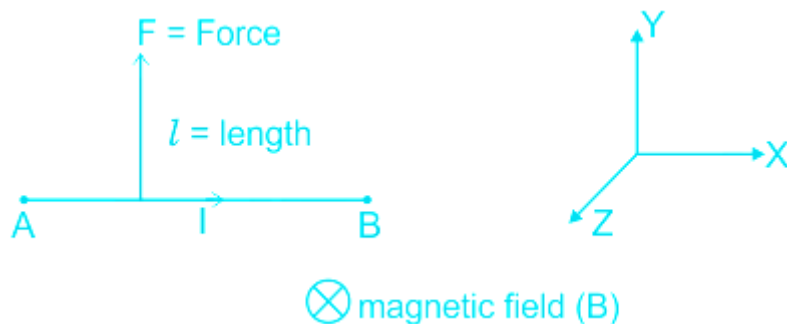
- When a current-carrying wire is placed in a magnetic field then a force is applied by the magnetic field on the wire. This force is called the magnetic force.

Force on a wire is given by:

$$F = I \vec{l} \times \vec{B}$$

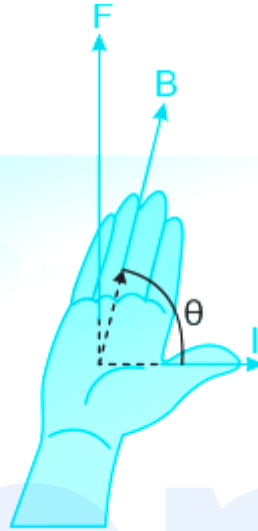
Where I is current in the wire, l is the length of the wire and B is the magnetic field

The force on the wire is the cross product of the length vector and magnetic field vector.



EXPLANATION:

- As we can see in the diagrams, the **direction of the force depends on both the direction of current in the conductor and the direction of the magnetic field**. So option 4 is correct.



20. Answer: d

Explanation:

Given: **Your Personal Exams Guide**

$$y = x / 6, \text{ and } 4x + 12y = 48$$

Calculation:

Putting the value of y in second equation we get

$$\Rightarrow 4x + 2x = 48 \quad [6y = x]$$

$$\Rightarrow 6x = 48$$

$$\Rightarrow x = 8, \text{ so } y = 4 / 3 = 1\frac{1}{3}$$

\therefore Required value of $x = 8$, value of $y = 1\frac{1}{3}$

21. Answer: c

Explanation:

CONCEPT:

- Nuclear Fission : In this reaction, a bigger nucleus splits into smaller nuclei and neutrons with the release of energy.
 - The most common example of this is the fission of Uranium into Barium and Krypton .
 - Atomic bombs (Little Boy and Fat Man) dropped on Hiroshima and Nagasaki used fission reactions.
 - Nuclear power plants also work on the principle of fission but in a controlled manner.
- Nuclear Fusion : The fusion of smaller nuclei to form a bigger one refers to Nuclear Fusion.
 - The fusion of hydrogen isotopes to form a helium nucleus is an example.
 - Fusion bombs have never been used in warfare till date.
 - Fission reaction is the source of energy in the sun .

EXPLANATION:

- The electron, proton and neutron can't be produced during nuclear fission and nuclear fusion.
- The **neutron is a neutral particle that can be produced during nuclear fission and nuclear fusion.** So option 3 is correct.

22. Answer: c

Explanation:

Given:

series = 7, 11, 15, 19, 23, ...

Formula Used:

$S_n = n / 2 \times \{2a + (n - 1) \times d\}$; where n = number of terms, d = common difference, a = first term, S_n = sum of n terms; $d = (a_2 - a_1)$; a_2 = second term of A.P., a_1 = first term of an A.P

Calculation:

Using the above formulae, we get $d = 4$

$$\Rightarrow S_{25} = 25 / 2 \times \{2 \times 7 + (25 - 1) \times 4\}$$

$$\Rightarrow S_{25} = 55 \times 25$$

$$\Rightarrow S_{25} = 1375$$

Required sum of 25 terms = 1375

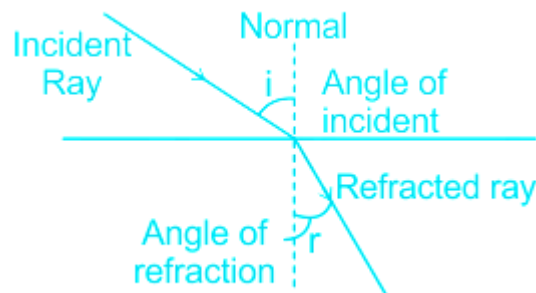
Therefore the correct answer is 1375.

23. Answer: b

Explanation:

CONCEPT:

- Refraction of Light: The bending of the ray of light passing from one medium to the other medium is called refraction .



- The refraction of light takes place on going from one medium to another because the speed of light is different in the two media .
- The greater the difference in the speeds of light in the two media, the greater will be the amount of refraction .
- A medium in which the speed of light is more is known as optically rarer medium and a medium in which the speed of light is less is known as an optically denser medium .
- The apparent depth is the distance of the virtual image from the surface of reference and the real depth is the distance of the real image from the surface of reference.

$$\Rightarrow \text{Refractive index} = \frac{\text{Real depth}}{\text{Apparent depth}}$$

CALCULATION:

Given - refractive index (μ) = $4/3$

Let actual depth is h .

So apparent depth (h') = $(h - 80)$

$$\Rightarrow \text{Refractive index} = \frac{\text{Real depth}}{\text{Apparent depth}}$$

$$4/3 = h/(h - 80)$$

$$3h = 4h - 320$$

$$\text{So } h = 320 \text{ cm}$$

Hence option 2 is correct.

24. Answer: d

Explanation:

Given:

Right angled triangle PQR, PR = 8 cm.

Formula Used:

For a given right angled triangle, $H = (B^2 + P^2)^{1/2}$; where P = perpendicular, B = base, H = Hypotenuse

Calculation:

$$\Rightarrow PR^2 = PQ^2 + QR^2$$

$$\Rightarrow PR^2 = PY^2 - (QR/2)^2 + RX^2 - (PQ/2)^2$$

$$\Rightarrow PR^2 = PY^2 + RX^2 - 1/4(PQ^2 + QR^2)$$

$$\Rightarrow PR^2 = PY^2 + RX^2 - PR^2/4$$

$$\Rightarrow 5PR^2/4 = PY^2 + RX^2$$

$$\Rightarrow 5 \times 64 / 4 = PY^2 + RX^2$$

$$\Rightarrow PY^2 + RX^2 = 80 \text{ cm}$$

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25. Answer: a

Explanation:

CONCEPT:

- Power of Lens: The inverse of the focal length is known as the power of the lens.
 - It shows the bending strength for the light ray of the lens.
 - The unit of power of a lens is Dioptre when the focal length of the lens is taken in meter (m).

$$P = \frac{1}{f}$$

where P is the power of the lens and f is the focal length of the lens.

- Concave lens : It is a diverging lens that diverges the parallel beam of light.
 - It can also gather light from all directions and project it as a parallel beam.
 - The focal length of the concave lens is negative .
 - It has a virtual focus from the diverging rays of light that seem to converge.
- Convex lens : The lens whose refracting surface is upside is called a convex lens .
 - The convex lens is also called a converging lens .
 - The focal length of a convex lens is positive .

The **power (P)** of the combination of two lenses is given by:

$$P = P_1 + P_2$$

Where P_1 and P_2 are the power of two lenses.

CALCULATION:

Given that:

$$P_1 = -15 \text{ D and } P_2 = +5 \text{ D}$$

$$\text{So } P = P_1 + P_2 = -15 + 5 = -10 \text{ D}$$

$$\text{Focal length (f) of the combination of lens} = 1/P = 1/(-10) = -0.1 \text{ m} = -10 \text{ cm}$$

So option 1 is correct.

26. Answer: c

Explanation:

CONCEPT:

- **Good fuel** : The fuel having following properties are called good fuel.

I. which would do a large amount of work per unit volume or mass and **have high calorific value**

II. be easily accessible,

III. be easy to store and transport, and

IV. most importantly, be economical

EXPLANATION:

- **High calorific value is the characteristic of a good fuel.** So option 3 is correct.

27. Answer: b

Explanation:

CONCEPT:

- **Magnetic field** : Magnetic field line starts from the North pole and ends at the south pole, it always makes a closed loop.
 - It is formed by electric currents and magnets .

EXPLANATION:

- An **electric current** produces magnetic field.
- **Static charge can't create magnetic field.** So option 2 is correct.
- A **rotating magnet** can produce magnetic field.
- A **galvanometer** carrying current can produce magnetuc field.

28. Answer: a

Explanation:

Calculation:

$$(-12x + 48) / (x - 4)$$

$$\Rightarrow -12(x - 4) / (x - 4)$$

$$\Rightarrow -12$$

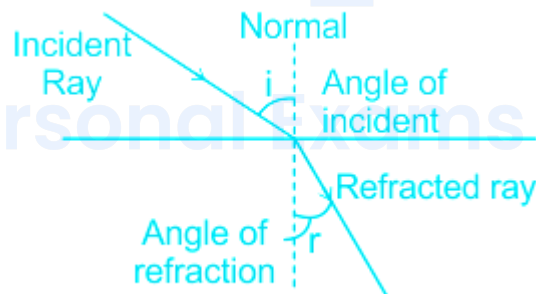
29. Answer: a

Explanation:

Concept:

Refraction: When a ray of light passes from one medium to another it suffers a change in direction at the boundary of two media is called refraction.

- The change in direction because the speed of light travels at different speeds in different mediums. The Refractive Index of a medium defines that it is denser or rarer



Snell's law of refraction : " The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant, for the light of a given color and for the given pair of media".

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$$

Where μ_2 and μ_1 are the refractive indexes of the two mediums 2 and 1 respectively.

Calculation:

Given that:

Angle of incidence (i) = 60°

Ray is incident from the air, $\mu_1 = 1$

Refractive index of medium (μ_2) = $\sqrt{3}$

Use $\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$

$$1. \sin 60^\circ = \sqrt{3} \cdot \sin r$$

$$\text{So } \sin r = 1/2 \Rightarrow r = 30^\circ$$

Angle of deviation (δ) = $i - r = 60^\circ - 30^\circ = 30^\circ$

Hence option 1 is correct.

30. Answer: a

Explanation:

CONCEPT:

- Projectile motion: Projectile motion is the motion of an object projected into the air, under only the acceleration of gravity. The object is called a projectile, and its path is called its trajectory.
 - Initial Velocity: The initial velocity can be given as x components and y components.

$$u_x = u \cos \theta$$

$$u_y = u \sin \theta$$

Where u stands for initial velocity magnitude and θ refers to projectile angle.

- Maximum Height: The maximum height is reached when $v_y = 0$.

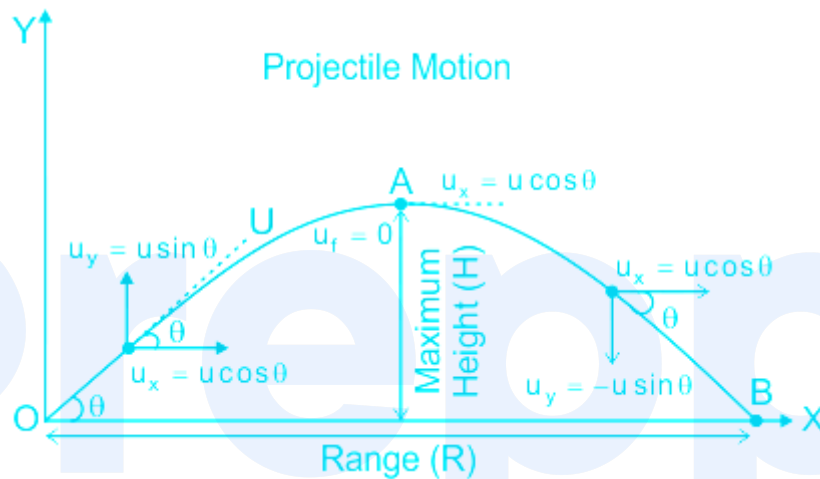
$$h = \frac{u^2 \sin^2 \theta}{2g}$$

Where h is the maximum height.

- Range: The range of the motion is fixed by the condition $y = 0$.

$$R = \frac{u^2 \sin 2\theta}{g}$$

Where R is the total distance covered by the projectile.



$$\text{Kinetic energy (KE)} = (1/2)m V^2$$

Where m is mass and V is the velocity

CALCULATION:

Given that:

(Angle with vertical = 90°)

$\theta = 60^\circ$ (with horizontal $90^\circ - 60^\circ = 30^\circ$)

$$u_x = u \cos \theta = u \cos 60^\circ = u / 2$$

$$u_y = u \sin \theta = u \sin 60^\circ = (\sqrt{3}/2) u$$

$$\text{Kinetic energy on the ground (KE)} = (1/2)m u^2 = K$$

At the top, velocity = $V = u / 2$

$$\text{Kinetic energy at top (KE')} = (1/2)m (u/2)^2 = mu^2/8 = K/4$$

So option 1 is correct.

31. Answer: d

Explanation:

Given:

If two hemispheres of curved surface area $8\pi \text{ cm}^2$ each are joined together to form a sphere.

Concept Used:

In this type of question, the total surface area of the sphere can be calculated by adding two hemispheres of curved surface area.

Calculation:

$$\text{Total surface area of the sphere} = (8\pi + 8\pi) \text{ cm}^2$$

$$\therefore \text{Total surface area of the sphere} = 16\pi \text{ cm}^2$$

32. Answer: c

Explanation:

CONCEPT:

- The product of mass and velocity is called momentum.

$$\text{Momentum (P)} = \text{mass (m)} \times \text{Velocity (V)}$$

- Momentum conservation principle : It states that, whenever there is no external force on the system then the total momentum of the system remains constant.

$$P_1 = P_2$$

Where P_1 is initial momentum of the system and P_2 is final momentum of the system

$$\text{Kinetic energy (KE)} = \frac{1}{2} m V^2$$

CALCULATION:

Given that:

Total mass of the system (spacecraft) = 2000 kg

Mass of first piece (m_1) = 500 kg

Mass of the second piece (m_2) = 2000 - 500 = 1500 kg

The spacecraft was initially moving with 600 m/s

So initial momentum of the system (P_1) = 2000 × 600 = 1200000 kg.m/s

After explosion :

Momentum of the first piece = $m_1 \times 0 = 0$

Final momentum of the system (P_2) = momentum of the first piece + Momentum of the second piece

$P_2 = 0 + \text{Momentum of second piece}$

- Since there is no external force on the bomb during the explosion , so momentum of the system before or after the explosion will remain same .

According to momentum conservation :

$$P_1 = P_2$$

1200000 = 0 + Momentum of second piece

Momentum of second piece = - 120000 = $m_2 \times V$

$$1500 \times V = - 120000$$

$$v = - 1200000/1500 = - 800 \text{ m/s}$$

The negative sign show the direction of the velocity.

So option 3 is correct.

33. Answer: c

Explanation:

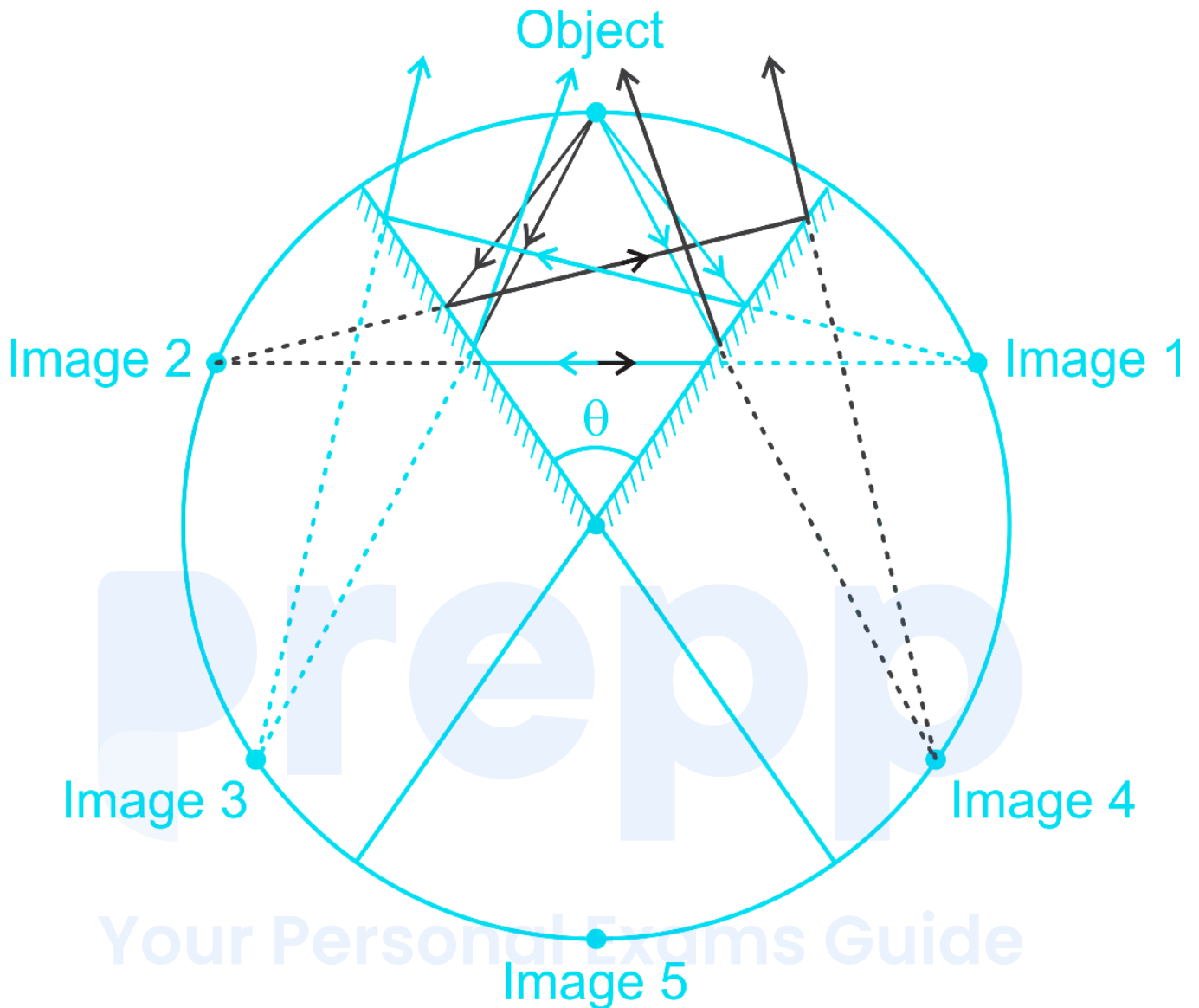
CONCEPT:

- If the image of an object is viewed in two **plane mirrors** that are inclined to each other, more than one image is formed.
- The number of images depends on the angle between the two mirrors.

$$\text{Number of images} = \frac{360}{\theta} - 1$$

- **For example** : If $\theta = 60^\circ$ then $n = 5$. So 5 images will be formed which can be seen in given diagram.

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CALCULATION:

Given that: $\theta = 45^\circ$

$$\text{Number of images} = \frac{360}{\theta} - 1$$

- Number of images (n) = $(360/45) - 1 = 8 - 1 = 7$

So option 3 is correct.

34. Answer: a

Explanation:

Given:

$$(15x + 3) / 6x = 2 / 3$$

Calculation:

$$3 \times (15x + 3) = 2 \times 6x$$

$$\Rightarrow 45x + 9 = 12x$$

$$\Rightarrow 33x + 9 = 0$$

$$\Rightarrow 11x + 3 = 0$$

$$\therefore \text{Required linear form} \Rightarrow 11x + 3 = 0$$

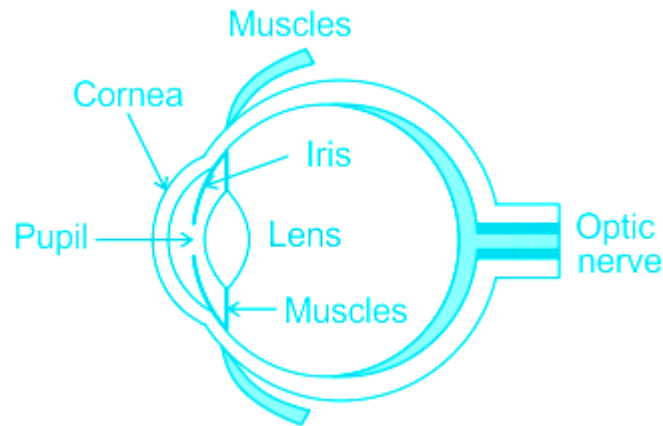
35. Answer: c

Explanation:

CONCEPT:

- Pupil is a hole through which light enters into our eye.
- Iris is a muscle in our eye that controls size of pupil. It dilate and contract because of which size of pupil vary.
- So we can say Iris controls the amount of light entering into our eye.
- Retina : Image is formed on retina.
- Ciliary muscles are smooth muscle fibers. When the ciliary muscles relax the lens become flat and when they contract the lens becomes thicker. This change in curvature of the eye lens changes the focal length of the eyes.

|



EXPLANATION:

- Since the **image forms at retina and this distance never changes** .
- So the **image distance from eye lens remains constant** . Hence option 3 is correct.

36. Answer: d

Explanation:

Given:

A ladder resting on the wall is grounded 3 metres away from the base of the wall. If the length of the ladder is 5 m

Calculation:

Height can be calculated by using Pythagoras theorem

$$\Rightarrow \text{Height} = (5^2 - 3^2)^{1/2}$$

$$\Rightarrow \text{Height} = 4 \text{ m}$$

$$\therefore \text{Required height} = 4 \text{ m}$$

37. Answer: c

Explanation:

CONCEPT:

- Kinetic energy (K.E): The energy possessed by a body by the virtue of its motion is called kinetic energy.

The expression for kinetic energy is given by:

$$KE = \frac{1}{2}mv^2$$

Where m = mass of the body and v = velocity of the body

- Momentum (p): The product of mass and velocity is called momentum.

Momentum (p) = mass (m) \times velocity (v)

The relationship between the kinetic energy and Linear momentum is given by:

As we know,

$$KE = \frac{1}{2}mv^2$$

Divide numerator and denominator by m , we get

$$KE = \frac{1}{2} \frac{m^2 v^2}{m} = \frac{1}{2} \frac{(mv)^2}{m} = \frac{1}{2} \frac{p^2}{m} \quad [p = mv]$$

$$\therefore KE = \frac{1}{2} \frac{p^2}{m}$$

$$p = \sqrt{2mKE}$$

EXPLANATION:

Since momentum is doubled, $p' = 2p$

$$\therefore KE = \frac{1}{2} \frac{p^2}{m}$$

Final kinetic energy (KE') is given by:

$$\therefore KE' = \frac{1}{2} \frac{(2p)^2}{m} = 4 KE$$

Hence option 3 is correct.

38. Answer: c

Explanation:

CONCEPT :

- Equation of motion : The mathematical equations used to find the final velocity, displacements, time, etc of a moving object without considering force acting on it are called equations of motion.
- These equations are only valid when the acceleration of the body is constant and they move on a straight line.

There are three equations of motion :

$$V = u + at$$

$$V^2 = u^2 + 2 a S$$

$$S = ut + \frac{1}{2}at^2$$

Where, V = final velocity, u = initial velocity, s = distance traveled by the body under motion, a = acceleration of body under motion, and t = time taken by the body under motion.

CALCULATION:

Given that:

$$\text{Initial speed (u) = 50 km/hr}$$

$$\text{Distance (S) = 6 m = 6/1000 km}$$

$$\text{Final velocity (v) = 0}$$

$$\text{use } V^2 = u^2 + 2 a S$$

$$0 = 50^2 + 2 \times a \times (6/1000)$$

$$\text{So } a = - (2500 \times 1000)/12 \text{ m/s}^2$$

Now initial speed (u) = 100 km/hr

$$\text{Final speed (v)} = 0$$

$$\text{use } v^2 = u^2 + 2 a s$$

$$0 = 100^2 + 2 \times (- (2500 \times 1000)/12) s'$$

$$\text{So } s' = (10000 \times 12)/(5000000) = 0.024 \text{ km} = 24 \text{ m}$$

Hence option 3 is correct.

39. Answer: d

Explanation:

Given:

$$\text{equation: } 6x^2 + 4x - 2 = 0$$

Calculation:

$$\Rightarrow 6x^2 + 4x - 2 = 0$$

$$\Rightarrow 6x^2 + 6x - 2x - 2 = 0$$

$$\Rightarrow 6x(x + 1) - 2(x + 1) = 0$$

$$\Rightarrow (x + 1)(6x - 2) = 0$$

$$\Rightarrow x = 1/3, -1$$

\therefore Required roots = $1/3, -1$

40. Answer: d

Explanation:

Given:

Terms = 0.125, 0.225, 0.182, 0.156, 0.196, 0.220

Formula Used:

Mean = sum of terms / number of terms

Calculation:

Using the above formulae, we get

$$\Rightarrow \text{Mean} = (0.125 + 0.225 + 0.182 + 0.156 + 0.196 + 0.220) / 6$$

$$\therefore \text{Required mean} = 0.184$$

41. Answer: c

Explanation:

CONCEPT:

Principle of homogeneity of dimensions:

- According to this principle, a physical equation will be dimensionally correct if the dimensions of all the terms occurring on both sides of the equation are the same.
- This principle is based on the fact that only the physical quantities of the same kind can be added, subtracted, or compared.
- Thus, velocity can be added to velocity but not to force.

EXPLANATION

Given - $x = t + bt + ct^2$

- From the principle of dimensional homogeneity, the left-hand side of the equation dimensionally equal to the right-hand side of the equation.
- The dimension formula of distance $(x) = [L]$

$$\therefore [L] = [a]$$

$$\Rightarrow [a] = [L]$$

- Therefore the unit of 'a' is 'm'. Hence option 3 is correct.

For the second term,

$$\Rightarrow [L] = [b] [T]$$

$$\Rightarrow [a] = \frac{[L]}{[T]} = [LT^{-1}]$$

- Therefore the unit of 'b' is ms^{-1} .

For the third term,

$$\Rightarrow [L] = [c] [T^2]$$

$$\Rightarrow [c] = \frac{[L]}{[T^2]} = [LT^{-2}]$$

- Therefore the unit of 'c' is ms^{-2} .

42. Answer: b

Explanation:

CONCEPT:

- Measurement of any physical quantity involves comparison with a certain basic, arbitrarily chosen, internationally accepted reference standard called unit, and a Dimension is a mathematical tool used for studying the nature of physical quantities.
- The basic concept of dimensions is that we can add or subtract only those quantities which have the same dimensions.

- And the dimensional formula is defined as the expression of the physical quantity in terms of mass, length, and time.

EXPLANATION:

- Speed is defined as the rate of change of distance i.e.,

$$\Rightarrow \text{Speed}(v) = \frac{\text{Distance}(d)}{\text{time}(t)}$$

As we know, the dimension formula of distance (d) = [L]

The dimension formula of time (t) = [t]

∴ The dimension formula of speed is

$$\Rightarrow v = \frac{[L]}{[T]} = [M^0 L T^{-1}]$$

So option 2 is correct.

★ Important Points

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Quantity	Unit	Dimension
Pressure	Pascal	$[ML^{-1}T^{-2}]$
Stress	Pascal	$[ML^{-1}T^{-2}]$
Velocity	m/s	$[LT^{-1}]$
Speed	m/s	$[LT^{-1}]$
Force	Newton	$[MLT^{-2}]$
Impulse	Newton-second	$[MLT^{-1}]$
Work	Joule	$[ML^2T^{-2}]$
Energy	Joule	$[ML^2T^{-2}]$
Capacitance (C)	Coulomb/volt or Farad	$[M^{-1}L^2T^4A^2]$
Resistivity or Specific resistance (ρ)	Ohm-meter	$[ML^3T^{-3}A^{-2}]$
Electric current (I)	Ampere	[A]
Electric charge (q)	Coulomb	[AT]
Inductance (H)	henry	$[ML^2T^{-2}A^{-2}]$

43. Answer: b

Explanation:

Follow BODMAS rule to solve this question, as per the order given below.

Step - 1: Parts of an equation enclosed in 'Brackets' must be solved first, and following BODMAS rule in the bracket -

Step - 2: Any mathematical 'Of' or 'Exponent' must be solved next.

Step - 3: Next, the parts of the equation that contain 'Division' and 'Multiplication' are calculated.

Step - 4: Last but not the least, the parts of the equation that contain 'Addition' and 'Subtraction' should be calculated.

Since, we need to find out the approximate value, we can write these values to their nearest integers.

Given expression is:

$$(0.2 \times 0.36 + 0.8 \times 0.36) / 0.18$$

$$\Rightarrow (0.072 + 0.288) / 0.18$$

$$\Rightarrow 0.36 / 0.18$$

$$\Rightarrow 2$$

44. Answer: a

Explanation:

Concept Used:

In this type of question, sample outcomes possible is $\{1, 2, 3, 4, 5, 6\}$

Formula Used:

Probability = favourable terms / sample space

Calculation:

Using the above formulae, we get favourable terms = $\{2, 4, 6\}$

\Rightarrow Probability = $3 / 6$

\therefore Required Probability = $1 / 2$

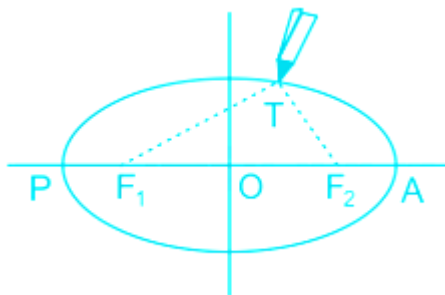
45. **Answer: d**

Explanation:

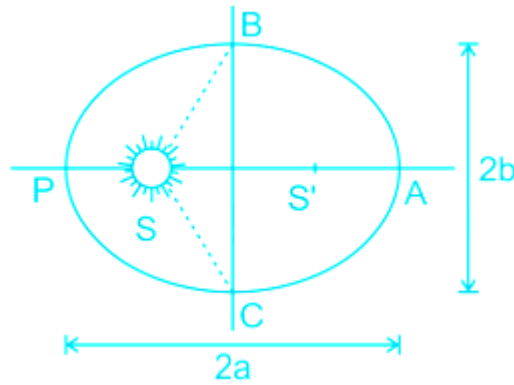
CONCEPT:

Johannes Kepler first proposed his three laws of motion which were later termed as Kepler's law of planetary motion .

- **Kepler's First law:** Every planet revolves around the Sun in an elliptical orbit and Sun is situated at one of its two foci. It is also termed as 'the Law of Orbits'.



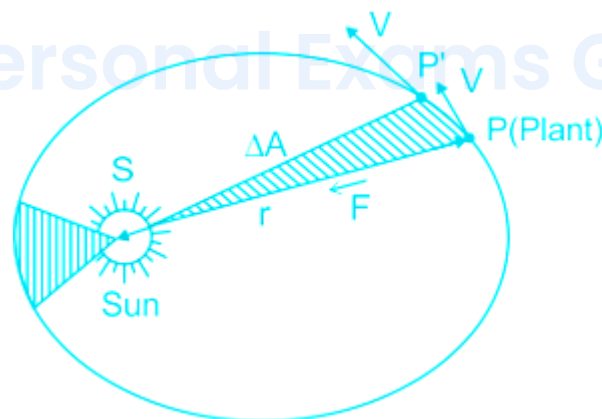
Drawing an ellipse. A string has its ends fixed at F 1 and F 2. The tip of a pencil holds the string at T and is moved around.



An ellipse traced out by a planet around the sun. The closest point is P and the farthest point is A. P is called the perihelion and A the aphelion. The semi-major axis of half the distance ΔP .

Here F1 and F2 are two foci of an elliptical orbit and 2a and 2b are the distance of the semi-major and semi-minor axis of ellipse respectively.

- Kepler's Second Law: The line that joins any planet to the sun sweeps equal areas in equal intervals of time .
 - This law comes from the observations that planets appear to move slower when they are farther from the sun than when they are nearer , they appear to move faster . It is also termed as the Law of Equal Areas.



The planet P moves around the sun in an elliptical orbit. The shaded area is the area ΔA swept out in a small interval of time Δt .

i.e., $\frac{dA}{dt} = \text{constant}$

- Kepler's third law: The Square of the time period of revolution of a planet is proportional to the cube of the semi-major axis of the ellipse traced out by the planet. It is also termed as the Law of Periods.
- Law of Gravitation: The force of attraction between any objects in the universe is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

CALCULATION:

Total number of days = 29

Total area = K

Number of days in a week = 7

So area swept in 7 days = $7K/29$.

Hence option 4 is correct.

46. Answer: c

Explanation:

Concept Used:

In this type of question, An *Irrational Number* is a real number that cannot be written as a simple fraction

$\therefore \sqrt{3} - 3$ is an *Irrational Number*

47. Answer: d

Explanation:

Given:

Concept Used:

In this type of question, irrational roots always occur in pair

Formula Used:

Quadratic equation = $x^2 - (a + b)x + (a \times b) = 0$; here 'a' and 'b' are the roots

Calculation:

Using the above formulae, we get another root as $(-\sqrt{3} - 1)$

$$\Rightarrow x^2 - (-\sqrt{3} - 1 + \sqrt{3} - 1)x + (-\sqrt{3} - 1)(\sqrt{3} - 1) = 0$$

$$\Rightarrow x^2 + 2x - 2 = 0$$

$$\therefore \text{Required quadratic equation} = x^2 + 2x - 2 = 0$$

48. Answer: d

Explanation:

CONCEPT:

The following are the characteristics of the **sound** :

1. Pitch or Frequency
2. Intensity or Loudness
3. Quality or timber

a. Pitch: The frequency of a sound wave is the parameter that ear understands as pitch. A higher frequency sound has a higher pitch, and a lower frequency sound has a lower pitch

b. Loudness: The amplitude of a sound wave determines its loudness or volume. A larger amplitude means a louder sound, and a smaller amplitude means a softer sound

c. Quality or timbre : It is the characteristics which enable us to distinguish between
Timbre is associated with the shape of sound waves or waveforms produced by them.

EXPLANATION:

- **Amplitude, wavelength and frequency** are the characteristics of sound wave.
- **Brightness is not the characteristic of sound wave** . So option 4 is correct.

49. Answer: b

Explanation:

Formula Used:

$$\cos \theta = B / H; B = \text{base}, H = \text{Hypotenuse}$$

Calculation:

Using the above formulae, we get

$$\Rightarrow \cos 30^\circ = 10 / H$$

$$\Rightarrow \sqrt{3} / 2 = 10 / H$$

$$\Rightarrow H = 20 / \sqrt{3} \text{ m}$$

\therefore Required distance between her eye and the base of the tree = $20 / \sqrt{3} \text{ m}$

50. Answer: d

Explanation:

Given:

Triangles PQR and ABC are similar triangles.

Concept Used:

In this type of question, if two triangles are similar then their corresponding angles are congruent and corresponding sides are in proportion

Formula Used:

$$AB : PQ = CB : RQ$$

Calculation:

Using the above formulae, we get

$$\Rightarrow 36 : 9 = 48 : RQ$$

$$\Rightarrow RQ = 12 \text{ cm}$$

\therefore Required length of RQ = 12 cm.

51. Answer: d**Explanation:**

Given: 

Central angle of 90° intercepts an arc of length 13 cm

Formula Used:

$$\theta = \text{arc} / \text{radius} \text{ and } 1^\circ = \pi^\circ / 180$$

Calculation:

Using the above formulae, we get $\theta = \pi / 2$

$$\Rightarrow \pi / 2 = 13 / \text{radius}$$

$$\Rightarrow \text{Radius} = 26 / \pi \text{ cm}$$

\therefore Required radius = $26 / \pi$ cm

52. Answer: a

Explanation:

Concept Used:

In this type of question, A *rational Number* is a real number that can be written as a simple fraction

$\therefore 4 / 15$ is a *rational Number*.

53. Answer: b

Explanation:

Given:

A(15, 14), B(30, 15), C(27, 5) and D(10, 5) are the vertices of a quadrilateral

Formula Used:

Area of quadrilateral = $(1 / 2) \times \{(x_2y_1 + x_3y_2 + x_4y_3 + x_1y_4) - (x_1y_2 + x_2y_3 + x_3y_4 + x_4y_1)\}$ where symbols have their usual meaning

Calculation:

Using the above formulae, we get

$$\Rightarrow \text{Area of quadrilateral ABCD} = (1 / 2) \times \{(30 \times 14 + 27 \times 15 + 10 \times 5 + 15 \times 5) - (15 \times 15 + 30 \times 5 + 27 \times 5 + 10 \times 14)\}$$

$$\Rightarrow \text{Area of quadrilateral ABCD} = (1 / 2) \times \{950 - 650\}$$

$$\Rightarrow \text{Area of quadrilateral ABCD} = 150 \text{ sq. units}$$

\therefore Required area = 150 sq. units

54. Answer: a

Explanation:

CONCEPT:

- Light year: The distance travelled by light in one year is called as light year.
- It is the unit of astronomical distance.
- 1 light year = 9.461 trillion kilometers which is a very large distance .

EXPLANATION:

- As light year is the distance travelled by light in a year so light year is a unit of distance/Length . Hence option 1 is correct.

55. Answer: a

Explanation:

Concept Used:

In this type of question, if two triangles are similar then their corresponding angles are congruent i.e. equal

\therefore Angle at B will also be 30°

56. Answer: a

Explanation:

Given:

Circular areas of same size have been marked to drill holes in a road. If the radius of one of the holes to be drilled is 21cm, and there are 10 holes to be drilled along the

road

Formula Used:

Area of circle = $\frac{22}{7} \times r^2$; r = radius of circle

Calculation:

Using the above formulae, we get

$$\Rightarrow \text{Total area} = 10 \times \frac{22}{7} \times 21^2$$

$$\Rightarrow \text{Total area} = 13860 \text{ sq.cm}$$

\therefore Required total area = 13860 sq.cm

57. **Answer: c**

Explanation:

Given:

Series: 2, 11, 20, 29, 38,

Formula Used:

$T_n = a + (n - 1)d$; $T_n = n^{\text{th}}$ term, a = first term, d = common difference

Calculation:

Using the above formulae, we get $d = 9$

$$\Rightarrow T_7 = 2 + (7 - 1) \times 9$$

$$\Rightarrow T_7 = 56$$

\therefore Required seventh term = 56

58. Answer: c

Explanation:

Given:

A farmer is marking his field to sow seeds if he marks a rectangular area of his field in the ratio of length : width 3 : 1.

Formula Used:

Area of rectangular field = (length \times width)

Calculation:

Let the width of the rectangular area be 'x' units and using the above formulae, we get

$$\Rightarrow \text{Area of rectangular field} = (3x \times x)$$

$$\Rightarrow \text{Area of rectangular field} = 3x^2$$

$$\therefore \text{Required expression for area} = 3x^2$$

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59. Answer: a

Explanation:

Given:

$$\text{Function } f(x) = (x - 3)(x - 2)$$

Concept Used:

In this type of question, zeroes of the function can be calculated by equating the given function with zero

Calculation:

Using the above concept, we get

$$\Rightarrow (x - 3)(x - 2) = 0$$

$$\Rightarrow x = 3, 2$$

\therefore Required zeroes = 3, 2

60. Answer: c

Explanation:

CONCEPT:

- Power : The rate of work done by the electric energy is called power. It is denoted by P.
 - The SI unit of power is the watt (W).
 - Watt is a small unit that's why kilowatt-hour is used as the unit for electrical energy.
- 1 unit of electric energy : When one-kilowatt load works for 1 hour then the energy consumed is called 1 unit of electricity.

$$1 \text{ Unit of electricity} = 1 \text{ kWh} = 1000 \text{ Watt-hour} = 3.6 \times 10^6 \text{ J}$$

$$1 \text{ Kilo-watt} = 1000 \text{ Watt}$$

- 1 Watt : The energy consumption rate of 1 joule per second is called 1 watt.

EXPLANATION:

$$\text{Since } 1 \text{ hr} = 3600 \text{ sec}$$

$$1 \text{ Kilo-watt} = 1000 \text{ Watt}$$

$$1 \text{ kWh} = 1000 \text{ Watt-hour} = 1000 \times 3600 \text{ W.s} = 3.6 \times 10^6 \text{ J}$$

So option 3 is correct.

61. Answer: c

Explanation:

Given:

The minute hand of a watch is 2 cm long

Formula Used:

$$\theta = \text{arc} / \text{radius and } 1^\circ = \pi^\circ / 180$$

Calculation:

Using the above formulae, and we know 1 minutes = $360^\circ / 60^\circ$, we get $\theta = \pi / 3$

$$\Rightarrow \text{Arc} = \pi / 3 \times 2$$

$$\Rightarrow \text{Arc} = 2\pi / 3 \text{ cm}$$

\therefore Length of the tip moves in 10 minutes = $2\pi / 3 \text{ cm}$.

62. Answer: a

Explanation:

CONCEPT:

- The transparent curved surface which is used to refract the light and make an image of any object placed in front of it is called a lens.
 - The lens whose refracting surface is upside is called a convex lens .
 - The convex lens is also called a converging lens .

The lens formula is given by :

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Where u is object distance, v is image distance and f is the focal length of the lens

The **power (P) of the lens** is given by:

$$P = 1/f$$

CALCULATION:

Given that:

Since the person's near point is at 50 cm

So the image should form at 50 cm.

$$\text{Image distance (v)} = -50 \text{ cm}$$

$$\text{Object distance (u)} = -25 \text{ cm}$$

$$\text{use } \frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-50} - \frac{1}{-25} = \frac{1}{f}$$

$$1/f = 1/50$$

$$\text{So } f = 50 \text{ cm} = 0.5 \text{ m}$$

$$\text{Power of the lens (P)} = 1/f = 1/0.5 = 2\text{D}$$

Hence option 1 is correct.

63. Answer: d

Explanation:

Given:

Length of the field = 200 m

Area of the field = 3000 m²

Cost of fencing per metre = Rs. 5

Formula Used:

$$P = 2 \times (\text{length} + \text{breadth})$$

$$\text{Area of rectangular field} = (\text{length} \times \text{breadth})$$

Calculation:

Using the above formulae, we get

$$\Rightarrow 3000 = (200 \times \text{breadth})$$

$$\Rightarrow \text{Breadth} = 15 \text{ m}$$

$$\Rightarrow P = 2 \times (200 + 15)$$

$$\Rightarrow P = 430 \text{ m}$$

$$\Rightarrow \text{The total cost of fencing} = 430 \times 5 = \text{Rs. } 2150$$

$$\therefore \text{Required cost of fencing} = \text{Rs. } 2150$$

64. Answer: a

Explanation:

Given:

Five cards—the ten, jack, queen, king and ace of hearts, are well-shuffled with their face downwards

Formula Used:

$$\text{Probability} = \text{favourable terms} / \text{sample space}$$

Calculation:

Using the above formulae, we get favourable terms i.e. Ace = 1, sample space = 5

$$\therefore \text{Required Probability} = 1 / 5$$

65. Answer: a

Explanation:

Concept used:

Follow the **BODMAS** rule to solve this question, as per the order given below.

B	Brackets in order (), {}, []	ब्रैकेट (), {}, [] क्रम में
O	of	का
D	Division (÷)	विभाजन (÷)
M	Multiplication (×)	गुणा (×)
A	Addition (+)	जोड़ (+)
S	Subtraction (-)	घटाव (-)

Calculations:

$$24 \times (15 + 45) \div 6 + (45 + 5) - 5 = ?$$

$$\Rightarrow 24 \times 60 \div 6 + 50 - 5 = ?$$

$$\Rightarrow 24 \times 10 + 50 - 5 = ?$$

$$\Rightarrow 240 + 50 - 5 = ?$$

$$\Rightarrow 285 = ?$$

\therefore The value of ? is 285.

66. Answer: c

Explanation:

Given:

Points P(15, 15), Q(50, 25) and R(β , 35) are collinear

Concept Used:

In this type of question, slope of line joining by any two points are equal

Formula Used:

$$\text{Slope} = (y_2 - y_1) / (x_2 - x_1)$$

Calculation:

Using the above formulae, we get

$$\Rightarrow \text{Slope of line PQ} = (25 - 15) / (50 - 15) = 2 / 7$$

$$\Rightarrow \text{Slope of line QR} = (35 - 25) / (\beta - 50)$$

Since slope of line PQ and line QR are equal as they are collinear

$$\Rightarrow 10 / (\beta - 50) = 2 / 7$$

$$\Rightarrow 70 = 2\beta - 100$$

$$\Rightarrow \beta = 85$$

\therefore Required value of $\beta = 85$.

67. Answer: c

Explanation:

Concept:

Newton's law of gravitation :

The gravitational force between two objects is **directly proportional** to the **product of masses** of the objects and **inversely proportional** to the distance between two

mass .

$$\text{i.e. } F = \frac{GMm}{R^2}$$

whereas according to classical mechanics force acting on the particle is given as

Force = mass × acceleration

where F = gravitational force, M = mass of a heavier object, m = mass of a lighter object, R = distance between two masses

Explanation :

Now using the above equation, we can say that $G = \frac{FR^2}{Mm}$

The SI unit of force is the Newton (N). The SI unit of distance (R) is metre (m) and the SI unit of mass is (kg).

The SI unit of $G = \frac{Nm^2}{kg^2}$

So, option 3 is correct.

68. Answer: a

Explanation:

CONCEPT:

- Force: The interaction which after applying on a body changes or try to change the state of rest or state of motion of the body is called force.

Force (F) = Mass (m) × acceleration (a)

CALCULATION:

Given that:

Force (F) = 10 N

$$\text{Acceleration (a)} = 2 \text{ m/s}^2$$

$$\text{Force (F)} = \text{Mass (m)} \times \text{acceleration (a)}$$

$$\text{Mass (m)} = F/a = 10/2 = 5\text{kg}$$

So option 1 is correct.

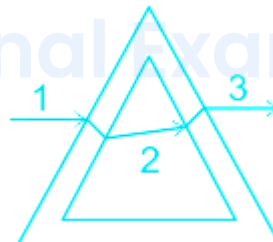
69. Answer: c

Explanation:

CONCEPT:

- Dispersion of light: The phenomenon in which a white light ray when falls on a prism get separated into its component colors is called dispersion of light .
- When light rays fall on the prism then there is a deviation in the path of the ray after refraction through the prism .

EXPLANATION:



- When the light rays enter the first wall of the **hollowprism** then it bends towards normal to the surface because it enters the denser medium.
- Just the opposite will happen when it leaves the first wall and the ray will bend away from normal because it enters a lighter medium with exactly the same angle.
- Similarly, when the light ray enters the wall on the other side, on the way towards the exit, it bends toward normal.
- And finally **bends away from the normal at the exit.**

- Thus we find that there is **no dispersion and no deviation of light rays** . So option 3 is correct.

70. **Answer: a**

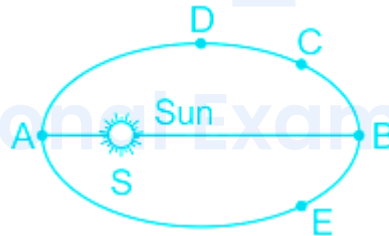
Explanation:

CONCEPT:

Johannes Kepler proposed laws of planetary motion .

- Kepler’s First law: Every planet revolves around the Sun in an elliptical orbit and Sun is situated at one of its two focii. It is also termed as ‘the Law of Orbits ’.
- Conservation of Angular Momentum: The velocity and distance from the Sun both change as the planet moves in an elliptical orbit, but the product of the velocity times the distance stays constant.

$$L = m v r ,$$



Where m is the mass of the planet, v is the planet's orbital velocity and r is the distance can be taken as the semi-major axis of the orbit (the distance between sun and planet).

CALCULATION:

When the distance is y then speed is v .

When the distance is $4y$ then speed =?

Here apply **momentum conservation** :

$$m v_1 r_1 = m v_2 r_2$$

$$m \times v \times y = m \times v' \times 4y$$

$$\text{So speed } (v') = v/4$$

Hence option 1 is correct.

71. Answer: d

Explanation:

Given:

Points P(12, 16), Q(8, 13) divides in the ratio 2 : 7 internally

Formula Used:

$$x \text{ coordinate of Point P} = \frac{(m_1 x_2 + m_2 x_1)}{(m_1 + m_2)};$$

$$y \text{ coordinate of Point P} = \frac{(m_1 y_2 + m_2 y_1)}{(m_1 + m_2)};$$

Where m_1, m_2 are the ratio in which point P divides internally.

Calculation:

Using the above formulae, we get

$$\Rightarrow P(x, y) = \frac{(2 \times 8 + 7 \times 12)}{9}, \frac{(2 \times 13 + 7 \times 16)}{9}$$

$$\Rightarrow P(x, y) = (100/9), (138/9)$$

$$\therefore \text{Required point } P(x, y) = (100/9, 138/9)$$

72. Answer: b

Explanation:

CONCEPT :

- Equation of motion : The mathematical equations used to find the final velocity, displacements, time, etc of a moving object without considering force acting on it are called equations of motion.
- These equations are only valid when the acceleration of the body is constant and they move on a straight line.

There are three equations of motion :

$$V = u + at$$

$$V^2 = u^2 + 2as$$

$$S = ut + \frac{1}{2}at^2$$

Where, V = final velocity, u = initial velocity, s = distance traveled by the body under motion, a = acceleration of body under motion, and t = time taken by the body under motion.

CALCULATION:

Particle starts from rest,

$$\text{Initial velocity (u) = 0}$$

Let acceleration = a

In first 2 second, $t = 2$ sec

$$x = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times a \times 2^2 = 2a$$

For first 4 sec, $t = 4$

$$S = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times a \times 4^2 = 8a$$

So distance travelled in next two second, $y = S - x = 8a - 2a = 6a$

$$y = 6a = 3x$$

Here $n = 3$

Hence option 2 is correct.

73. Answer: c

Explanation:

CONCEPT:

- Magnification: In a concave mirror, the magnification is the ratio of the height of the image to the height of the object.
 - When the image is real, the magnification will be negative because the real image is inverted.
 - When the image is virtual, the magnification will be positive because the virtual image is erect.

$$m = \frac{-v}{u}$$

where m is magnification, v is the distance of the image from the mirror, and u is the distance of the object from the mirror.

EXPLANATION:

$$\text{So } m = -v/u$$

Hence option 3 is correct.

74. Answer: b

Explanation:

Taking L.H.S, also all sides are equal in rhombus

$$\Rightarrow PQ^2 + QR^2 + RS^2 + SP^2$$

$$\Rightarrow (PQ^2 + QR^2) + (RS^2 + SP^2)$$

$$\Rightarrow (PR^2 + QS^2)$$

75. Answer: d

Explanation:

Given:

Number $82178342*52$ is divisible by 11

Concept Used:

In this type of question, a number is divisible by 11 when difference of digits at even place and odd places is equal to zero or a multiple of 11

Calculation:

Using the above concept, we get

$$\Rightarrow (8 + 1 + 8 + 4 + * + 2) - (2 + 7 + 3 + 2 + 5) = 0 \text{ or multiple of } 11$$

Since the value of * should be minimum the R.H.S will be 11

$$\Rightarrow (23 + *) - (19) = 11$$

$$\Rightarrow * = 7$$

\therefore Required least value of * = 7.