



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

BSF HC RO (Radio Operator) 20 Nov 2022 Official Paper

Total Time: 2 Hour

Total Marks: 200

Instructions

Sl No.	Section Name	No. of Question	Maximum Marks	Negative Marks	Positive Marks
1	Physics	40	80	0.25	2
2	Chemistry	20	40	0.25	2
3	Mathematics	20	40	0.25	2
4	English & GK	20	40	0.25	2

- 1.) A total of 120 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.

Physics

1. If a clock based on oscillating pendulum is taken from the earth to moon, it will (+2, -0.25)
- a. Become slow
 - b. Become fast
 - c. Give same time as on the earth
 - d. Stop working

2. Which one among the following waves bats use to detect the obstacles in their flying path? (+2, -0.25)
- a. Infrared waves
 - b. Electromagnetic waves
 - c. Ultrasonic waves
 - d. Radio waves

3. The velocity of sound in air is affected by change in the (+2, -0.25)
- I. Moisture content of air
 - II. Temperature of air
 - III. Composition of air
 - IV. Atmospheric pressure
- Choose the correct answer.
- a. I, II and III

- b. II, III and IV
- c. I, II and IV
- d. I, III and IV

4. Decibel is used to measure the intensity of (+2, -0.25)

- a. Magnetic field
- b. Sound
- c. Light
- d. Heat

5. A device which is used in our TV set, computer, radio set for storing the electric charge is (+2, -0.25)

- a. Resistor
- b. Inductor
- c. Capacitor
- d. Conductor

6. When a soap bubble is charged, (+2, -0.25)

- a. Its radius increases
- b. Its radius decreases
- c. Its radius remains unchanged
- d. It collapses

7. 'Farad' is the unit of

(+2, -0.25)

- a. Resistance
- b. Conductance
- c. Capacitance
- d. Inductance

8. **Assertion (A):** The coulomb force is the dominating force in the universe.

(+2, -0.25)

Reason (R): The coulomb force is weaker than the gravitational force.

- a. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- b. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- c. If Assertion is true but Reason is false.
- d. Both Assertion and Reason are false.

9. Consider following statements

(+2, -0.25)

- I. A comb moving through dry hair get electrically charged.
- II. Electric lines of force are not closed but magnetic lines of force are closed.

Which of the statement(s) given above is/are correct?

- a. Only I

- b. Only II
 - c. Both I and II
 - d. Neither I nor II
-

10. If two conducting spheres are separately charged and then brought in contact (+2, -0.25)

- a. The total energy of the two spheres is conserved.
 - b. The total charge on the two spheres is conserved
 - c. Both the total energy and the total charge are conserved
 - d. The final potential is always the mean of the original potential of the two spheres
-

11. Which of the following pairs of physical quantities has the same dimensions? (+2, -0.25)

- a. Work and power
 - b. Momentum and energy
 - c. Force and power
 - d. Work and energy
-

12. A passenger in a moving train tosses a five rupees coin. If the coin falls behind him, then the train must be moving with a uniform (+2, -0.25)

- a. Acceleration
- b. Deceleration

- c. Speed
 - d. Velocity
-

13. Newton's first law is also called as (+2, -0.25)

- a. Law of moment
 - b. Law of inertia
 - c. Law of energy
 - d. Law of momentum
-

14. In which case does the potential energy decrease? (+2, -0.25)

- I. On compressing a spring
- II. On stretching a spring
- III. On moving a body against gravitational force
- IV. On the rising of an air bubble in water

Select the correct answer.

- a. I and II
 - b. Only IV
 - c. III and IV
 - d. All of these
-

15. Which of the following statements is true? (+2, -0.25)

- a. g is the same at all places on the surface of the earth.
- b. g is less at the earth's surface than at a height above or at a depth below it.
- c. g has its maximum value at the equator.
- d. g is greater at the poles than at the equator.

16. Consider the following statements.

(+2, -0.25)

I. Young's modulus of elasticity is defined as the ratio of normal stress to the longitudinal strain within the elastic limit.

II. Bulk modulus of elasticity is defined as the ratio of normal stress to the volumetric strain, within the elastic limit.

Which of the statement(s) given above is/are correct?

- a. Only I
- b. Only II
- c. Both I and II
- d. Neither I nor II

17. At normal temperatures due to a puncture, the compressed air inside the tube of a car wheel suddenly starts coming out. Then, the air inside the tube

(+2, -0.25)

- a. Starts becoming hotter
- b. Starts becoming cooler
- c. Remains at the same temperature

- d. May become hotter or cooler depending on the amount of water vapour present in the air
-

18. The specific heat of a gas at constant pressure is greater than the specific heat at constant volume because (+2, -0.25)

- a. Work is done in the expansion of the gas at constant volume.
 - b. Work is done in the expansion of the gas at constant pressure.
 - c. The molecular collision increases at constant pressure.
 - d. The attraction between the molecules increases at constant pressure.
-

19. A slow-running pendulum clock can be speeded up by (+2, -0.25)

- a. Increasing the length of the rod
 - b. Increasing the weight of the bob
 - c. Reducing the length of the rod
 - d. Reducing the weight of the bob
-

20. When a wave goes from one medium to another, there is a unchanged quantity is (+2, -0.25)

- a. Velocity
- b. Amplitude
- c. Frequency
- d. Wavelength

21. If the rotational velocity of a dynamo armature is doubled, then the induced emf will (+2, -0.25)

- a. become half
- b. become double
- c. remain unchanged
- d. None of the above

22. Magnetic Resonance Imaging (MRI) is used in medical diagnosis to obtain images of our internal body organs. This is primarily possible, because (+2, -0.25)

- a. our body possesses a permanent magnet
- b. MRI uses an external magnet to generate a magnetic field in our body
- c. MRI uses an external electric field to generate magnetic field in our body
- d. ions motion along our nerve cells generates magnetic fields

23. The phenomenon of electromagnetic induction implies the production of induced (+2, -0.25)

- a. resistance in a coil when the magnetic field changes with time
- b. current in a coil when an electric field changes with time
- c. current in a coil when a magnetic field changes with time

d. voltage in a coil when an electric field changes with time

24. By inserting a soft iron piece into the solenoid, the strength of the magnetic field (+2, -0.25)

- a. decrease
- b. increase
- c. first increase then decrease
- d. remains unchanged

25. When an AC source is connected across a resistor (+2, -0.25)

- a. the current lags behind the voltage in phase
- b. the current and the voltage are in same phase
- c. the current-leads the voltage in phase
- d. None of the above

26. Fibre optics cable used in communication works on the principle of (+2, -0.25)

- a. regular reflection of light
 - b. diffuse reflection of light
 - c. refraction of light
 - d. total internal reflection of light
-

27. When a CD (Compact disc used in audio and video system) is seen in sunlight, rainbow-like colors are seen. This can be explained on the basis of the phenomenon of (+2, -0.25)

- a. reflection and diffraction
 - b. reflection and transmission
 - c. diffraction and transmission
 - d. refraction, diffraction and transmission
-

28. Lights travels slower in glass than in air because (+2, -0.25)

- a. refractive index of air is less than that of glass
 - b. refractive index of air is greater than that of glass
 - c. density of glass is greater than that of air
 - d. density of glass is less than that of air
-

29. The penetrating powers of α , β , and γ radiations, in decreasing order, are:- (+2, -0.25)

- a. α , β , γ
 - b. γ , β , α
 - c. β , α , γ
 - d. γ , α , β
-

30. In an atomic explosion, the release of a large amount of energy due to the conversion of (+2, -0.25)

- a. chemical energy into nuclear energy
- b. nuclear energy into heat
- c. mass into energy
- d. chemical energy into heat

31. Which of the following is not correctly matched? (+2, -0.25)

- a. Voltametre - Potential difference
- b. Ammeter - Electric current
- c. Potentiometer - Emf
- d. Meter bridge - Electrical resistance

32. Two bulbs are fitted in a room in the domestic electrical installation. One of them glows brighter than the other. Then (+2, -0.25)

- a. The brighter bulb has smaller resistance
- b. The brighter bulb has larger resistance
- c. Both the bulbs have the same resistance
- d. None of the above

33. A current I flows through a potential difference V in an electrical circuit containing a resistance R . The product of V and I i.e. VI may be (+2, -0.25)

understood as

- a. Resistance R
- b. Heat generated by the circuit
- c. Thermal power radiated by the circuit
- d. Rate of change of resistance

34. Ohm's law defines (+2, -0.25)

- a. a resistance
- b. current only
- c. voltage only
- d. both current and voltage

35. The material used for electric fuse is an alloy of tin and lead. This alloy should have (+2, -0.25)

- a. high specific resistance and low melting point
- b. low specific resistance and high melting point
- c. low specific resistance and low melting point
- d. high specific resistance and high melting point

36. Consider the following statements. A magnetic field (+2, -0.25)

- I. never exerts a force on a charged particle.

II. always exerts a force on a charged particle.

III. exerts a force on a charged particle if it is moving across the magnetic lines of force.

IV. exerts a force on a charged particle if it is moving along the magnetic lines of force.

Which of the statement(s) given above is/are correct?

- a. Only III
- b. Only IV
- c. I and II
- d. I, II, III and IV

37. All the magnetic materials lose their magnetic properties when (+2, -0.25)

- a. dipped in oil
- b. dipped in water
- c. strongly heated
- d. brought near a piece of iron

38. A magnetic needle is kept in a non-uniform magnetic field. It experiences (+2, -0.25)

- a. a force but not a torque
- b. a force and a torque
- c. a torque but not a force

d. None of the above

39. In terms of magnetic properties, oxygen belongs to (+2, -0.25)

- a. magnetic materials
 - b. ferromagnetic materials
 - c. paramagnetic materials
 - d. diamagnetic materials
-

40. When a bar magnet is cut into two equal halves the pole strength of each piece (+2, -0.25)

- a. becomes double
- b. becomes half
- c. becomes zero
- d. remains the same

Chemistry

41. Glass is (+2, -0.25)
- Supercooled liquid
 - Crystalline solid
 - Liquid crystal
 - None of the above
-
42. Preparation of 'Dalda or Vanaspati' ghee from vegetable oil utilizes the following process (+2, -0.25)
- Hydrolysis
 - Oxidation
 - Hydrogenation
 - Ozonolysis
-
43. The quality of petrol is expressed in terms of (+2, -0.25)
- Gold number
 - Cetane number
 - Added unleaded compounds
 - Octane number
-
44. Which of the following is responsible for the conduction of electricity through the electrolytic solution? (+2, -0.25)

- a. Movement of ions of electrolyte
 - b. Movement of only positive charges
 - c. Movement of particles
 - d. Movement of molecules
-

45. Which one of the following pairs of materials serves as electrodes in chargeable batteries commonly used in devices such as torch lights, electric shavers, etc.?(+2, -0.25)

- a. Nickel and cadmium
 - b. Zinc and carbon
 - c. Lead peroxide and lead
 - d. Iron and cadmium
-

46. Atomic theory of matter was given by(+2, -0.25)

- a. Avogadro
 - b. Dalton
 - c. Newton
 - d. Pascal
-

47. Consider the following statements,(+2, -0.25)

- I. Atom consists of nucleus and shell.

II. Nucleus consists of protons and electrons.

III. Neutrons are present in atoms.

Which of the above statement(s) is/are correct?

- a. I and II
 - b. I and III
 - c. Only II
 - d. I, II and III
-

48. Which of the following theory said that bond is formed between two atoms either by sharing or transfer of valence electrons? (+2, -0.25)

- a. Valence shell electron pair repulsion.
 - b. Molecular orbital theory
 - c. Valence bond theory
 - d. Electronic theory of chemical bonding
-

49. Which one among the following statements about an atom is not correct? (+2, -0.25)

- a. Atoms always combine to form molecules.
- b. Atoms are the basic units from which molecules and ions are formed.
- c. Atoms are always neutral in nature.

- d. Atoms aggregate in large numbers to form the matter that we can see, feel and touch.

50. In deep-sea diving, divers use a mixture of gases consisting of oxygen and (+2, -0.25)

- a. Hydrogen
- b. Nitrogen
- c. Argon
- d. Helium

51. CO_2 when passed in excess, in lime water turns colourless again because of: (+2, -0.25)

- a. Calcium Carbonate
- b. Calcium Bicarbonate
- c. Calcium Chloride
- d. Copper Carbonate

52. Arrange the following elements in the increasing order of their metallic property (+2, -0.25)

Li, Na, K, Rb, Cs

- a. Na, Li, Rb, K, Cs
- b. Cs, Rb, K, Na, Li
- c. Li, Na, K, Rb, Cs

d. Li, Na, K, Cs, Rb

53. The most electronegative elements among the following is (+2, -0.25)

- a. sodium
- b. chlorine
- c. oxygen
- d. fluorine

54. Highly reactive metals are found in combined state in nature. The natural substances containing metal in combined form are known as minerals. A mineral is called ore if (+2, -0.25)

- a. the metal present in the mineral is costly
- b. a metal can be extracted from it
- c. a metal can be profitably extracted from it
- d. a metal cannot be extracted from it

55. Consider the following statements, (+2, -0.25)

- I. In Mendeleef's Periodic Table, position of the isotopes was not fixed.
- II. In the 19th Century, Mendeleef propounded periodic law is based on atomic mass.

Which of the above statement(s) is/are correct?

- a. Only I

- b. Only II
 - c. Both a and b
 - d. Either of them
-

56. When a spoon is to be electroplated with nickel the spoon is (+2, -0.25)

- a. Dipped in a nickel sulphate solution
 - b. made anode and a pure nickel rod, the cathode
 - c. made cathode and a pure nickel rod, the anode
 - d. coated with nickel sulphate and dried
-

57. Alcohol obtained in the saponification process is (+2, -0.25)

- a. Ethyl alcohol
 - b. Methyl alcohol
 - c. Wood spirit
 - d. Glycerol
-

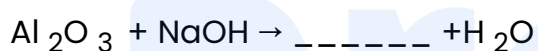
58. Which one among the following statements is correct? (+2, -0.25)

- a. All bases are alkalis
- b. None of the bases is alkali
- c. There are no more bases except the alkalis
- d. All alkalis are bases but all bases are not alkalis

59. The pH of fresh ground water slightly decreases upon exposure to air because (+2, -0.25)

- a. carbon dioxide from air is dissolved in the water
- b. oxygen from air is dissolved in the water
- c. the dissolved carbon dioxide of the ground water escapes into air
- d. the dissolved oxygen of the ground water escapes into air

60. Complete the following chemical reaction: (+2, -0.25)



- a. $\text{Al}(\text{OH})_3$
- b. Na_2O
- c. NaAlO_2
- d. AlNaO_2

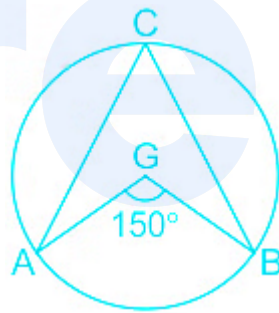
Mathematics

61. The parallel sides of a trapezium are 20 cm and 10cm and its non-parallel sides are equal to each other. If its area is 180cm^2 , then what is the length (in cm) of each non-parallel side? (+2, -0.25)
- 12
 - 13
 - 11
 - 15
-
62. What is the area of a rhombus (in cm^2) whose side is 10 cm and the smaller diagonal is 12cm? (+2, -0.25)
- 120
 - 192
 - 96
 - 50
-
63. The area of a triangle is 15 sq cm and the radius of its incircle is 3 cm. Its perimeter is equal to? (+2, -0.25)
- 12 cm
 - 20 cm
 - 5 cm
 - 10 cm

64. If one of the zeros of the quadratic Polynomial $(k - 1)x^2 + kx + 1$ is -3 , then the value of k is: (+2, -0.25)

- a. $-\frac{2}{3}$
- b. $\frac{4}{3}$
- c. $-\frac{4}{3}$
- d. $\frac{2}{3}$

65. In the figure, 'G' is the centre of the circle. Find the angle ACB when $\angle AGB = 150^\circ$ (+2, -0.25)



- a. 75°
- b. 60°
- c. 65°
- d. 50°

66. The number 2143251 is divisible by (+2, -0.25)

- a. 13
- b. 17

c. 3

d. 7

67. The average of the first 43 natural numbers is

(+2, -0.25)

a. 33

b. 44

c. 43

d. 22

68. If $\sin \theta = \frac{\sqrt{3}}{2}$, and θ is an acute angle, find the value of $\cos 3\theta$

(+2, -0.25)

a. $\frac{1}{2}$

b. 1

c. -1

d. 0

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69. $\tan(\pi + \theta) = ?$

(+2, -0.25)

a. $\sec \theta$

b. $\operatorname{cosec} \theta$

c. $\cot \theta$

d. $\tan \theta$

70. A wire is bent to form a square of area 169 cm^2 . If the same wire is bent to form a circle, then what is its area(in cm^2)? (to the nearest whole number) (+2, -0.25)
- a. 215
 - b. 227
 - c. 532
 - d. 531

71. The table below gives the numbers of students from five different colleges who participated in olympiads of five different subjects during a given year. (+2, -0.25)

Subjects	College A	College B	College C	College D	College E
Hindi	110	100	125	103	112
English	98	120	80	122	105
Maths	130	110	250	160	180
Science	100	100	150	200	80
GK	182	200	120	130	183

Find the difference between 'the range of the numbers of participants in the different olympiads from college C' and 'the average number of participants in all olympiads from college E' during the given year.

- a. 38
- b. 13
- c. 37
- d. 36

72. Solve the inequality: $\left| \frac{2}{x-4} \right| > 1, x \neq 4$ (+2, -0.25)

- a. $x \in (4, 6)$
- b. $x \in 4$
- c. $x \in (-6, 2)$
- d. $x \in 0$

73. $\int_2^3 \frac{1}{x} dx =$ (+2, -0.25)

- a. $\log \left| \frac{3}{2} \right|$
- b. 0
- c. $\log \left| \frac{2}{3} \right|$
- d. None of these

74. $\int_1^2 x^2 dx$ (+2, -0.25)

a. $\frac{3}{7}$

b. $\frac{5}{6}$

c. $\frac{7}{3}$

d. $\frac{6}{5}$

75. The total number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ after (+2, -0.25) simplification is

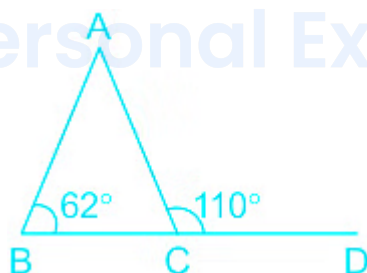
a. 202

b. 51

c. 50

d. None of these

76. In the given figure, the measure of $\angle BAC$ is: (+2, -0.25)



a. 56°

b. 62°

c. 48°

d. 58°

77. $3x + 5y = 14$ and $xy = 6$, then what is the value of $9x^2 + 25y^2 = ?$ (+2, -0.25)

- a. 182
- b. 20
- c. 14
- d. 16

78. What is solution of the differential equation $(dy - dx) + \cos x (dy + dx) = 0$? (+2, -0.25)

- a. $y = \tan\left(\frac{x}{2}\right) - x + c$
- b. $y = \frac{1}{2} \tan\left(\frac{x}{2}\right) - x + c$
- c. $y = 2 \tan\left(\frac{x}{2}\right) - x + c$
- d. $y = \tan\left(\frac{x}{2}\right) - 2x + c$

79. If $5x + \frac{1}{3x} = 4$, then what is the value of $9x^2 + \frac{1}{25x^2}$? (+2, -0.25)

- a. $\frac{174}{125}$
- b. $\frac{144}{125}$
- c. $\frac{114}{25}$
- d. $\frac{119}{25}$

80. The solution of the differential equation $dy = (1 + y^2)dx$ (+2, -0.25)

- a. $y = \tan + c$

b. $y = \tan(x + c)$

c. $\tan^{-1}(y + c) = x$

d. $\tan^{-1}(y + c) = 2x$

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English & GK

81. Commercial vehicles are not produced by which of the following companies in India? (+2, -0.25)

- a. TELCO
- b. Ashok Leyland
- c. DCM Daewoo
- d. Birla Yamaha

82. When was the Reserve Bank of India nationalised? (+2, -0.25)

- a. 1947
- b. 1949
- c. 1950
- d. 1951

83. The blood vessels with the smallest diameter are called _____. (+2, -0.25)

- a. Capillaries
- b. Arterioles
- c. Venules
- d. Lymphatics

84. Who composed the song "Zara Yaad Karo Kurban" ? (+2, -0.25)

- a. Javed Akhtar
 - b. Pradeep
 - c. Nusrat Fateh Ali Khan
 - d. Raghupati Sahay 'Firaq'
-

85. Who among the following Indian nationals got the 'Legion of Merit' Award 2020 from the US? (+2, -0.25)

- a. Dr Manmohan Singh
 - b. Narendra Modi
 - c. Dr K Sivan
 - d. General Bipin Rawat
-

86. In which of the following years did Telangana become the 29th State of India after the reorganisation of the State of Andhra Pradesh? (+2, -0.25)

- a. 2014
 - b. 2015
 - c. 2013
 - d. 2012
-

87. The High Court comes under: (+2, -0.25)

- a. State List
- b. Union List

- c. Concurrent List
 - d. None of the above
-

88. _____ is not soluble in water. (+2, -0.25)

- a. Vitamin A
 - b. Vitamin B
 - c. Vitamin C
 - d. None of the above
-

89. Dyarchy means: (+2, -0.25)

- a. double government
 - b. a government in which the centre is very powerful.
 - c. a government based on division of power between centre and provinces.
 - d. None of the above
-

90. Which country is called the 'sugar bowl' of the world? (+2, -0.25)

- a. Cuba
 - b. India
 - c. Argentina
 - d. U.S.A
-

91. Direction:- Select the option you consider most appropriate for the blank space. (+2, -0.25)

When calamity _____ the family, he faced it boldly.

- a. fell
- b. fall
- c. befell
- d. falled

92. Direction:- Select the option you consider most appropriate for the blank space. (+2, -0.25)

_____ are tiny, wingless, parasitic insects that feed on human blood.

- a. Vice
- b. Rice
- c. House
- d. Lice

93. Direction:- Select the option you consider most appropriate for the blank space. (+2, -0.25)

I really like watching old movies. _____ are some of the best things on TV.

- a. Those
- b. That

- c. This
- d. These

94. Directions:- Read the following passage carefully and answer the questions given below them. (+2, -0.25)

Mountain is now looked upon as the king of sports But men have lived amongst the mountains since prehistoric times and in some parts of the world, as in the Andes and Himalayas, difficult mountain journeys have inevitably been part of their everyday life.

However, some of the peaks there, were easily accessible from most of the cities of Europe. It is quite interesting that while modern mountaineers prefer difficult routes for the greater enjoyment of sport, the early climbers looked for the easiest ones, for the summit was the prize they all set their eyes on.

Mountaineering is different from other sports because.

- a. it is risky and dangerous.
- b. it can be fatal.
- c. it is most thrilling and exciting, there is no competition between individuals.
- d. There is competition between individuals

95. Directions:- Read the following passage carefully and answer the questions given below them. (+2, -0.25)

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People living in the Andes and the Himalayas made mountain journeys because.

- a. it was a kind of sport
- b. they had to undertake them in their day to day life.
- c. they lived in pre-historic time
- d. of the challenge offered by the difficult journey.

96. From the following find which tense is this.

(+2, -0.25)

"It was still raining when I reached there."

- a. Past Continuous Tense
- b. Past Perfect Tense
- c. Present Continous Tense
- d. Present Perfect Tense

97. Below sentence is given in active/passive voice. From the given alternatives, select one which best expresses the same sentence in passive / active voice.

(+2, -0.25)

"They will laugh at you."

- a. You can be laughed at by them
 - b. You may be laughed at by them.
 - c. You will be laughed at by them
 - d. You will have been laughed at by them.
-

98. Choose the alternative that best expresses the meaning of the expression. (+2, -0.25)

"Make no bones about"

- a. to make no effort
 - b. to admit something readily.
 - c. to make fuss about
 - d. to create no hindrance
-

99. Out of the given four alternatives, Select the one which best expresses the meaning of the given word: (+2, -0.25)

Proximal

- a. Frontier
 - b. obscure
 - c. Remote
 - d. Adjacent
-

100. Select the one, which best expresses the same sentence in Indirect / Direct speech. (+2, -0.25)

Teacher said to children, "Have you prepared well for the finals?"

- a. Teacher asked the children whether they have prepared well for the finals.
- b. Teacher asked the children whether they have been preparing well for the finals.
- c. Teacher asked the children if they did prepare well for the finals.
- d. Teacher asked the children if they had prepared well for the finals.

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Answers

1. Answer: a

Explanation:

Concept:

- The time period of the simple pendulum is given by, $T = 2\pi\sqrt{\frac{l}{g}}$, Where, l = length of the string, T = time period, g = acceleration due to gravity.
- The acceleration on the moon is **one-sixth of the acceleration due to gravity on the earth**.
- The time period of the pendulum is **inversely proportional** to the acceleration due to gravity, $T \propto \frac{1}{\sqrt{g}}$

Explanation:

The time period of the pendulum is given by, $T = 2\pi\sqrt{\frac{l}{g}}$

From the above expression, the time period of the pendulum is inversely proportional to the acceleration due to gravity,

$$T \propto \frac{1}{\sqrt{g}}$$

We know that the acceleration on the moon's surface is one-sixth of the acceleration due to gravity on the earth.

$$g' = \frac{g}{6}$$

So, when the pendulum is taken on the moon the value of g will decrease. Hence, the pendulum takes more time to complete one vibration. **It will become slow.**

2. Answer: c

Explanation:

Concept:

- Bats detect obstacles in their flying path by a process called echolocation.
- **Echolocation** : It is a Physiological process for locating distant objects or obstacles by sound waves reflected back to the emitter.
- The bats emit **Ultrasonic waves** in the echolocation process.
- **The frequency range of the Ultrasonic wave is 20 kHz to 200 kHz.**

Explanation:

- Bats detect obstacles in their flying path by a process called echolocation.
- In this process, a bat emits ultrasonic waves of frequency range 20 kHz to 200 kHz.
- If there are any obstacles in their path, these waves strike and bounce back, sending them back to the bat.
- Then, the bat process this information to determine the size of the object and how far it is.

3. Answer: a

Explanation:

Concept:

- During the day the sun heats up the earth's surface, warming the air close to the ground.
- **Sound travels faster in warmer air.** So the sound travels faster in the air close to the ground.
- The **reverse happens at night.**
- The speed of the sound in air is given by, $v = \sqrt{\frac{\gamma RT}{M}}$ where M = molecular mass of the air, R = Universal gas constant, T = temperature, γ = adiabatic index
- In terms of density, speed, $v = \sqrt{\frac{\beta}{\rho}}$, where β = bulk modulus, ρ = density

Explanation:

The speed of the sound in air is given by, $v = \sqrt{\frac{\gamma RT}{M}}$

In terms of density and bulk modulus, $v = \sqrt{\frac{\beta}{\rho}}$

From the above expression, the speed of the sound is depended on the following factors,

- The temperature
- density: The composition of the air and the humidity(moisture) change the density
- The speed is almost independent of the atmospheric pressure.

4. Answer: b

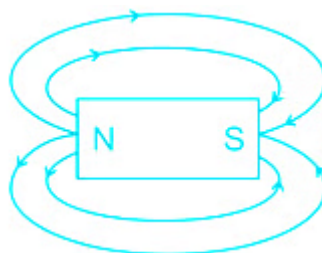
Explanation:

Concept:

- All **mechanical waves** that occur in nature are called Sound waves.
- The sound wave cannot travel in a vacuum.
- **The SI unit of the sound is Decibel**
- The speed of the sound in air is, $v = \sqrt{\frac{\gamma RT}{M}}$ where, M = molecular mass of the air, R = Universal gas constant, T = temperature
- Intensity formula, $I(dB) = 10 \log_{10}(\frac{I}{I_0})$
- The Decibel is used to measure the intensity of sound.

★ Additional Information

- **Magnetic field**
 - A magnetic field is **a vector field that describes the magnetic influence on moving electric charges, electric currents, and magnetic materials.**



- The SI unit of the magnetic field is Tesla, denoted by the capital T.
- **Light**
 - Light is a form of energy that makes us see.
 - The intensity of the light can be measured with the help of a photometer.
 - The speed of light in the air is 3×10^8 m/s
- **Heat**
 - Heat is a form of energy that produces the sensation of warmth.
 - Its SI unit is Joule,
 - The heat flows from a higher-temperature body to lower temperature body.

5. Answer: c

Explanation:

Concept:

- capacitor, a **device for storing electrical energy, consisting of two conductors in close proximity and insulated from each other.**
- It is used to **store the energy in presence of an electric field .**
- It is a device used to store an **electric charge** between two plates.
- It consists of **one or more pairs of conductors** separated by an insulator.
- The **SI unit of capacitance is Farads (F).**

Explanation:

A capacitor is used in our TV set, computer, and radio set for storing the electric charge.

Hence, the correct option is 3.

★ Additional Information

- **Inductor**
 - A component in an electric circuit that possesses an inductance.
 - A two-terminal passive component, store energy in a magnetic field.

- **Resistor**
 - A device having resistance to the passage of electric current.
 - The SI unit of resistance is the ohm.
- **Conductor**
 - A material that conducts heat and electricity through it is called a conductor.
 - For example, Silver, aluminum,

6. Answer: a

Explanation:

Concept:

- **Electric charge:** It is an intrinsic property of the elementary particle of matter which gives rise to electric force between various objects .
- It is a **scalar quantity**.
- The **total charge on the conductor** is given by, $q = It$, when an electric current is flowing in the conductor for some time.
- Here, I = Electric current, t = time
- The **SI unit of electric charge is Coulomb** denoted by C.

Explanation:

- When a soap bubble is charged, an electric charge particle will be distributed over the surface of the soap bubbles.
- It expands to decrease the surface tension or minimize the surface tension.
- The soap bubble is expanded means an increase in size, so its radius also increases.

7. Answer: c

Explanation:

Concept:

Capacitance

- Capacitance is a property of the electric conductor **measured by the amount of separated electric charge that can be stored on it per unit change in electrical potential** .
- In capacitor, **amount of charge** , $Q = CV$, where, C = Capacitance, V = electrical potential
- A capacitance in an electric circuit is introduced by a device called a **capacitor** .
- The SI unit of the capacitance is Farad and is denoted by the F.

Explanation:

The SI unit of capacitance is Farad denoted by F.

★ Additional Information

- **Resistance**
 - Resistance in an electric circuit is introduced by a device called a **resistor** .
 - Formula, $V = IR$, where I = electric current flowing in the circuit, V = supplied voltage, R = Resistance
 - The SI unit of resistance is Ohm denoted by Ω .
- **Conductance**
 - **The reciprocal of the resistance** In a conductor is called conductance.
 - Relation, $Conductance = \frac{1}{Resistance}$
 - The SI unit of conductance is Ohm $^{-1}$.
- **Inductance**
 - The inductance in an electric circuit is introduced by a device called an **inductor** .
 - The SI unit of the inductance is Henry denoted by H.

8. Answer: d

Explanation:

Concept:

- **Gravitational Force:**
 - It is the force responsible for holding planets in their orbits and this is possible only because of their infinitely long range.
 - It is the weakest force.
 - It is also the **attractive force that arises from the gravitational interaction.**
- **Coulomb Force:**
 - An electrostatic force is also known as the **Coulombic force.**
 - It is **the force of attraction between two opposing charges, i.e., protons and electrons.**

Explanation:

- The dominating force in the universe is the gravitational force, not a coulomb force because the gravitational force is applied on the macroscopic level, between stars or planets.
- **The gravitational force is weaker than the coulomb force.**

Hence, the assertion and reason both are incorrect.

★ Additional Information

- **Nuclear strong force:**
 - The nuclear force is **a force that acts between the protons and neutrons of atoms.**
 - This force can exist **between protons and protons, neutrons and protons, or neutrons and neutrons.**
 - The nuclear force is the force that **binds the protons and neutrons in a nucleus together .**
 - This force is what holds the nucleus together.
- **Weak force:**
 - **The weak** force is the force existing between the elementary particles which are responsible for certain processes to take place at a low probability.
 - The Weak nuclear force is **responsible for the change in quark into other forms.**

9. Answer: c

Explanation:

Concept:

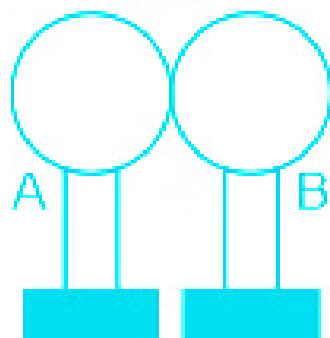
- A comb moving through dry hair gets electrically charged through **induction** .
- Induction charging is **a charging method that charges an object without actually touching the object to any other charged object.**
- The charging by induction process is where the charged particle is held near an uncharged conductive material that is grounded on a neutrally charged material.

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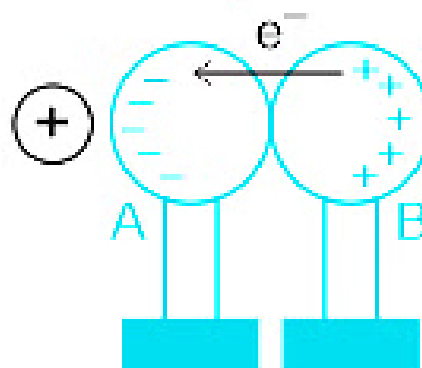
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Diagram i.



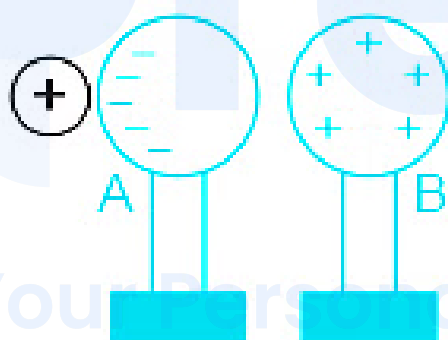
Two metal spheres are mounted on insulating stands.

Diagram ii.



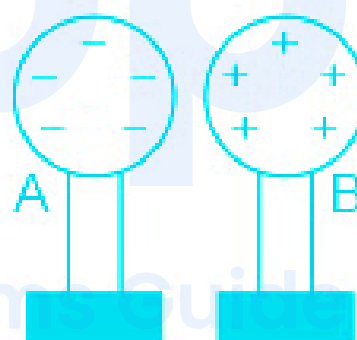
The presence of a + charge induces e^- to move from spheres B to A. The two-sphere system is polarized.

Diagram iii.



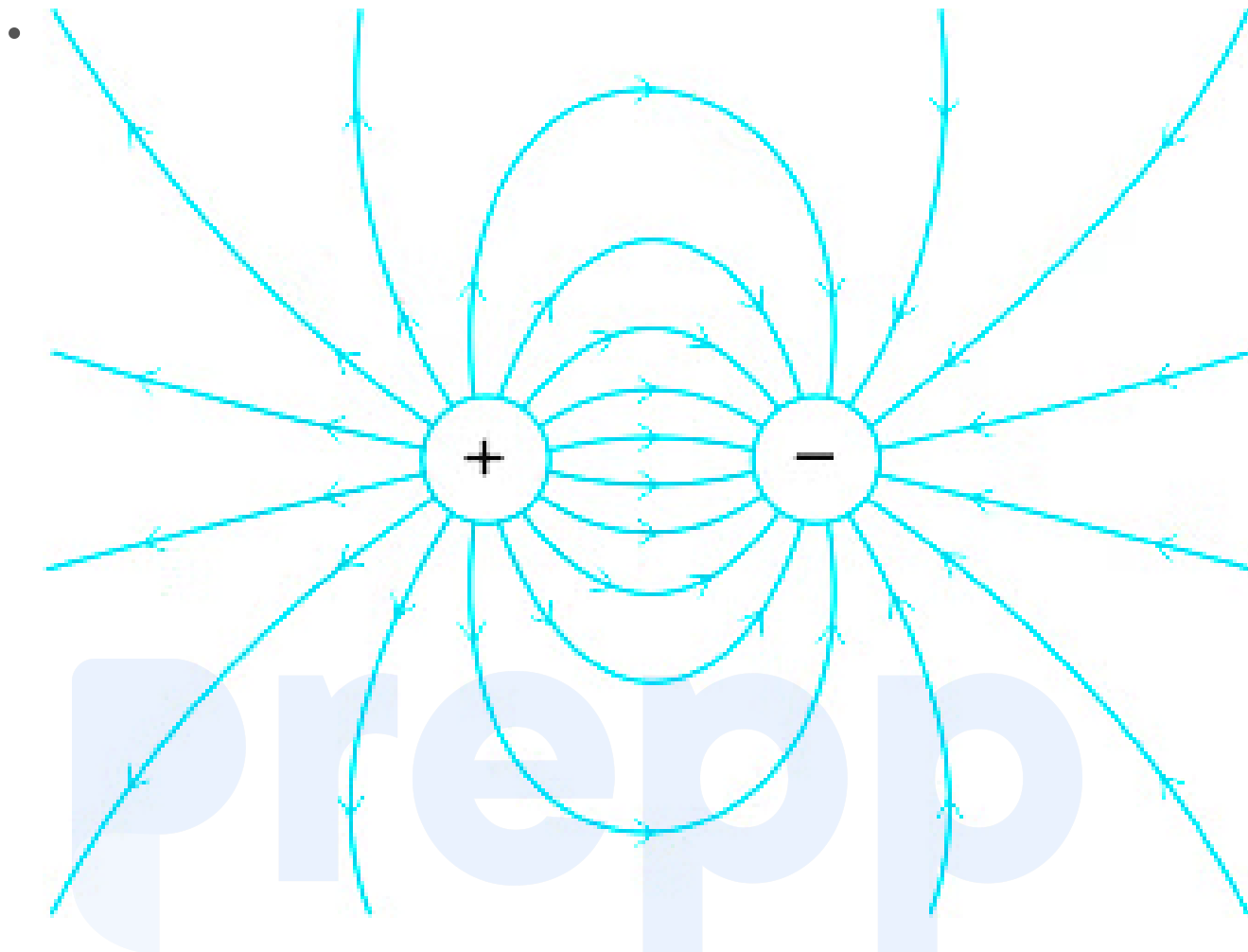
Sphere B is separated from sphere A using the insulating stand. The two spheres have opposite charges.

Diagram iv.

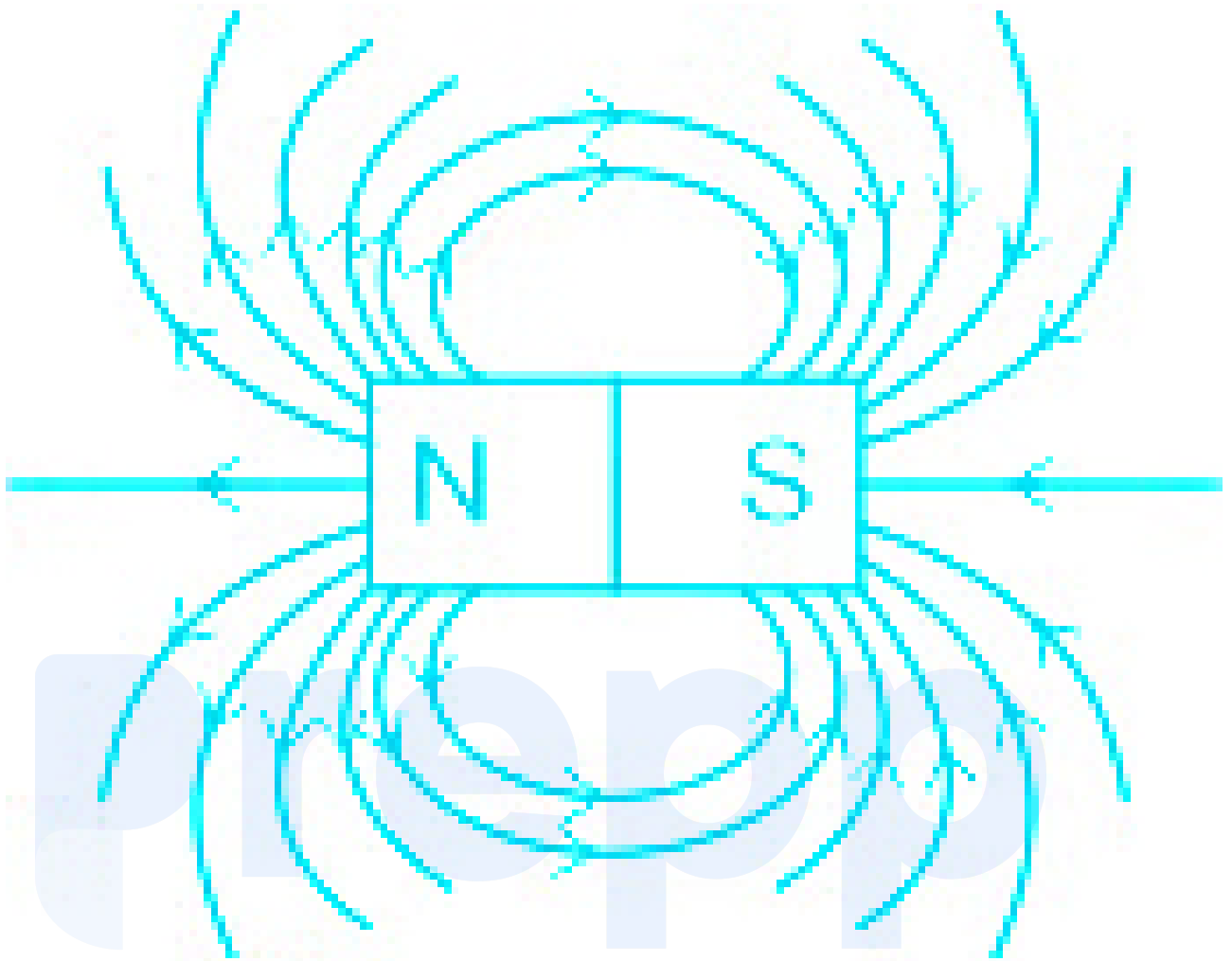


The excess charge distributes itself uniformly over the surface of the spheres

Charging by Induction



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Explanation:

- When a comb is moved through dry air, charge transfer takes place between the comb and hair and so the comb becomes electrically charged.
- Electric field lines of force always originate at the positive charge and terminate at the negative charge.
- So, they do not form a closed loop.
- Whereas the magnetic field lines of force always form a closed loop.

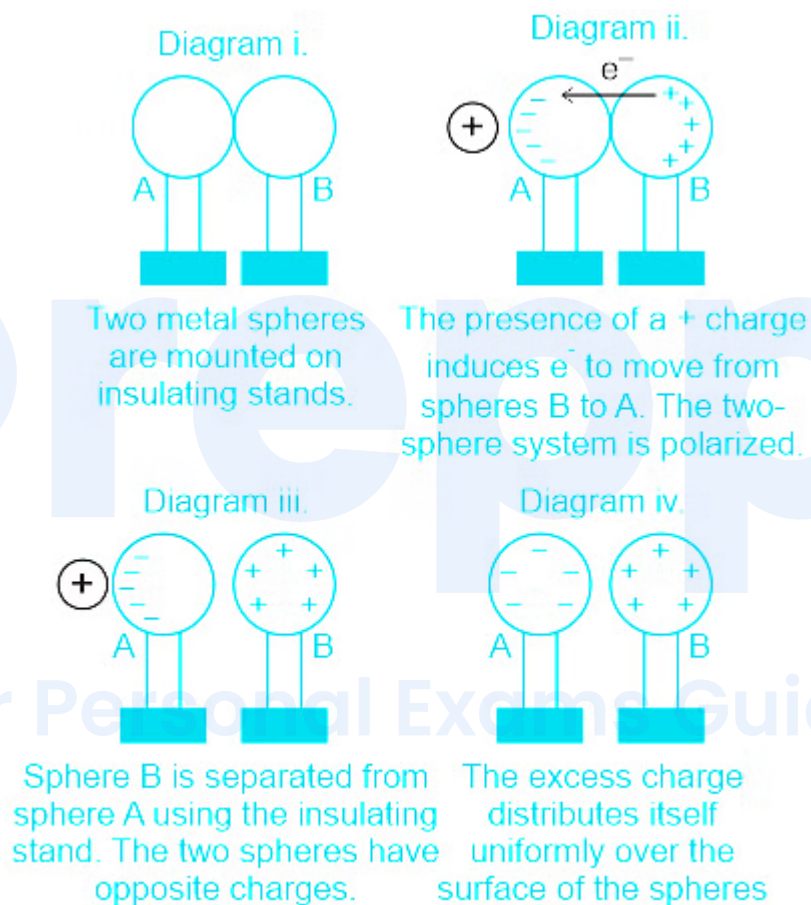
Hence, both statements are correct.

10. Answer: b

Explanation:

Concept:

- Conducting sphere can be electrically charged through induction .
- Induction charging is a charging method that charges an object without actually touching the object to any other charged object .
- The charging by induction process is where the charged particle is held near an uncharged conductive material that is grounded on a neutrally charged material.



Charging by Induction

- **Charge:**
 - It is the **property of matter that is responsible for the electrical phenomenon.**
 - Two- types: **Positive charge and negative charge.**
- **Law of conservation of charge:**
 - The charge can neither be created nor destroyed.
 - It can be only transferred from one system to another system.

Explanation:

- If two conducting spheres are separately charged and then brought in contact.
- Then, **the total charge on the two-sphere is conserved by the law of conservation of charge**.
- But, energy may not conserved because of the different sizes or having different charges then some of the energy might losses in the **distribution of the charge**.
- In the case of final potential, the final potential is not always the mean of the original potential of the two spheres because of the distribution of the charge and some losses occur but, the final potential of both spheres is equal.

11. Answer: d

Explanation:

Concept:

Work:

- Work is the product of the component of the force in the direction of the displacement and the magnitude of this displacement.
- Formula, $W = F \times d$, where F = component of force, d = magnitude of the displacement, W = work done
- The **SI unit of the work** is Joule or N-m.
- The **dimensional formula** of the work, $[W] = [M^1 L^2 T^{-2}]$.

Energy:

- It is defined as **the ability to do work**.
- The **SI unit of the energy** is Joule.
- The **dimensional formula** of the energy, $[E] = [M^1 L^2 T^{-2}]$.

Explanation:

The dimensional formula of the energy and work is the same.

$$[W] = [E] = [M^1 L^2 T^{-2}].$$

★ Additional Information

Power:

- Power is the **amount of energy transferred or converted per unit of time**.
- Formula, $P = \frac{E}{t}$, where P = power, E = energy transferred, t = time.
- The **SI unit of the power** is Joule/s.
- The **dimensional formula** of the power, $[W] = [M^1 L^2 T^{-3}]$.

Force:

- Force is defined as **the product of mass and acceleration**.
- It is a **vector quantity because it has both magnitude and direction**.
- Formula, $F = ma$, where, F = force, m = mass, a = acceleration
- The **SI unit of force** is N or $kg\ ms^{-2}$.
- The **dimensional formula** of the force, $[F] = [M^1 L^1 T^{-2}]$

Momentum:

- Momentum is defined **as the product of the mass and velocity of an object**.
- It is a **vector quantity because it has both magnitude and direction**.
- Formula, $P = mv$, where m = mass of the object, v = velocity, P = momentum
- The **SI unit of momentum** is $kg\ ms^{-1}$.
- The **dimensional formula** of the momentum is $[P] = [M^1 L^1 T^{-1}]$.

12. Answer: a

Explanation:

Concept:

- **Acceleration:** It is defined as the **rate of change of velocity** with respect to time.
- It is a **vector quantity because it has both magnitude and direction**.
- The **SI unit** of acceleration is ms^{-2} .

Explanation:

- A passenger in a moving train tosses a five rupees coin.
- The coin has the same velocity as the velocity of the train, but during the time, the coin is in the air, the train keeps moving forward and the coin falls behind the passenger.
- Hence, the train must be moving with uniform acceleration.

★ Additional Information

Deceleration:

- When the **velocity of the body decreases with time**, then the **acceleration becomes negative**.
- The **negative acceleration** is also known as **deceleration or retardation**.

Velocity:

- It is defined as the **rate of change of displacement** with respect to time.
- It is a **vector quantity** because it has both magnitude and direction.
- The **SI unit velocity** is ms^{-1} .

Speed:

- It is defined as the **rate of change of distance** with respect to time.
- It is a **scalar quantity** because it has only magnitude but not direction.
- The SI unit velocity is ms^{-1} .

13. Answer: b

Explanation:

Concept:

Newton's First Law of motion

- This law implies that things cannot start, stop, or change direction all by themselves, it requires some **external force**.

- It states that a body that is at rest or uniform motion will continue to be at rest or uniform motion until or unless a net external force is applied to it.
- It is also known as **the law of inertia**.

★ Additional Information

Newton's second law of motion

- It describes what happened to **the massive body when acted upon by an external force**.
- This law states that **the net external force acting on the object is equal to the product of mass and acceleration**.
- Formula, $F = ma$, where, m = mass, a = acceleration

Newton's third law of motion

- It describes **what happened to the body when it exerts a force on another body**.
- This law states that **there is an equal and opposite reaction for every action**.

14. Answer: b

Explanation:

Concept:

Potential energy

- It is the energy possessed **due to the position** of the object is called potential energy
- The **potential energy due to gravitation**, $P.E = mgh$, where m = mass, g = acceleration due to gravity, h = height
- **Potential energy due to spring**, $P.E = \frac{1}{2}kx^2$, where k = spring constant, x = displacement
- In the case of spring, **the potential energy increases when a spring is stretched or squeezed**.

Explanation:

- In the case of the spring, the **potential energy increases** when a spring is stretched or squeezed.
- **Work is done against the gravitational force of attraction** when moving a body against gravity. It indicated that the **potential energy of the system has increased**.
- When the bubble rises in the direction of the upthrust force, the **potential energy of the system gets vanished**.

Hence, the correct option is 2.

★ Additional Information

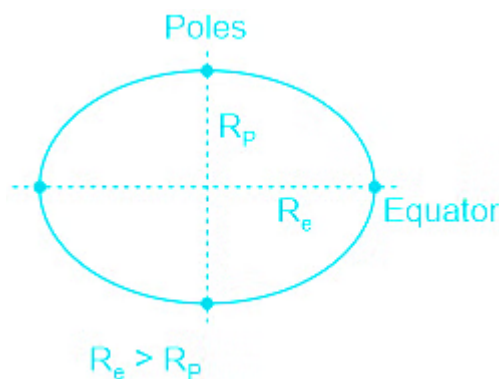
- **Kinetic energy**
 - The energy possessed **due to the motion** of an object is called kinetic energy.
 - Formula, $K.E = \frac{1}{2}mv^2$, where m = mass, v = v velocity

15. Answer: d

Explanation:

Concept:

- The **acceleration due to gravity on the earth's surface**, $g = \frac{GM}{R^2}$ where, G = universal gravitational constant, M = mass of the earth, and R = radius of the earth.
- We know that $R_e > R_p$, where R_e = radius of the earth on the equator side, R_p = radius of the earth on the pole side.



- The acceleration due to gravity is **inversely proportional to the square of the radius of the earth**.
- Relation, $g \propto \frac{1}{R^2}$
- In case of **rotation** . $g' = g(1 - R\omega^2 \cos^2 \phi)$, where, R = radius of the earth, ω = angular velocity of the earth.
- g is decreasing at the earth's surface than at a height above or at a depth below it.

Explanation:

- The acceleration due to gravity is not the same at all places on the surface of the earth due to the elliptical size of the earth.
- **The acceleration due to gravity at the equator is less than that of a pole.**
- At the equator, $\theta = 0^\circ$ the value of g is minimum.
- **At the pole, $\theta = 90^\circ$, the value of g is maximum.**
- g decreases at the earth's surface than at a height above or at a depth below it.

16. Answer: c

Explanation:

Concept:

Young's modulus of elasticity

- It is defined as the **ratio of normal stress to the longitudinal strain within the elastic limit.**
- $Y = \frac{\sigma}{\epsilon}$
- It represents **the longitudinal elasticity.**
- Formula, $Y = \frac{F/A}{\Delta l/l}$ where, F = force, A = area, Δl = change in length, l = original length

The bulk modulus of elasticity

- It is defined as **the ratio of normal stress to the volumetric strain, within the elastic limit.**
- It represents **the volumetric elasticity .**
- Formula, $K = -\frac{P}{\Delta V/V}$ where, P = pressure, ΔV = change in volume, V = volume

Explanation:

- Young's modulus of elasticity is defined as the ratio of normal stress to the longitudinal strain within the elastic limit.
- The bulk modulus of elasticity is defined as the ratio of normal stress to the volumetric strain, within the elastic limit.

Hence, both given statement is correct.

★ Additional Information

- **Shear modulus of elasticity**
 - It is defined as the ratio of **shear stress to shear strain .**
 - Shear modulus, also known as **Modulus of rigidity.**

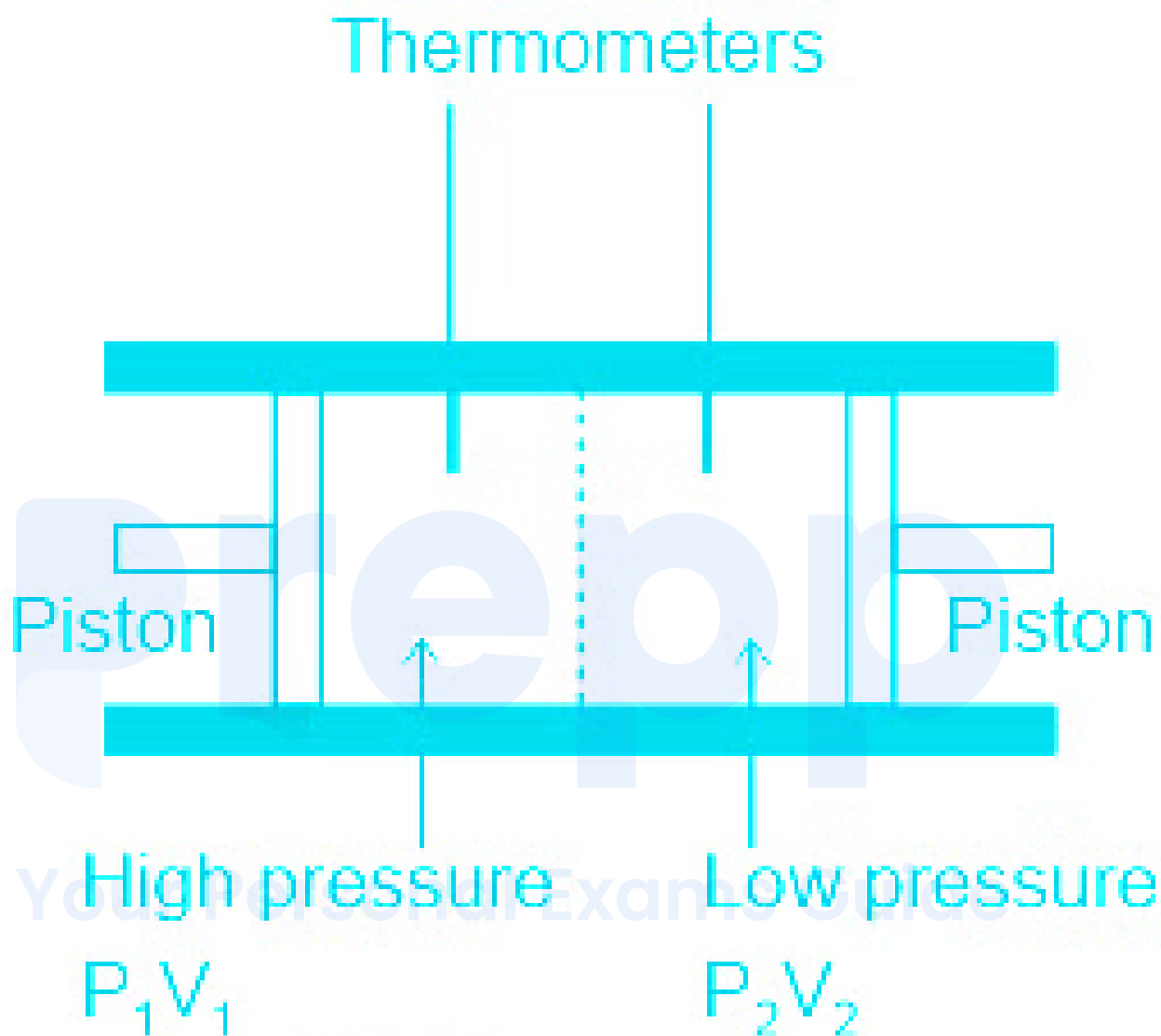
17. Answer: b

Explanation:

Concept:

Joule-Thomson effect:

- The Joule-Thomson effect also known as Kelvin–Joule effect or Joule–Kelvin effect is the change in fluid's temperature as it flows from a higher pressure region to lower pressure.



Joule-Thomson Effect

- The basic principle of the **Joule-Thomson effect** is based on the transfer of **heat**.
- The cooling produced in the Joule-Thomson expansion has made it a very valuable tool in **refrigeration**.

Explanation:

- When a puncture happens, the air flows from the high-pressure region inside to the low-pressure region outside.
- As air gains kinetic energy, it gains this energy from the internal heat of the air.
- So it will use the internal energy of the compressed air, so it uses up internal heat and temperature falls.
- This phenomenon is referred to as, the Joule-Thomson effect.

18. Answer: b

Explanation:

Concept:

Specific heat at constant pressure

- If the heat transfer to the sample is done when it is held at constant pressure.
- Then the specific heat obtain using such a method is called **Molar Specific Heat Capacity at Constant Pressure**.
- It is denoted by C_p .

Specific heat at constant volume

- If the heat transfer to the sample is done when the volume of the sample is held constant.
- Then the specific heat obtain using such a method is called **Molar Specific Heat Capacity at Constant Volume**.
- It is denoted by C_v .
- **Work done in thermodynamics** is given by, $W = P\Delta V$
- **At constant pressure, work is done in the expansion of gas .**
- **At constant volume, there is no work done in the gas expansion.** Or simply means, **work done is zero .**

Explanation:

The specific heat of a gas at constant pressure is greater than the specific heat at constant volume because work is done in the expansion of the gas at constant

pressure.

Hence, the correct option is 2.

19. Answer: c

Explanation:

Concept:

- The time period of the pendulum is given by, $T = 2\pi\sqrt{\frac{l}{g}}$ where g = acceleration due to gravity, l = length of the rod.
- The time period of the **pendulum is directly proportional to the square root of the length of the rod.**
- Relation, $T \propto \sqrt{l}$
- The SI unit of time period is second.

Explanation:

The time period of the pendulum is given by, $T = 2\pi\sqrt{\frac{l}{g}}$

From the above expression, the time period of the pendulum is directly proportional to the square root of the length of the rod.

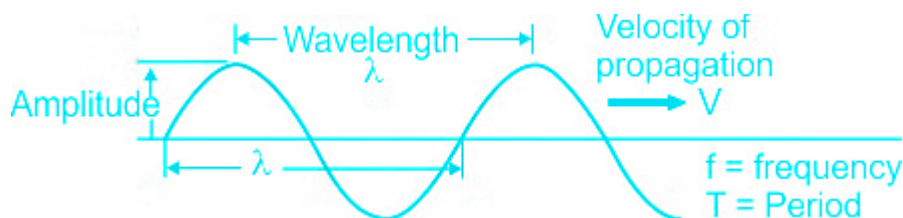
- For speeding up, in a pendulum clock, the time period should be decreased.
 - and it can be achieved by reducing the length of the rod.
 - Hence, the slow-running pendulum clock can be speeded up by reducing the length of the rod.
-

20. Answer: c

Explanation:

Concept:

- The basic properties of the waves are **wavelength, frequency, velocity, and amplitude.**



- Wavelength** is defined as the distance between the crest or troughs of a wave motion.
- Frequency** is defined as the number of oscillations per unit of time.
- The **relation between the frequency, wavelength, and velocity** is given by, $v = f\lambda$ where v = velocity, f = frequency, λ = wavelength
- The velocity of the sound in a solid, $v = \sqrt{\frac{\beta}{\rho}}$ where, β = bulk modulus, ρ = density

Explanation:

- When a sound goes from one medium to another medium, the **wavelength changes but the frequency remains the same** because the frequency of the sound depends on the source of the sound.
- The relation between the frequency, wavelength, and velocity is given by, $v = f\lambda$, where v = velocity, f = frequency, λ = wavelength
- The **velocity of the sound depends on the elasticity and the inertia of the medium**. Hence, the **velocity also changes when** the sound wave goes from one medium to another medium.
- When a particle moves from one medium to another medium, **its amplitude increases or decreases depending on the medium**.

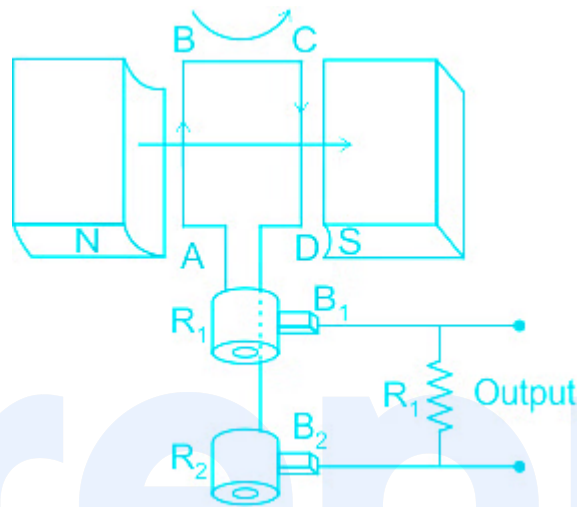
Hence, when a wave goes from one level to another, there is a change in amplitude, velocity, and wavelength, but the frequency of sound remains constant.

21. Answer: b

Explanation:

Concept:

- An electric generator is generated **emf by rotating a coil inside a magnetic field.**
- When a coil is rotated **in a magnetic field, magnetic energy and magnetic flux change through a coil.**



- The magnitude of emf produced in the armature by the electric generator is given as,
- $e = NAB\omega \sin(\omega t)$, where N = number of turns, A = cross-sectional area, B = magnetic field, ω = angular velocity
- The emf is induced in the **coil that produces induced current.**

Calculation:

Given,

The rotational velocity of the dynamo, $\omega' = 2\omega$

The magnitude of emf produced in the armature by the electric generator is given as

$$e = NAB\omega \dots \dots \dots (1)$$

The new emf produced in the armature when the angular velocity is double,

$$e' = NAB(2\omega)$$

$$e' = 2 NAB\omega$$

$$e' = 2e$$

Hence, If the rotational velocity of a dynamo armature is doubled, then the induced emf will become double.

22. Answer: b

Explanation:

Concept:

- Magnetic Resonance Imaging (MRI) is a technique used by medical specialists to generate images of the human body's anatomy.
- Magnetic resonance imaging (MRI) is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body
- An MRI scanner is a large tube that contains powerful magnets. You lie inside the tube during the scan.
- The most biggest and important component of is MRI system is a magnet.

Explanation:

- The MRI is a type of scan that use a **strong magnetic field and radio wave to produce detailed images of the inside of the body.**
- The most powerful **magnet produces a strong magnetic field to expose patients.**
- It forces the proton in the body to align with that field and this **alignment of the proton helps us image the body .**
- MRI uses an external magnet to **generate a magnetic field in our body.**

23. Answer: c

Explanation:

Concept:

- **Electromagnetic Induction** was discovered by Michael Faraday in 1831.
- And **James Clerk Maxwell** mathematically described it as **Faraday's law of induction**.
- Electromagnetic induction is defined as **the process of production of emf or current by changing the magnetic flux with time.**
- Formula, emf, $e = -N \frac{d\phi}{dt}$ where ϕ = magnetic flux, N = number of turns in a coil.
- Magnetic flux is defined as **the number of magnetic field lines passing through a given closed surface.**
- The formula of magnetic flux, $\phi = BA \cos \theta$, where B = magnetic field, A = closed surface, θ = angle between the magnetic field and the closed surface area vector.

Explanation:

- When a magnetic field linked to a coil changes with time, then the magnetic flux also changes.
- Due to the **change in magnetic flux, the emf induced in the coil.**
- When we attach a resistor of resistance in the circuit, then the current flow in the circuit, and that current is called **induced current.**
- The phenomenon of electromagnetic induction implies the production of induced **current in a coil when a magnetic field changes with time.**

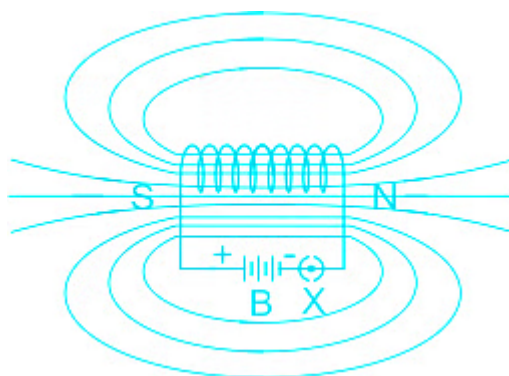
Hence, the correct option is 3.

24. Answer: b

Explanation:

Concept:

- **Electromagnets** are the kind of magnet where the wire is wrapped around an iron core
- A solenoid is a device that **produces a uniform magnetic field inside it.**



- The magnetic field at **any point beyond the solenoid is very thin .**
- The magnetic field **inside the solenoid is parallel to its axis at all times.**
- The magnetic field produced by a solenoid can be defined using the Law of the Ampere, $B = \mu_0 nI$, where, n = number of turns per unit length, I = current flowing

Explanation:

- When a soft iron piece is **introduced inside the solenoid, this iron core is magnetized thereby increasing the magnetic field** inside a solenoid.
- Therefore, a soft iron core inserted inside a solenoid increases the strength of the magnetic field.

Hence, the correct option is 2.

25. Answer: b

Explanation:

Concept:

Alternating current:

- An alternating current is **produced by switching the potential between two terminals in a fixed time interval—the frequency.**

Resistance:

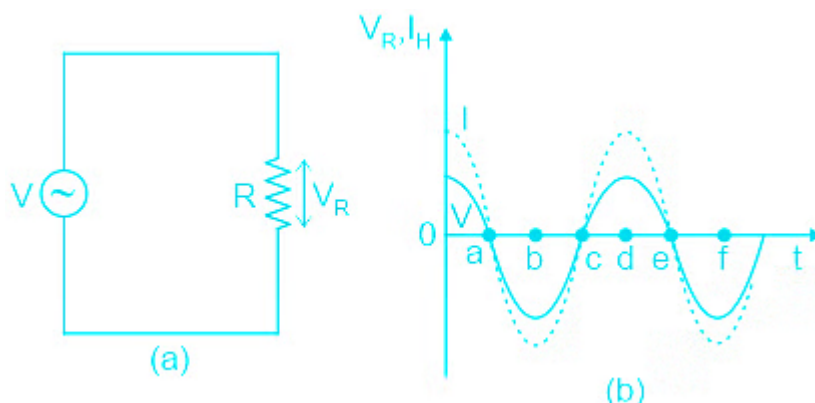
- Resistance is **a measure of the opposition to current flow in an electrical circuit.**
- A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element.
- The SI unit of resistance is Ohm.

Current:

- It is defined **as the charge per unit of time.**
- Its **SI unit is Ampere** and it is denoted by A.

Voltage:

- Voltage is **the pressure from an electrical circuit's power source that pushes charged electrons (current) through a conducting loop, enabling them to do work such as illuminating a light**
- An electromotive force is expressed as a volt.
- **Ohm's law** gives the relation between the current, voltage, and resistance.
- Ohm's law: $V = IR$, where V = voltage, I = current, R = resistance.
- **An alternating source in a resistor :**
 - When a constant voltage source or battery is applied across a resistor current is developed in resistor.



- Applied ac voltage, $V = V_0 \sin \omega t$
- Current flowing in the circuit, $i = \frac{V_0}{R} \sin \omega t$

Explanation:

- The direction of current flowing through the resistor in an AC circuit has no effect on their behavior.
- Therefore, they will rise and falls as the voltage rises and falls.
- At the same time, the current and voltage hit the maximum, decrease through zero, and reach the maximum.
- In a **resistor** , the current and voltage are in the **same phase** .
- In the **inductor** , the **current lags voltage by 90 degrees** .
- Whereas, in a **capacitor** , the **current leads voltage by 90 degrees**.

Hence, the correct option is 2.

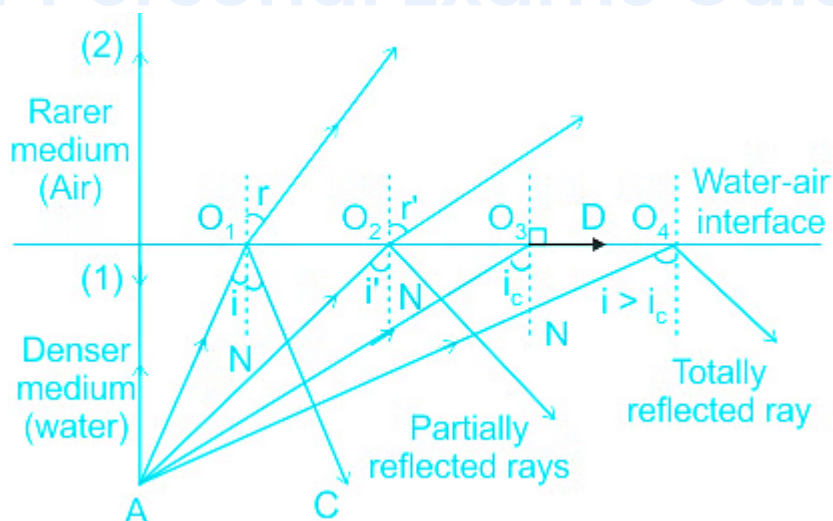
26. Answer: d

Explanation:

Concept:

Total internal reflection of light:

- The phenomenon occurs when the **light** rays travel from a more optically denser medium to a less optical denser medium.



- The two conditions of total internal reflection:

- The light ray moves from a more dense medium to a less dense medium.
- The angle of incidence must be greater than the critical angle.
- The expression for the refractive index in the total internal reflection, $\mu = \frac{1}{\sin C}$, where C = critical angle, μ = refractive index.

Practical application of the total internal reflection:

- The working of optical fiber is based on the total internal reflection of light.
- Mirage is formed due to total internal reflection.
- The brilliance of the diamond.

Explanation:

Fiber optics cable used in communication works on the principle of the total internal reflection of light.

★ Additional Information

- **Reflection of light:**
 - When a ray of light approaches a smooth polished surface and the light ray bounces back.
 - This phenomenon usually **occurs in mirrors**.
 - The light entering the medium **returns to the same medium**.
 - The **angle of incidence of the light is equal to the angle of reflection**.
- **Refraction of light:**
 - Refraction is the process by which light shifts its path as it travels through a material, causing the light to bend.
 - This phenomenon usually **occurs in lenses**.
 - During refraction, the light waves pass through the surface while simultaneously changing both direction and medium.
 - The **angle of incidence is not equal to the angle of refraction**.

27. Answer: d

Explanation:

Concept:

Transmission:

- The transmission of light **occurs when light hits an object that is transparent or translucent and light can penetrate the material to travel all the way through.**
- When light transmission happens, it can be scattered or refracted.
- For example, **sunlight moving through windows glass** or flashlight moving through car windows

Diffraction:

- Diffraction is the **spreading out of waves** as they pass through an aperture or around objects.
- It occurs when the **size of the aperture or obstacle is of the same order of magnitude as the wavelength of the incident wave.**

Refraction:

- Refraction is **the bending of light (it also happens with sound, water and other waves) as it passes from one transparent substance into another.**
- This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms and rainbows.
- Even our eyes depend upon this bending of light..

Explanation:

- The reason CDs reflect rainbow colors is that they have a clear plastic coating on top of a mirrored surface.
- Light refracts when it moves from one medium to another with a different optical density (such as the clear plastic surface of a CD).
- Different wavelengths of light (every color has a different wavelength) travel at different speeds so that full spectrum appears when white light passes from the air through the plastic surface of a CD, separated light rays which are then reflected back to us by the mirrored center surface of a CD .
- Here **diffraction and transmission also take place** because diffraction of light rays occurs when it strikes the surface of CD and **transmission is obvious when light enters from one medium to another.**

- The thickness of the different optical media, angle of source light, and brightness of source light all affect which rainbow patterns are visible on a CD.

Hence, the correct option is 4.

28. Answer: a

Explanation:

Concept:

- When a wave travels from one medium to another medium, **wavelength, and speed amplitude change**.
- But the **frequency remains constant** because it is a property of the source and it only deepened on the source of the wave.
- The speed of light depends on the optical density (refractive index) of the medium.

Refractive index:

- It is defined as the ratio of the speed of light in air to the speed of light in the medium.
- Formula, refractive index, $\mu = \frac{c}{v}$ where, c = speed of light in air, v = speed of light in the medium.
- It is a **dimensionless** physical quantity.
- Whereas, **density is defined as the mass per unit volume**.
- The refractive index of air is 1 and the refractive index of glass is 1.5.

Explanation:

- The speed of light depends on **the optical density (refractive index) of the medium**.
- Light travels faster in a medium with a lower refractive index than in one with a higher refractive index.
- As **glass is optically denser than air**, light travels slower in glass than in air.

- Or the refractive index of air is less than that of glass.

Hence, the correct option is 1.

29. Answer: b

Explanation:

Concept:

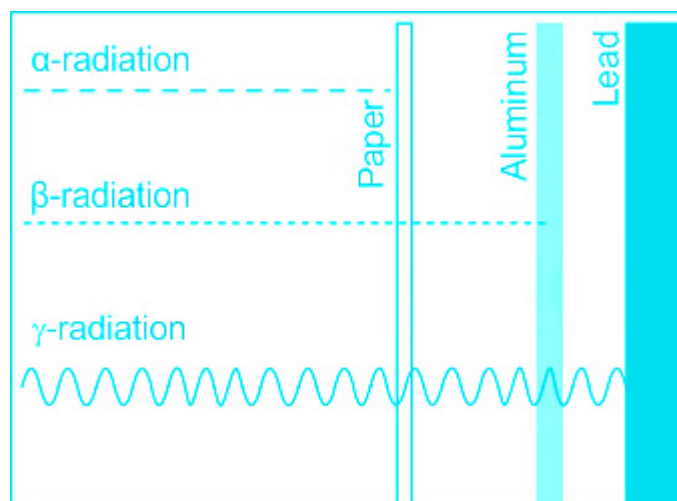
Penetrating power:

- The ability of each type of radiation to pass through matter is expressed in terms of penetration power.
- The more material the radiation can pass through, the greater the penetration power and the more dangerous they are
- Beta particles have a higher penetration power when compared to alpha particles
- The penetrating power of the alpha rays is minimum

Explanation:

The alpha rays are the least penetrating, followed by beta rays, and gamma rays are the most penetrating.

Hence, the correct option is 2.



★ Additional Information

Alpha (α) rays:

- An alpha ray is a stream of alpha particles .
- An alpha particle consists of two protons and two neutrons bound together into a particle identical to a helium nucleus.
- It is a positively charged particle with charge $+2e$.
- It is radioactive and is produced in the process of alpha decay.
- Alpha particles, like helium nuclei , have a net spin of zero. .

Beta (β) rays:

- Beta particles are extremely energetic electrons that are liberated from the inner nucleus.
- They bear negligible mass and carry a negative charge .
- A neutron in the nucleus splits into a proton and an electron on the emission of a beta particle.
- Hence, it is the electron that is emitted by the nucleus at a rapid pace.

Gamma radiation(γ):

- It was first discovered by a French chemist and physicist , Paul Villard, in 1900.
- It was named *gamma ray* by Ernest Rutherford in 1903.
- Gamma radiation or gamma ray is an extremely high-frequency radioactive radiation consisting of high-energy photons.
- Gamma rays are ionizing in nature , which means that they are capable enough of releasing electrons from atoms.
- Detecting gamma rays is not as easy as detecting other ray types, such as x-ray or light .

30. **Answer: c**

Explanation:

Concept:

Atomic explosion:

- A **nuclear explosion** is an explosion that occurs as a result of the rapid release of energy from a high-speed nuclear reaction.
- can cause significant damage and casualties from blasts, heat, and radiation.

Mass:

- A **quantitative measure of inertia**.
- A **fundamental property of all matter**.
- It is the resistance that a body of matter offers to a change in its speed or position upon the application of a force.
- The greater the mass of a body, the smaller the change produced by an applied force.
- Its SI unit is the kilogram (kg).

Energy:

- The **capacity of doing work is called energy**.
- It may exist in **potential, kinetic, thermal, electrical, chemical, nuclear, or other various forms**.
- Its **SI unit** is Joule (J).

Explanation:

- The atomic explosion is carried out via **nuclear reaction** in which there is a net change in mass of the product and reactant and this **change in mass**.
- And gets converted into energy due to which a huge amount of energy in the form of heat is released.

Hence, In an atomic explosion, the release of a large amount of energy is due to the conversion of mass into energy.

★ Additional Information

Heat:

- Heat is **the transfer of kinetic energy from one medium or object to another, or from an energy source to a medium or object**.

- The SI unit of heat is the same as that of energy.

Chemical energy:

- the energy which is stored in the bonds of chemical compounds (molecules and atoms).
- It is released in the chemical reaction and mostly produces heat as a by-product, known as an exothermic reaction

Nuclear energy:

- It is a form of energy released from the nucleus, the core of atoms, made up of protons and neutrons .
- Nuclear energy can be used to create electricity .

31. Answer: a

Explanation:

Concept:

Voltameter:

- A voltameter or coulometer is a scientific instrument used for measuring electric charge (quantity of electricity) through electrolytic action.
- The SI unit of electric charge is the coulomb.

Potential difference:

- It is the difference in the amount of energy that charge carriers have between two points in a circuit.
- It is measured by the voltmeter.
- Its SI unit is Volt.

Explanation:

- A voltmeter is used to measure electrical charge.
- An ammeter is used to measure electrical current.

- The Potentiometer is used to measure emf.
- A Meter bridge is used to measure the electrical resistance.

Hence, the correct option is 1.

★ Additional Information

- Ammeter:
 - It is an electrical instrument used to measure the amount of current in the electric circuit.
- Potentiometer:
 - It is a device used to measure the **emf of the cell**, the potential difference across two terminals, unknown resistance, and internal resistance of the cell.
 - It is also used as **a voltage divider in the circuit** to bring down the voltage to the desired value.
- Meter Bridge:
 - It is an electrical instrument based on the principle of the Wheatstone bridge.
 - It is used to measure unknown electrical resistance.

32. Answer: a

Explanation:

Concept:

Electric power:

- It is **the rate at which electrical energy is transferred by an electric circuit**.
- Formula, Power, $P = VI = I^2R = \frac{V^2}{R}$ where V = voltage, I = current, R = resistance
- The electrical power is **inversely proportional** to the electrical resistance.

Resistance:

- It is **the ratio between the voltage applied to the current flowing through it**.

- The **SI unit** of electrical resistance is ohms.

Explanation:

- All home **appliances are connected in parallel combination, so, the voltage in each bulb is equal.**
- We know that electrical power is inversely proportional to electrical resistance,

$$Power \propto \frac{1}{Resistance}$$
- Therefore, **the brighter bulb emitted more power and less resistance** and the **dimmer bulb had low power and more resistance.**

Hence, the correct option is 1.

33. Answer: c

Explanation:

Concept:

- **Electrical power:** It is the rate at which electrical energy is transferred by an electric circuit .
- Formula, Power, $P = VI = I^2R = \frac{V^2}{R}$ where V = voltage, I = current, R = resistance
- The electrical power is inversely proportional to the electrical resistance.

Explanation:

- A current I flows through a potential difference V in an electrical circuit containing a resistance R.
- The product of V and I i.e. VI may be understood as **thermal power radiated by the circuit.**

★ Additional Information

- Resistance (R):
 - It is the ratio between the voltage applied to the current flowing through it .

- The SI unit of electrical resistance is ohms.
- **Current (I):**
 - It is defined as **the charge flowing in the conductor per unit of time.**
 - Formula, current $I = \frac{q}{t}$ where, q = charge, t = time
 - The **SI unit of current is Ampere .**
- **Potential difference:**
 - It is **the difference in the amount of energy that charge carriers have between two points in a circuit.**
 - It is measured in volts (V) and is also called voltage.

34. Answer: d

Explanation:

Concept:

- **Ohm's law:** It states that **the voltage across a conductor is directly proportional to the current flowing through it, provided all physical conditions and temperature, remain constant.**
- Mathematically, **current-voltage can be written as $V = IR$** , where V = Voltage, I = Current, R = Resistance

Explanation:

The formula for Ohm's law is given as, $V = IR$

Hence, Ohm's law defines both current and voltage.

★ Additional Information

- **Resistance (R):**
 - It is the ratio between the voltage applied to the current flowing through it .
 - The SI unit of electrical resistance is ohms.
- **Current (I):**
 - It is defined as the charge flowing in the conductor per unit of time.

- Formula, current $I = \frac{q}{t}$ where, q = charge, t = time
- The SI unit of current is Ampere .
- Potential difference:
 - It is the difference in the amount of energy that charge carriers have between two points in a circuit .
 - It is measured in volts (V) and is also called voltage.

35. Answer: a

Explanation:

Concept:

- **Fuse:** It is an electrical safety device that operates to provide overcurrent protection of an electrical circuit.
- **The material used for the fuse element must be of:**
 - **Low melting point.**
 - **Low Ohmic loss.**
 - **High Resistivity**
- The current rating of the fuse is the maximum value of current due to which the fuse does not get melt.
- **The current carrying capacity of a fuse depends on**
 - The material used for it.
 - The dimensions of the fuse.
 - Surrounding of the fuse.

Explanation:

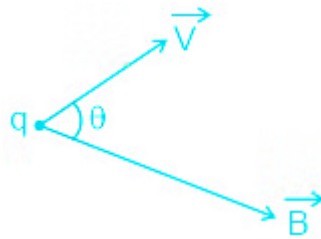
- The material used for the electric fuse is an alloy of tin and lead. This alloy should have **high resistivity to avoid loss of current.**
- And the **low melting point** , so that in case of short-circuit, the fuse wire will melt with a slight **change in temperature** .

36. Answer: a

Explanation:

Concept:

- When a charged particle is moving in a magnetic field, then the force applied on the charge is $F = qvB \sin\theta$, where, F = force, q = charge of the particle, v = velocity, B = magnetic field, θ = the angle between the velocity and the magnetic field.



$$\vec{F}_B = q(\vec{v} \times \vec{B})$$

$$|\vec{F}| = qvB \sin\theta$$

Explanation:

Force on the charged particle is given by, $F = qvB \sin\theta$

From the above expression, we can conclude the following statement:

- The magnetic field **does not always exert a force on a charged particle.**
- The magnetic field exerts a force on the particle in a particular condition.
- When the charged particle is moving in the same direction as the magnetic field, then the force is zero.
- The magnetic field exerts a force on a charged particle if it is moving across the magnetic lines of force

37. Answer: c

Explanation:

Concept:

- The magnetic property of a material is **the atomic or subatomic response material to an applied magnetic field wherein the electron spin and charge create a dipole moment and a magnetic field.**
- Ferromagnetic materials tend to lose their magnetism permanently if they are heated above a temperature. This temperature is known as **Curie temperature**.

Explanation:

- Every magnet has the **capacity to sustain its magnetic properties.**
- When we start **heating the magnet**, it starts losing its magnetic property.
- If the **magnet is strongly heated**, then it **can not hold its magnetic property under that high temperature.**
- Thus, it gets **demagnetized losing all of its magnetic properties.**

38. Answer: b

Explanation:

Concept:

- **Force:**
 - The **push or pull** on an object with mass **causes it to change its velocity.**
 - It is defined as **the product of mass and acceleration.**
 - Formula, $F = ma$, where m = mass, a = acceleration
 - Its SI unit is Newton N.
- **Torque:**
 - It is a **cross-product of displacement and force.**
 - Formula, $\vec{\tau} = \vec{r} \times \vec{F}$
 - It **SI unit** is N-m,

Explanation:

- When a magnetic needle is kept in a **non-uniform magnetic field.**
- It experiences **both force and torque** due to unequal force acting on the pole.

★ Additional Information

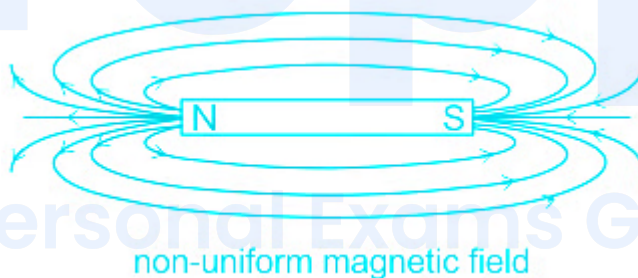
• **Uniform magnetic field:**

- A uniform magnetic field is **one that has the same strength and direction at all points.**
- It is represented by a set of **parallel lines that are equally spaced apart.**
- The direction of the magnetic field line points in the same direction as a north-south pole of a magnet point.



• **Non-Uniform magnetic field:**

- If the magnetic field lines in a **particular magnetic field range are not uniform**, the field at all the points is non-uniform.
- The magnetic field generated due to a **bar magnet** is non-uniform.



39. Answer: c

Explanation:

Concept:

- A material or object that **produces a magnetic field** is called **magnetic material**.
- In physics, there are three types of magnetic materials: **Paramagnetic materials, Diamagnetic materials, and ferromagnetic materials.**

- Paramagnetic materials:
 - **Materials that tend to get weakly magnetized in the direction of the magnetizing field when placed in a magnetic field.**
 - Materials have a permanent dipole moment or permanent magnetic moment.
 - However, if we remove the applied field the materials tend to lose their magnetism.
 - For example **Aluminium, sodium, magnesium, and oxygen**

Explanation:

In terms of magnetic properties, oxygen belongs to paramagnetic materials.

★ Additional Information

- **Ferromagnetic material:**
 - Ferromagnetic materials are those **materials that exhibit a spontaneous net magnetization at the atomic level, even in the absence of an external magnetic field.**
 - For example **Iron, Cobalt, Nickel.**
- **Diamagnetic material:**
 - Diamagnetic materials are those **materials that are freely magnetized when placed in a magnetic field.**
 - However, the magnetization is in the direction opposite to that of the magnetic field.
 - For example **superconductors, copper, carbon, and water.**

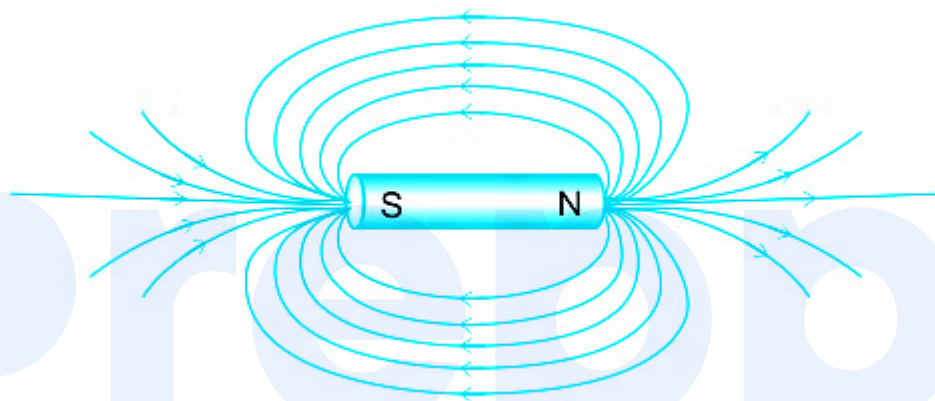
40. Answer: d

Explanation:

Concept:

- When a bar magnet is cut into equal parts, each part becomes a bar magnet.
- **Bar magnet:**

- A bar magnet is a rectangular piece of an object, made up of iron, steel, or any other ferromagnetic substance or ferromagnetic composite, that shows permanent magnetic properties.
- It has a **north pole** and a **south pole** at two ends. Even if you break a bar magnet from the middle, both the pieces will still have a north pole and a south pole, no matter how many pieces you break it in.
- Its magnetic force of it is **the strongest at the poles**.
- A bar magnet will attract **all ferromagnetic materials such as iron, nickel, and cobalt**.



- **Pole strength:**
 - It is defined as the strength of a magnetic pole to attract magnetic materials toward itself.
 - Pole strength is a **scalar quantity**.

Explanation:

- When a bar magnet is cut into two equal halves perpendicular to its length.
- Then, the pole strength of each piece is **the same as the pole strength of the original bar magnet**.

41. Answer: a

Explanation:

Explanation:

Glass:

As the material does not develop a crystalline structure, the amorphous solids are known as supercooled liquids because they allow molecules to continue to move within them for very very short periods of time. Because of this tendency to flow like liquids, they are also known as pseudo solids or supercooled liquids.

When silica is used to make glass, it is cooled from a liquid condition; yet, even at temperatures under freezing, silica does not solidify. Glass is therefore a super-cooled liquid.

Thus, Glass is considered a supercooled liquid.

★ Additional Information

Crystalline Solid:

- Crystalline solids typically have sharp melting points, well-defined edges, and faces, and exhibit x-ray diffractive.
- Amorphous solids, on the other hand, have wavy or uneven surfaces, poorly resolved x-ray diffraction patterns, and a wide temperature range for melting.
- Due to the short-range order or the lack of regularity in the arrangement of its molecular constituents, glass is an amorphous solid material.

Liquid Crystal:

- The phrase "liquid crystal" refers to a thermodynamically stable phase that is a process change, or between the solid and isotropic liquid phases, and is characterized by anisotropy of characteristics without the presence of a three-dimensional crystal lattice.
- In essence, glass is an amorphous solid.
- It does not take the shape of crystals.
- The glass's component parts can therefore move.
- Under normal circumstances, the constituent particles of ordinary solids do not move.

42. Answer: c

Explanation:

Explanation:

Hydrogenation:

- A chemical reaction known as hydrogenation occurs when molecular hydrogen interacts with another substance or element, typically in the presence of a catalyst made of nickel, palladium, or platinum.
- The method is frequently used to saturate or decrease organic molecules.
- A chemical reaction between a substance or element and molecular hydrogen usually takes place with the aid of a catalyst.
- Vanaspati is solidified and hydrogenated vegetable ghee from India. It costs a lot less than desi ghee.
- Palm or palm olein oil is used to make all varieties of Vanaspati.
- Nickel is used as a catalyst in reactors operating at low to medium pressure to produce hydrogenation.

★ Additional Information

Hydrolysis:

- The term "hydrolysis" refers to the breaking of chemical bonds by the addition of water and describes the reaction of an organic compound with water to produce two or more new chemicals.
- Some instances of hydrolysis include the formation of hydronium and bisulfate compounds when sulphuric acid is dissolved in water or a salt of a weak acid or base is dissolved in water.

Oxidation:

- A chemical process that occurs when an object comes into contact with oxygen or another oxidizer.
- Rust and an apple's brown color are examples of oxidation.

Ozonolysis:

- When ozone is used in an organic chemical reaction to break the unsaturated bonds in alkenes, alkynes, and azo compounds, this process is known as ozonolysis.
- The reaction is an organic redox one.
- The two phases of ozonolysis reactions are as follows: Alkene molecules are initially attacked by ozone to create ozonide, and after that, hydrolysis occurs, causing bond cleavage.

43. Answer: d

Explanation:

Explanation:

Petrol:

- Petroleum-derived clear flammable liquid known as gasoline or petrol is the main fuel for the majority of spark-ignited internal combustion engines.
- It primarily comprises organic chemicals derived from petroleum fractional distillation, supplemented with a number of additions.

Types of Petrol:

- Regular unleaded has the lowest octane level of the three categories with a RON of 91.
- When comparing gasoline prices liter for liter, it is frequently the least expensive.
- The majority of locally made and Japanese automobiles are built to run on normal unleaded fuel.
- The lowest RON rating for premium fuels is Premium 95, which is often in the center of the pricing range.
- The majority of European automobiles demand at least 95RON.
- The fuel with the highest octane rating, premium 98, is typically the most expensive.
- This gasoline, according to some experts, is the most fuel-efficient.

Quality of Petrol:

- The octane number is used to measure gasoline's ignition quality and the cetane number is used to measure diesel's.
- The ignition quality of gas is typically measured by the octane rating or octane number (gasoline or petrol).
- The higher this value, the less likely it is that the gas would "knock"—an explosion brought on by its early burning in the combustion chamber.
- When burned in a typical internal combustion engine with spark ignition.

44. Answer: a

Explanation:

Explanation:

Electrolytic Solution:

The electrolyte solution is made up of an ionizable material, such as a salt or an acid, which is referred to as the electrolyte, and a liquid or solid phase that contains at least one component, such as water.

Factors responsible for the conduction of electricity in an electrolytic solution:

- The ions that are present in electrolytes are the only factors contributing to their conductivity.
- As there are more charge carriers if the ion concentration is higher, the conductivity of electrolytes will be high.
- This is because the conductivity of electrolytes increases with an increase in ion concentration.
- The electrolytic solution's ability to conduct electricity is due to the solvent's particle mobility.
- The concentration of ions, the kind of ions present, and the solution's temperature are the three key variables that influence a solution's conductivity.

45. Answer: a

Explanation:

Explanation:

Chargeable Batteries:

In contrast to a disposable or main battery, which is delivered fully charged and thrown away after use, a rechargeable battery, storage battery, or secondary cell can be charged, discharged into a load, and recharged numerous times.

Electrodes:

- Conductors used to make electrical contact with a non-metallic component of the circuit are known as electrodes.
- An electrode is a conductor that establishes electrical contact with nonmetallic circuit components such as an electrolyte, a semiconductor, or a vacuum.
- This can also be referred to as an anode or a cathode if it is in an electrochemical cell.
- In rechargeable batteries, the negative electrode functions as the cathode during discharge and as the anode during charge.
- Lead-acid, zinc-air, nickel-cadmium (NiCd), nickel-metal hydride (NiMH), lithium-ion (Li-ion), lithium iron phosphate (LiFePO₄), and lithium-ion polymer are among the several electrode materials and electrolytes that are utilized (Li-ion polymer).
- In contrast to other varieties of rechargeable cells the ability to deliver almost their entire rated capacity at high discharge rates is a key benefit of nickel-cadmium cells, which also have fair cycle life and performance at low temperatures (discharging in one hour or less).

46. Answer: b

Explanation:

Explanation:

The atomic theory of matter:

- The atomic theory of matter, first proposed by JOHN DALTON, holds that each chemical element is composed of basic building blocks termed ATOMS.
- An element's atoms are identical in every way.
- All of these distinct elements—gold, copper, iron, and zinc—are composed of the same atoms.
- The English chemist John Dalton put forward the modern atomic theory in about 1803.
- The idea that all elements are made up of atoms is a fundamental one.

Postulates:

1. Atoms make up all matter.
2. Atoms are unbreakable and undividable.
3. Two or more different types of atoms combine to create compounds.
4. Atoms are rearranged during a chemical process.

★ Additional Information

- The laws of motion were created by Newton.
- According to the first law, until a force acts on an item, it will not alter its motion.
- According to the second law, an object's force is determined by multiplying its mass by its acceleration.
- According to the third law, when two objects interact, they exert equal-sized and opposite-direction pressures upon one another.
- According to Avogadro's law, equal volumes of various gases each contain an equal number of molecules at the same temperature and pressure.
- Under the presumption of an ideal (perfect) gas, this empirical relation can be deduced from the kinetic theory of gases.
- Pascal's principle or the fluid pressure transfer principle are other names for Pascal's law.

- Blaise Pascal, a French mathematician, formulated Pascal's law in 1653.
- According to Pascal's law, pressure applied to a fluid inside of a container will be transmitted without a change in magnitude to every point within the fluid as well as the container's walls.
- Any spot in the fluid experiences equal pressure in all directions.

47. Answer: b

Explanation:

Explanation:

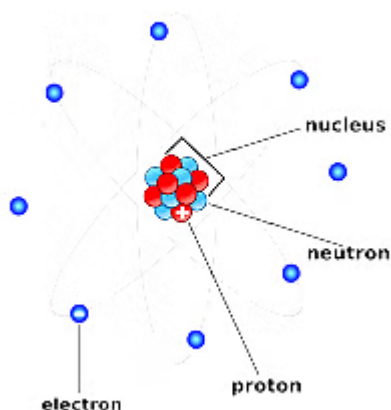
Atoms:

- A chemical element is uniquely defined by its atoms, which are tiny pieces of substance.
- An atom is made up of a core nucleus and one or more negatively charged electrons that orbit it.

Atomic Structure:

- An atom is a complicated configuration of negatively charged electrons grouped around a positively charged nucleus in certain shells.
- Protons and neutrons make up the majority of the atom's mass in this nucleus (except for common hydrogen which has only one proton).
- For instance, the nucleus of hydrogen is made up of a positively charged proton and a negatively charged electron.
- On the periodic table of elements, the atomic structure is also depicted.
- Every atom's nucleus has a neutron, with the exception of plain hydrogen, which does not.
- The fact that the particle has no electrical charge—it is neutral—gives it its name.
- Neutrons have a very high density.

Atomic Structure



48. Answer: d

Explanation:

Explanation:

Valency:

The valence or valency of an element in chemistry is a measurement of how well it can combine with other atoms to form chemical compounds or molecules.

Types of Bonds:

Chemical bonds, also known as electrical forces, can be categorized into five different groups: ionic, covalent, metallic, van der Waals, and hydrogen bonds.

Valence Shell Electron Pair Repulsion Theory:

- Based on the number of valence shell electron bond pairs between the atoms in a molecule or ion, the valence shell electron pair repulsion (VSEPR) theory is a model used to predict 3-D molecular shape.
- According to this hypothesis, electron pairs will position themselves to reduce the consequences of their mutual repulsion.
- In a molecule, electrons remain as far away from one another. Covalent bonds also contain electrons in addition to lone pairs.

- To reduce repulsion and increase molecular stability, electron pairs will repel away from one another.

Valance Bond Theory:

- The electrical structure of molecules is described by the valence bond theory.
- According to the hypothesis, electrons fill each of an atom's atomic orbitals inside a molecule, and the nucleus of one atom is drawn to the electrons of another atom.

Molecular Orbital Theory:

- According to the molecular orbital hypothesis, every atom has a tendency to group together to create molecular orbitals.
- As a result of this configuration, electrons can be found in a variety of atomic orbitals and are frequently linked to diverse nuclei.

Electronic Theory of Chemical Bonding:

- The electronic theory of valence was created by Kossel and Lewis to explain how chemical bonds are formed between two atoms.
- By losing, acquiring, or sharing electrons, every atom strives to achieve octet configuration (the presence of eight electrons in its valence shell).

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49. Answer: a

Explanation:

Explanation:

Atoms:

- Each atom is made up of a nucleus and one or more electrons that are linked to it.
- One or more protons and a significant number of neutrons make up the nucleus.
- Only the most prevalent type of hydrogen is neutron-free.

- Atoms that are neutral or ionized make up every solid, liquid, gas, and plasma.
- In order to complete their octet by forming a chemical bond by sharing, losing, or gaining electrons, the atoms join to achieve a noble or inert gas electrical state.
- Since an atom has no overall charge, it is electrically neutral. Protons, electrons, and neutrons are the three subatomic particles that make up an atom.
- Electrons are negatively charged, neutrons are neutral, and protons are positively charged particles.
- Atoms combine to form compounds or molecules.
- Matter is made up of atoms and molecules.
- Anything with mass and spatial requirements is considered the matter.
- There are three states of matter: gases, liquids, and solids.

50. Answer: d

Explanation:

Explanation:

Deep-Sea Diving:

- The act of going below the water's surface to engage with the environment is known as underwater diving.
- It is also frequently referred to as "diving," a word that can indicate many things depending on the context.
- Since deep sea diving permits divers to dive deeper than the 40-meter limit of scuba diving, it necessitates specialized training from diving professionals.
- It is crucial to check that your oxygen analyzers are fully functional and equipped for dives deeper than you had planned.
- Divers occasionally utilize heliox, a mixture of helium and oxygen, or trimix, which combines all three gases, in place of nitrox.
- Both nitrogen and oxygen can sometimes cause a state that is akin to intoxication during dives.

Concept:

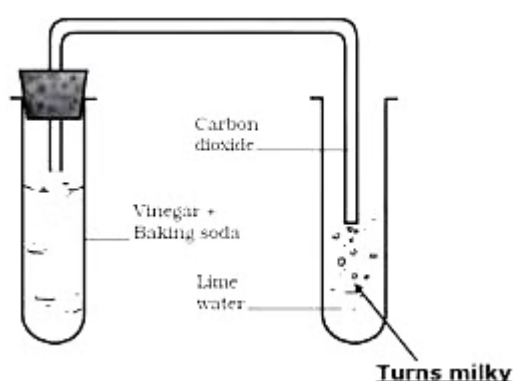
1. Helium is added to the mixture to lessen the toxication, allowing divers to think more clearly.
2. Additionally, using helium may allow divers to surface more quickly and without experiencing decompression sickness.

51. Answer: b

Explanation:

Explanation:

- Calcium carbonate, which is insoluble in water and becomes milky, is created when CO_2 is carried through lime water.
- The milkiness, however, disappears when too much CO_2 is added to the solution.
- This results from the production of colorless, water-soluble calcium bicarbonate.
- When too much CO_2 is added, it combines with water (H_2O) and calcium carbonate (CaCO_3) to generate calcium bicarbonate ($\text{Ca}(\text{HCO}_3)_2$), which dissolves in water to make the solution clear once more.



★ Additional Information

Calcium Chloride:

1. The term "lime chloride" refers to calcium chloride.
2. Calcium chloride has the chemical formula CaCl_2 .
3. Lime water has the chemical formula $\text{Ca}(\text{OH})_2$.
4. When lime water and chlorine interact, CaOCl_2 , or bleaching powder, is created (chloride of lime).

Copper Carbonate:

1. While copper oxide is dark, copper carbonate is green.
2. During the response, we can notice color a shift from green to black.
3. By shaking the gas produced in a container containing lime water, we can demonstrate this.
4. It is evident that this gas causes the lime water to turn milky.

52. Answer: c

Explanation:

Explanation:

Metallic Properties of Elements:

- Thin sheets of metal can be pounded out.
- It indicates that they have the quality of malleability.
- Metals can bend easily.
- They are able to be drawn into wires.
- Metals are efficient heat and electrical conductors.
- Metals have a glossy appearance because they are lustrous.
- The tensile strength of metals is high.
- It implies that they can support large weights.
- Metals have a resonant sound.
- It indicates that they produce a ringing sound.
- Except for mercury, which is a liquid at ambient temperature, metals are solids at that temperature.
- Metals are brittle. It implies that they are difficult to cut.

Metal Reactivity Series:

Metals are included in the Reactivity Series in decreasing order of Reactivity. The topmost metals are the most reactive, whereas the bottommost metals are the least reactive. Any two metals in the series can have their salt solutions replaced by the metal that is higher in the series for any two metals in the series.

Reactivity series of metals		
K	Potassium	Most reactive ↑ Increasingly reactive ↓ Least reactive
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	
Fe	Iron	
Sn	Tin	
Pb	Lead	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	

Concept:

Since the group atomic radius grows as we descend, the metallic character also grows.

53. Answer: d

Explanation:

Explanation:

Electronegativity:

1. The ability of an atom to draw an electron-binding pair determines its electronegativity.
2. The propensity of an atom of a certain chemical element to draw shared electrons when forming a chemical connection is known as electronegativity.
3. The atomic number and the separation of the valence electrons from the charged nucleus have an impact on an atom's electronegativity.

Factors responsible for electronegativity of elements:

- The atomic number and the separation of the valence electrons from the charged nucleus have an impact on an atom's electronegativity.
- An atom or a substituent group will draw electrons in greater amounts the higher the associated electronegativity.
- The number of protons in the nucleus, the distance from the nucleus, and the degree of inner electron screening all have an impact on electronegativity.

Concept:

Fluorine is the most electronegative element in the current periodic table because of its tiny atomic radius and significant nuclear charge, which have the strongest pull for the shared pair of electrons in a covalent connection with any other element.

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54. Answer: b

Explanation:

Explanation:

Minerals:

- In terms of geology and mineralogy, a mineral or mineral species is, generally speaking, a pure, naturally occurring solid chemical compound with a fairly well-defined chemical makeup.
- Minerals are those substances found in meals and in the ground that our bodies require for healthy growth and development.

- Calcium, phosphorus, potassium, sodium, chloride, magnesium, iron, zinc, iodine, chromium, copper, fluoride, molybdenum, manganese, and selenium are among the nutrients that are crucial for good health.
- Leaching methods such as tank leaching, heap leaching, dump leaching, and pressured leaching are typically used in the commercial extraction of metals from minerals.
- A leaching solution is percolated through mined ore that has low concentrations (low grade) of the target components to perform dump leaching.
- There are three primary techniques for removing metals from their ore.
- These include reducing the ore with carbon, electrolyzing the molten ore, and reducing it with a more reactive metal.
- Minerals are created when different elements are layered on top of one another.
- Minerals are merely a grouping of one or more elements arranged in a shape known as a crystal structure.

55. Answer: c

Explanation:

Explanation:

Mendeleev's Periodic Table:

1. A Russian scientist named Dmitri Mendeleev presented a paper on the Law of Octaves in 1869, just five years after John Newlands first proposed it.
2. Mendeleev stated that "Element characteristics are a periodic function of their atomic weight" in his renowned periodic law.
3. The Periodic Table of Mendeleev is a table that Mendeleev created to list elements in the order of their atomic weights.
4. Isotopes of an element must be given distinct locations in the periodic table because they have various atomic masses, according to Mendeleev's Periodic Law.

5. Because Mendeleev's periodic chart was structured in increasing order of atomic number, which is not how isotopes are arranged, and because isotopes share the same atomic number, no one isotope can fit into a single box in the periodic table.

I	II	III	IV	V	VI	VII	VIII			
H 1.01										
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0				
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5				
K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7	
Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9				
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106	
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127				
Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195	
Au 197	Hg 201	Tl 204	Pb 207	Bi 209						
			Th 232		U 238					

- The method of nickel electroplating involves plating metal components with a thin layer of nickel.
- In a galvanic cell, a spoon is used as the cathode, while nickel is used as the anode to deposit Ni^{+} ions across the cathode to prepare for plating.

Concept:

Sulfamate nickel is used in the majority of engineering applications, however, a nickel chloride/nickel sulfate bath is used for nickel-plated strip steel. The Watts baths, which combine nickel sulfate, nickel chloride, and boric acid, are the most often used nickel baths.

57. Answer: d

Explanation:

Explanation:

Saponification:

Esters are transformed into soaps and alcohols through the process of saponification, which uses an aqueous alkali. Fatty acids, which are long-chain carboxylic acids, are the building blocks of soaps.

Preparation of Alcohols:

1. Alkenes can be hydrated to produce alcohol, or aldehydes, ketones, acids, and esters can be reduced to produce alcohol.
2. An alkene's double-bonded carbons can be added to using either a Markovnikov's or an anti-method.
3. Markovnikov's e is created by reducing aldehydes, ketones, acids, and esters or hydrating alkenes.
4. In the process of saponification, an ester and an inorganic base combine to create soap and alcohol.
5. In most cases, it happens when triglycerides react with potassium or sodium hydroxide (lye) to create glycerol and fatty acid salt, sometimes known as

"soap," from triglycerides.

6. Ethyl Alcohol speeds up the saponification process by making the catalyst more soluble in the oil-ethyl ester phase.

58. Answer: d

Explanation:

Explanation:

Alkali:

1. **Alkalis are substances that can dissolve in water**, produce salts when combined with acids, and lessen the acidity of acids.
2. Alkalis have an unpleasant taste and render some colors blue.
3. Some alkalis can support the body's normal functioning.
4. The alkali is sodium hydroxide, for instance.
5. A basic, ionic salt of an alkali metal or an alkaline earth metal is referred to as an alkali in chemistry.
6. **A base that dissolves in water is another definition of an alkali.**
7. A soluble base solution has a pH higher than 7.0.
8. **While all alkalis are bases, not all bases are alkalis.**
9. Only those bases which are water soluble are alkalis.
10. Bases known as alkalis dissolve in water.
11. Lyes, ammonia, hair relaxers, nonphosphate detergents, dishwasher soaps, and disc batteries are examples of common alkali-containing materials.
12. Sodium hydroxide (NaOH), potassium hydroxide (KOH), or calcium hydroxide ($\text{Ca}(\text{OH})_2$) are the main components of lyes, which are alkaline substances.

59. Answer: a

Explanation:

Explanation:

pH Value:

- The pH scale determines how acidic or basic water is.
- The range is 0 to 14, with 7 representing neutrality.
- Acidity is indicated by pH values below 7, whereas baseness is shown by pH values above 7.
- In reality, pH is a measurement of the proportion of free hydrogen and hydroxyl ions in water.



Factors Affecting pH Value:

1. A water supply's inherent pH of 7 will typically become unbalanced when chemicals, minerals, pollutants, soil or bedrock composition, and other impurities interact with it.
2. In summary, environmental conditions play a major role in determining the pH of water, whether it is high or low.
3. Temperature increases cause a drop in pH.
4. However, this does not imply that as the temperature rises, water's acidity does as well.
5. If there are more hydrogen ions present in a solution than hydroxide ions, it is said to be acidic.

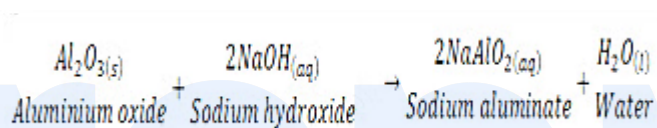
60. Answer: c

Explanation:

Explanation:

- Sodium aluminate and water are produced when aluminum oxide Al_2O_3 interacts with sodium hydroxide solution.
- Between 900 and 1100 °C is the temperature at which this reaction occurs.
- Aluminum oxide behaves as an acid in this reaction.

Reaction:



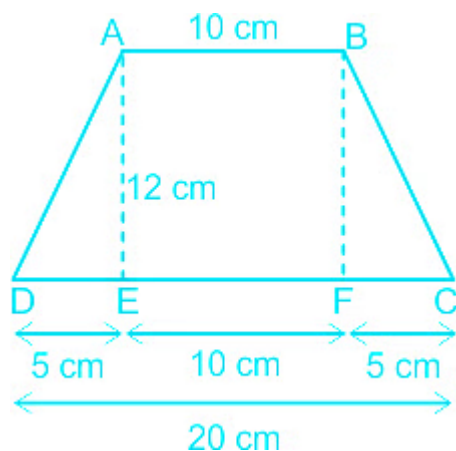
61. Answer: b

Explanation:

Concept-

Area of trapezium = $\frac{1}{2} \times \text{sum of parallel sides} \times \text{height}$.

Calculation-



$$\text{Area} = \frac{1}{2} \times (20 + 10) \times h$$

$$\Rightarrow 180 \text{ cm}^2 = \frac{1}{2} \times 30 \times h$$

$$\Rightarrow h = 12 \text{ cm.}$$

Now, in right angle $\triangle ADE$

$$AD^2 = DE^2 + AE^2$$

$$\Rightarrow AD = \sqrt{5^2 + 12^2} = 13 \text{ cm}$$

$\therefore$ the length of each non-parallel side is 13 cm.

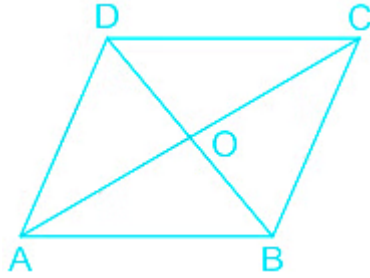
62. Answer: c

Explanation:

Concept-

- Diagonals of a rhombus bisect each other at 90°
- Area of rhombus = $\frac{1}{2} \times \text{Product of diagonals}$

Calculation-



$$BD = 12 \text{ cm}$$

$$\Rightarrow BO = 6 \text{ cm (half of diagonal)}$$

Using Pythagoras theorem in $\triangle AOB$ right angle at O.

$$AB^2 = BO^2 + OA^2$$

$$\Rightarrow OA = \sqrt{AB^2 - BO^2}$$

$$\Rightarrow OA = \sqrt{10^2 - 6^2} = 8 \text{ cm.}$$

$$AC = 2 OA = 16 \text{ cm}$$

$$\text{Area of rhombus} = \frac{1}{2} \times 12 \times 16$$

$$\Rightarrow 96 \text{ cm}^2.$$

$\therefore$ The area of a rhombus is 96 cm^2 .

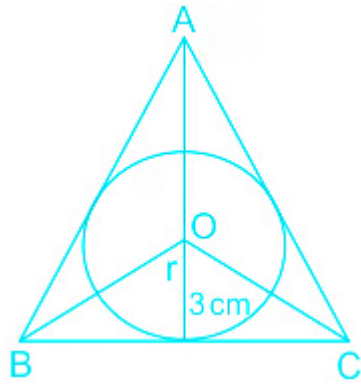
63. Answer: d

Explanation:

Concept-

$$\text{Inradius} = \frac{\text{Area of triangle}}{\text{Semiperimeter}}$$

Calculation



$$r = \frac{\Delta}{s}$$

$$\Rightarrow 3 = \frac{15}{s}$$

$$\Rightarrow s = 5 \text{ cm}$$

Now perimeter will be $2 \times \text{semiperimeter}$

$$\text{Perimeter} = 2 \times (5)$$

$$\text{Perimeter} = 10 \text{ cm.}$$

$\therefore$ the perimeter of a triangle is 10 cm.

64. Answer: b

Explanation:

Calculation-

As -3 is the zeros of the quadratic polynomial $(k - 1)x^2 + kx + 1$

On substitute -3 in the equation, we get 0

$$\Rightarrow (k - 1)(-3)^2 + k(-3) + 1 = 0$$

$$\Rightarrow 9k - 9 - 3k + 1 = 0$$

$$\Rightarrow 6k = 8$$

$$\Rightarrow k = 4/3$$

$\therefore$ the value of k is $4/3$.

65. Answer: a

Explanation:

Concept-

The angle subtended by the chord at the centre is double the angle subtended by it at any point on the circle.

Calculation-

$$\angle AGB = 2 \times \angle ACB$$

$$\Rightarrow 150^\circ = 2 \times \angle ACB$$

$$\Rightarrow \angle ACB = 75^\circ$$

$\therefore$ the value of $\angle ACB$ is 75°

66. Answer: c

Explanation:

Calculation-

The divisibility rule of 3 – the sum of the digits is divisible by 3.

In 2143251 sum of digits will be 18 which is divisible by 3

$\therefore$ The number 2143251 is divisible by 3.

67. Answer: d

Explanation:

Concept-

Sum of n natural no is = $\frac{n(n+1)}{2}$

Average = $\frac{\text{Sum of Observation}}{\text{Total no of observation}}$

Calculation-

Sum of 43 natural no = $\frac{43(43+1)}{2} = 946$

Now, Average = $\frac{946}{43} = 22$

∴ The average of the first 43 natural numbers is 22.

68. Answer: c

Explanation:

Calculation-

$\sin \theta = \frac{\sqrt{3}}{2}$

⇒ $\theta = 60^\circ$

Now, $\cos 3\theta$ will be

⇒ $\cos 180^\circ$

⇒ -1 ($\cos n\pi = (-1)^n$)

∴ The value of $\cos 3\theta$ is -1.

69. Answer: d

Explanation:

Concept-

- $\tan (A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$
- $\tan n\pi = 0$

Calculation-

$$\tan (\pi + \theta) = \frac{\tan \pi + \tan \theta}{1 - \tan \pi \tan \theta}$$

$$\tan (\pi + \theta) = \frac{0 + \tan \theta}{1 - 0}$$

$$\tan (\pi + \theta) = \tan \theta$$

$\therefore$ the value of $\tan (\pi + \theta)$ is $\tan \theta$.

70. Answer: a

Explanation:

Concept-

1. Area of square = (side)²
2. Perimeter of square = 4 × side
3. Circumference of circle = 2πr
4. Area of circle = πr²

Calculation-

Let wire is bent to form a square of side a

$$\Rightarrow a^2 = 169 \text{ cm}^2$$

$$\Rightarrow a = 13 \text{ cm}$$

The perimeter of square must be equal to length of wire

$$\Rightarrow 4a = 52 \text{ cm.}$$

Now, let r be the radius of circle formed by same wire

And circumference of circle must be equal to length of wire

$$\Rightarrow 2\pi r = 52 \text{ cm}$$

$$\Rightarrow r = 8.27 \text{ cm}$$

Now Area of circle will be

$$\Rightarrow \pi r^2 = 3.14 \times (8.27)^2$$

$$= 214.75$$

$\therefore$ the area of circle is 215 cm^2

71. Answer: a

Explanation:

Concept -

Range = highest value - lowest value

$$\text{Average} = \frac{\text{Sum of observation}}{\text{total no of observation}}$$

Calculation -

$$\text{Range of C} = 250 - 80 = 170$$

The average of participants from E will be

$$\frac{112+105+180+80+183}{5} = 132$$

The difference is $170 - 132 = 38$.

∴ the difference between 'the range of C and average of E participants is 38.

72. Answer: a

Explanation:

Calculation-

$$\left| \frac{2}{x-4} \right| > 1$$

$$\Rightarrow \left| \frac{x-4}{2} \right| < 1$$

$$\Rightarrow |x - 4| < 2$$

$$\Rightarrow -2 < x - 4 < 2$$

$$\Rightarrow 2 < x < 6$$

As $x \neq 4$ hence $x \in (2, 4) \cup (4, 6)$

∴ The solution of the equality $\left| \frac{2}{x-4} \right| > 1$ is $x \in (4, 6)$.

73. Answer: a

Explanation:

Concept-

$$\log a - \log b = \log \frac{a}{b}$$

Calculation-

$$\int_2^3 \frac{1}{x} dx$$

$$\Rightarrow [\log x]_2^3$$

$$\Rightarrow \log 3 - \log 2$$

$$\Rightarrow \log \left| \frac{3}{2} \right|$$

$$\therefore \int_2^3 \frac{1}{x} dx = \log \left| \frac{3}{2} \right|$$

74. Answer: c

Explanation:

Concept-

$$\int x^n = \frac{x^{n+1}}{n+1}$$

Calculation-

$$\int_1^2 x^2 dx$$

$$\Rightarrow \left[\frac{x^3}{3} \right]_1^2$$

$$\Rightarrow \left[\frac{2^3}{3} - \frac{1^3}{3} \right]$$

$$\Rightarrow \frac{7}{3}$$

75. Answer: b

Explanation:

Concept-

$$(x + y)^n + (x - y)^n$$

1. $\frac{n+1}{2}$ if n is odd
2. $\frac{n}{2} + 1$ if n is even.

Calculation-

$$(x + a)^{100} + (x - a)^{100}$$

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$$\Rightarrow \frac{100}{2} + 1$$

$$\Rightarrow 51$$

$\therefore$ The total number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ is 51

76. Answer: c

Explanation:

Concept-

Sum of the angles of a triangle is 180°

If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles.

Calculation-

By linear angle property

$$\angle ACB + 110^\circ = 180^\circ$$

$$\angle ACB = 70^\circ$$

Now in ΔABC

$$\angle BAC + \angle ABC + \angle ACB = 180^\circ$$

$$\angle BAC + 62^\circ + 70^\circ = 180^\circ$$

$$\angle BAC = 48^\circ$$

★ Alternate Method

By exterior angle property in ΔABC

$$\angle BAC + 62^\circ = 110^\circ$$

$$\Rightarrow \angle BAC = 48^\circ$$

$\therefore$ the measure of $\angle BAC$ is 48° .

77. Answer: d

Explanation:

Concept-

- $(a + b)^2 = a^2 + b^2 + 2ab$

Calculation-

We have $3x + 5y = 14$ and $xy = 6$

Now $3x + 5y = 14$

On squaring both sides we get

$$\Rightarrow 9x^2 + 25y^2 + 30xy = 196$$

$$\Rightarrow 9x^2 + 25y^2 + 30(6) = 196$$

$$\Rightarrow 9x^2 + 25y^2 = 16$$

$\therefore$ the value of $9x^2 + 25y^2$ is 16

78. Answer: c

Explanation:

Concept-

1. $1 - \cos x = 2 \sin^2 x/2$.

2. $1 + \cos x = 2 \cos^2 x/2$

$$3. 1 + \tan^2 x = \sec^2 x$$

Calculation-

$$(dy - dx) + \cos x(dy + dx) = 0$$

$$\Rightarrow dy - dx + \cos x dy + \cos x dx = 0$$

$$\Rightarrow dy(1 + \cos x) - dx(1 - \cos x) = 0$$

$$\Rightarrow dy = \frac{1 - \cos x}{1 + \cos x} dx$$

$$\Rightarrow dy = \frac{2\sin^2 \frac{x}{2}}{2\cos^2 \frac{x}{2}} dx$$

$$\Rightarrow dy = \tan^2 \frac{x}{2} dx$$

$$\Rightarrow dy = \sec^2 \frac{x}{2} - 1$$

$$\Rightarrow \int dy = \int (\sec^2 \frac{x}{2} - 1) dx$$

$$\Rightarrow y = 2 \tan \frac{x}{2} - x + c$$

$\therefore$ solution of the differential equation $(dy - dx) + \cos x (dy + dx) = 0$ is $y = 2 \tan \frac{x}{2} - x + c$.

79. Answer: c

Explanation:

Concept-

- $(a + b)^2 = a^2 + b^2 + 2ab$

Calculation-

$$5x + \frac{1}{3x} = 4$$

Multiply the equation by $3/5$ we get

$$3x + \frac{1}{5x} = \frac{12}{5}$$

Now squaring both sides

$$9x^2 + \frac{1}{25x^2} + 2 \times 3x \times \frac{1}{5x} = \frac{144}{25}$$

$$\Rightarrow 9x^2 + \frac{1}{25x^2} + \frac{6}{5} = \frac{144}{25}$$

$$\Rightarrow 9x^2 + \frac{1}{25x^2} = \frac{114}{25}$$

$\therefore$ The value of $9x^2 + \frac{1}{25x^2}$ is $\frac{114}{25}$

80. Answer: b

Explanation:

Concept-

- $\int \frac{dx}{1+x^2} = \tan^{-1} x$

Calculation-

$$dy = (1 + y^2) dx$$

$$\Rightarrow \frac{dy}{1+y^2} = dx$$

on integrating both side we get

$$\Rightarrow \tan^{-1} y = x + c$$

$$\Rightarrow y = \tan(x + c)$$

$\therefore$ The solution of the equation $dy = (1 + y^2) dx$ is $y = \tan(x + c)$.

81. Answer: d

Explanation:

The correct answer is Birla Yamaha.

★ Key Points:

- In **1984** ,**Birla Yamaha** opened its doors in **Mumbai** .
- It manufactures **multipurpose engines** and **portable generators** .
- Indra Power the two multipurpose engines produced by the business in 1995 are called **Birla Power Plus**.
- There are no **commercial vehicles** made there.

★ Additional Information:

- Any **motor vehicle** used to **deliver goods** or paying passengers qualifies as a **commercial vehicle** .
- **TELCO** stands for **Tata Engineering and Locomotive Company**.
 - Tata Engineering and Locomotive Company has been renamed and is presently known as Tata Motors.
- **Ashok Leyland** is a leading commercial vehicle manufacturer in India.
- In **1983 DCM Daewoo Company**, formerly known as **DCM Toyota Ltd.**, was incorporated as a Public Limited Comp. on August 1, & obtained a Certificate of Commencement of Business on October 1.

82. Answer: b

Explanation:

The correct answer is 1949.

★ Key Points:

- The country's monetary policy was completely under the supervision of the **Deposit Insurance and Credit Guarantee Corporation** up until the establishment of the **Monetary Policy Committee in 2016**.
- In compliance with the **Reserve Bank of India Act** , 1934, it began operating on **April 1st, 1935**.
- The initial share capital was divided in **100 fully paid shares**.
- The RBI was **nationalized** on **1 January 1949**, following India's **independence** on **August 15, 1947**.

★ Additional Information:

- The **Reserve Bank of India, or RBI**, is both the nation's **central bank** and the **regulatory body** in charge of policing the nation's banking sector.
- The proprietor is the **Ministry of Finance of the Government** of India.
- Its responsibilities include the **control, issue, and supply maintenance** of the **Indian rupee**.
- In addition, it controls the nation's **main payment systems** and seeks to promote economic development.
- The Reserve Bank of India (RBI) **manufactures and mints Indian Rupee (INR) currency notes** in two of its currency printing presses located in Nashik (Western India) and Dewas (BRBNM).

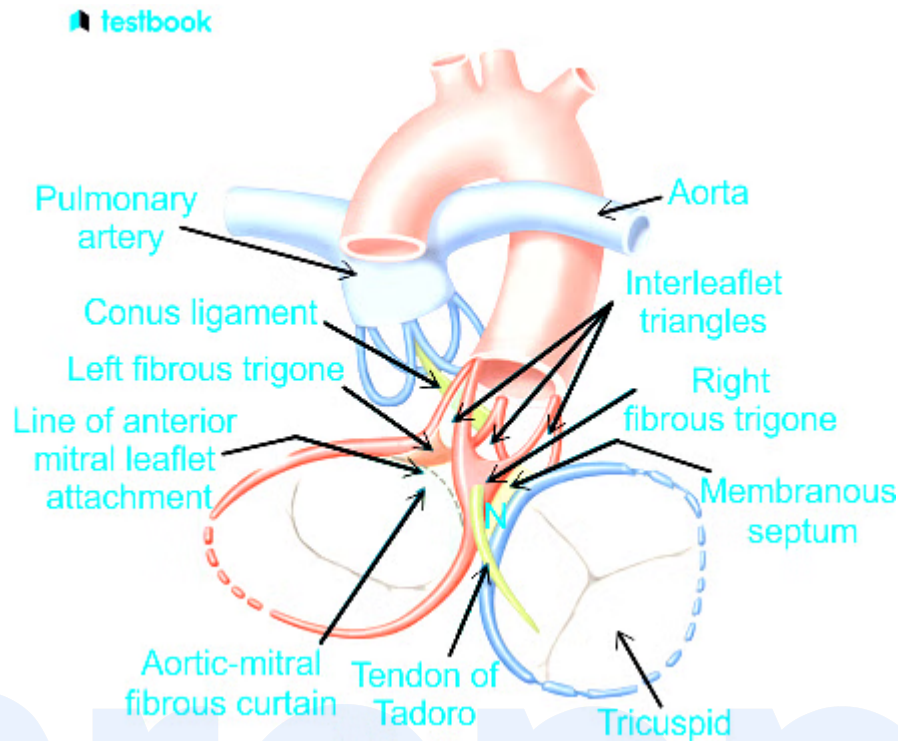
83. Answer: a

Explanation:

The correct answer is Capillaries.

★ Key Points:

- The **smallest** and most **abundant blood vessels**, **capillaries**, connect the **arteries** that take blood away from the heart and the veins that bring blood back to the heart (**veins**).
- The exchange of materials between the **blood** and **tissue cells** is the main purpose of **capillaries**.
- The **metabolic activity** of **bodily tissues** affects how capillaries are distributed.
- Because they are metabolically active and need a lot of oxygen and nutrients, tissues including skeletal muscle, the liver, and the kidney have vast capillary networks.



★ **Additional Information:**

- **Blood arteries** , which serve as conduits or channels, **transport** blood to human tissues.
- At the **heart** , two closed systems that resemble tubes begin and end.
- The **pulmonary arteries** are a single system that carry blood from the **right ventricle** to the **lungs** and back to the **left atrium** .
- The **secondary system** that moves blood from the left ventricle to the tissues all throughout the body before returning it to the **right atrium** is called the **systemic veins**.
 - Based on their **shape** and **purpose** , blood vessels are categorised as **arteries** ,**capillaries** , or **veins** .

84. Answer: b

Explanation:

The correct answer is Pradeep.

★ Key Points:

- **Aye Mere Watan Ke Logo** is a Hindi nationalist song written by **Kavi Pradeep** , performed by **Lata Mangeshkar**, and composed by **C. Ramchandra**.
- This song honours **Indian soldiers** who lost their lives in the **Sino-Indian War**.
- Mangeshkar gave the song its first live performance on **January 26, 1963**, in New Delhi's National Stadium.
- Along with the national anthem, "**Jana Gana Mana**", "**Vande Mataram**", and "**Sare Jahan Se Accha**", the song is frequently performed at public events and gatherings in India.
- It is regarded as one of the most **well-known patriotic songs**.

85. Answer: b

Explanation:

The correct answer is Narendra Modi.

★ Key Points

- President **Donald Trump** of the United States presented Prime Minister **Narendra Modi** with the "**Legion of Merit**" for his contributions to strengthening the ties between the two countries in 2020.
- **Shinzo Abe** , the former prime minister of **Japan** , and **Scott Morrison** , the former prime minister of **Australia** , also received the honour.
- The "**Quad**" group of nations comprised of **Australia** ,the **United States** ,**Japan** , and **India** is considered as a challenge to Chinese hegemony in the **Indo-Pacific area**.

★ Additional Information:

- The **United States Armed Forces** bestow the **Legion of Merit (LOM)**, a military honour, for extremely meritorious actions in the course of providing outstanding services and accomplishments.
- Members of the United States' **eight uniformed services** as well as **military** and **political leaders** from other countries are given the award.

- Members of the United States uniformed services are given the Legion of Merit without consideration of their **academic standing**.
- For **senior officers** at the **O-6 level and above** , the requirements are for extremely meritorious behaviour in the performance of outstanding services and achievements.

86. Answer: a

Explanation:

The correct answer is 2014.

★ Key Points:

- The Indian government proclaimed **2 June 2014** as **Telangana Formation Day** on March 4.
- Hyderabad serves as the capital of Telangana, which was formed as 29th State of India, but after making Jammu Kashmir and Ladakh the UTs, it is currently the **28th state** in the **Indian Union**.
- For ten years, the capital will be split between the two states until **Seemandhra** can build its own.
- However, **Telangana** will be the only state to receive **Hyderabad's earnings** and **state authority**.
- Despite hints in the **Telangana Bill** , Seemandhra did not receive a unique status.

★ Additional Information:

- The former princely state of **Hyderabad** was amalgamated with Andhra Pradesh in **1956** , which sparked the Mulki Agitations, and the new state corresponds to those Telugu-speaking regions.
- After decades of **demonstrations** and **agitations** , the **United Progressive Alliance-led federal government** chose to **split** the current Andhra Pradesh state into **two** , and on 2 June 2014, the Union Cabinet unilaterally approved the bill to establish Telangana.

87. Answer: b

Explanation:

The correct answer is Union List.

★ Key Points:

- The highest court in a state is known as the **High Court**.
- Every state in India is required to have a High Court, as stated in **Article 214**.
- A joint High Court, however, may exist for two or more States or for two or more States plus a **union territory**, according to Article 231.
- In India, there are total 25 High Courts, six of which have jurisdiction over several States or UTs.
- Delhi has a High Court of its own, among the Union Territories.
- A **Chief Justice** and any other **judges** chosen by the **President** of India make up each High Court.

★ Additional Information:

- Each High Court has a **Chief Justice** and **additional judges** who have been chosen by the President.
- The High Courts might have as **few or as many judges** as they choose.
- From **court to court** and **state to state**, it differs.
- To be appointed as a **judge** on the High Court, a person must be an **Indian citizen**.
- He was supposed to have served in a **judicial capacity** in India for ten years.
- He has represented one or more High Courts for at least **ten years**.

88. Answer: a

Explanation:

The correct answer is Vitamin A.

★ Key Points:

- **Micronutrients** including **vitamins** and minerals are required by the body for a variety of regular bodily functions.
- Vitamins fall into two categories: **fat-soluble** and **water-soluble**.
- They are stored in the **hepatic** and **adipose** tissues.
- The **vitamins A, D, E, and K** are **soluble** in **fat** but **insoluble** in **water**.
- **Vitamins B and C** can be dissolved in **water**.

★ Additional Information:

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Name of the vitamin	Source	Need	Deficiency
Fat-soluble vitamins			
Vitamin A	Milk, butter, egg	Normal growth and to keep eyes and skin healthy	Night blindness, Irregular growth of teeth
Vitamin D	Cheese, butter, milk, green vegetables, fish liver oil, sunlight	Formation of strong bones and teeth	Rickets
Vitamin E	vegetable oils, spinach, lettuce, turnip leaves, butter, milk, whole grains, nuts, seeds, leafy vegetables	Protection of cell membrane, formation of red blood cells (RBC)	Not yet confirmed
Vitamin K	Cabbage, cauliflower, spinach and other green leafy vegetables, cereals, soybeans	Clotting of blood	Excessive bleeding from wounds
Water-soluble vitamins			

Vitamin B1	Seafood, milk, meat, peas, cereals, green vegetables	Growth and development, releasing energy from carbohydrates	Beriberi
Vitamin B2	Yeast, egg, meat, peas	Body growth and red cell production, releasing energy from carbohydrates	Skin diseases, retarded growth
Vitamin B3	Whole cereals, tomatoes, potatoes, meat and fish	Healthy skin, digestion and nervous system	Pellagra (affects the skin, alimentary canal and nervous system)
Vitamin B12	Liver, milk, eggs, fish	Forming RBC	Anaemia
Vitamin C	Indian gooseberry (amla), lemons, lime, pineapple, oranges, watermelon, green peppers, tomatoes, cabbage, turnip, carrots, green mint, guava	Maintenance of ligaments, tendons, other supportive tissues and blood vessels	Scurvy (gums swell and bleed)

89. Answer: a

Explanation:

The correct answer is double government.

★ Key Points:

- For the British Indian provinces, the **Government of India Act (1919)** established the **dyarchy**, which is also spelled diarchy.
- The British-run executive branch of India's government was subjected for the first time to the **democratic ideal**.
- It was much **criticised**, yet it marked a turning point in British Indian administration and was a precursor to **India's eventual independence (1935)** and **total provincial autonomy (1947)**.
- The dyarchy constitutional change was advocated by **Edwin Samuel Montagu** and **Lord Chelmsford** while he served as India's secretary of state (1917–1922).

★ Additional Information:

- The **splitting** of each **provincial executive branch** into sections that were both dictatorial and answerable to the people formed the basis of **dyarchy**.
- The first was composed of representatives from the executive council, who were once more picked by the **monarch**.
- The **governor** chose the **ministers** for the second group from among the elected members of the **provincial assembly**.

Your Personal Exams Guide

90. Answer: a

Explanation:

The correct answer is Cuba.

★ Key Points

- Cuba is called the 'Sugar Bowl of the World'.
 - It has the largest sugar industry which is now decaying and its position is now taken up by Brazil followed by India.
 - It is an island in the Caribbean region.
 - The Cuban sugar economy is the principal agricultural economy in Cuba.

- Until 1960 Cuba was the largest Sugar Exporter in the world hence, the name Sugar Bowl of the World. But in the year 2017–18 Year Brazil started its lead in Sugar production which was about 38.9 million metric tons.
- **Cuba**
 - Capital : Havana
 - Currency : Cuban Peso

91. Answer: c

Explanation:

The correct answer is " **befell** ".

★ Key Points

- Let's look at the **meaning** of the **given words** .
 - **Fell**: to cut, knock, or bring down(past simple of fall).
 - **Fall**: (of a person) losing one's balance and collapse.
 - **Befell**: (especially of something bad) happens to (someone).
- As per the meaning of the given words, " **befell** " is the appropriate word choice for the blank.
- Options 1,2 and 4 are grammatically incorrect for the given blank.
- The implied meaning of the given sentence is that when the calamity struck the family, the person faced it boldly.
- Only **option 3** captures the meaning implied in the given sentence.

The complete sentence is :When Calamity**befell** the family, he faced it boldly.

Hence, the correct answer is **option 3** .

92. Answer: d

Explanation:

The correct answer is " **Lice** "

★ Key Points

- From the given options, only **option 4** is an **insect** .
 - **Vice** is a quality that means immoral or wicked behavior
 - **Rice** is a swamp grass that is widely cultivated as a source of food, especially in Asia.
 - **House** is a building for human habitation, especially one that consists of a ground floor and one or more upper floors.
 - **Lice** (plural) are small insects that live on the bodies of people or animals

Hence, the correct answer is **option 4 i.e lice**.

The correct sentence is :Lice are tiny, wingless, parasitic insects that feed on human blood.

93. Answer: a

Explanation:

The correct answer is "**Those** ".

★ Key Points

- Let's look at the usage of the given demonstratives:
 - **Those** : We use those with plural nouns. It is also used to convey the emotional distance that the speaker feels from a thing.
 - **That** : We use that for the singular noun. It is used to identify things that are distant from the speaker.
 - **This** : We use this for the singular noun. It is also used to point to people or things near the speaker.
 - **These** : We use these for plural nouns. It is also used to point to people or things near the speaker.
- In the given sentence, the speaker is stating that he/she/they really like watching old movies.

- So as per the above-mentioned usage of the demonstrations, " **those** " is the correct demonstrative to express the fondness that the speaker has for old movies.

The complete sentence is : *I really like watching old movies. Those are some of the best things on TV.*

Hence, the correct answer is **option 1**.

94. Answer: c

Explanation:

The correct answer is "it is most thrilling and exciting, there is no competition between individuals. "

★ Key Points

- It is mentioned in the last sentence of the given passage that while modern mountaineers prefer **difficult routes for the greater enjoyment of the sport** , the early climbers looked for the easiest ones, for **the summit was the prize they all set their eyes on**
- In the above-mentioned sentence, the **first clause** of the sentence implies modern mountaineers prefer difficult routes for greater enjoyment. The reader can infer from this sentence that mountaineering due to its difficulty generates thrill and excitement for its participant compared to other sports.
- In the above-mentioned sentence, the second clause of the sentence states **the early climbers looked for the easiest ones, for the summit was the prize they all set their eyes on** . The readers can infer from this that early climbers did not compete against each other but chose easier peaks as the final prize was to reach the summit.
- Only **option 3** captures the idea expressed in the given passage.
- Options 1,2 and 4 are not sufficiently addressed in the given passage.

Hence, the correct answer is **option 3** .

95. Answer: b

Explanation:

The correct answer is "they had to undertake them in their day to day life ."

★ Key Points

- It is mentioned in the **second sentence** of the given passage that in the Andes and Himalayas, difficult mountain journeys have inevitably **been part of their everyday life**.
- As per the above-mentioned sentence from the passage, we can infer that only **option 2** has the **correct reason** for the given question.
- As per the above-mentioned sentence, options 1,3, and 4 are not the correct reasons for the given question.

Hence, the correct answer is **option 2** .

96. Answer: a

Explanation:

The correct answer is "**Past Continuous Tense** ".

★ Key Points

- The given sentence is in the past continuous as we can observe the helping verb "**was** " (used for **past tense**) after the pronoun 'it'.
- The main verb "**raining** " is in the gerund form and the second verb "**reached** " is in the **past tense form** .
- The given sentence has the adverb "**still** " which is used to talk about **actions that continue up to a time** in the past, present, and future. It is used before the main verb in a sentence.
- We use the past continuous tense to talk about **ongoing actions in the past**.

- The speaker is stating that it was still raining(ongoing action) when he reached that place.

Hence, the correct answer is **option 1**.

97. Answer: c

Explanation:

The correct answer is "You will be laughed at by them "

★ Key Points

- The given sentence is in the **active voice** which has to be changed to the **passive voice**.
- There are a few rules to remember when hanging a sentence from active to passive voice.
 - The second-person pronoun " **you** " is the **object** in the **active** voice which will become the **subject clause** in the **passive** voice.
 - The passive voice constructions use the "to be" form of the verb which is " **be** " in the given passive voice sentence.
 - The **third-personsubject** pronoun " **they** " in the active voice will change to the **third-personobject** pronoun " **them** " in the passive voice.
 - The main verb " **laugh** "(V₁) in the active voice will take the past participle form(V₃) which is " **laughed** ".
- Only **option 3** has the correct passive voice sentence.

Hence, the correct answer is **option 3**.

98. Answer: b

Explanation:

The correct answer is "to admit something readily. ".

★ Key Points

- The meaning of the idiom "make no bones about" is to **have no hesitation in stating or dealing with (something), however unpleasant or awkward it is.**
- We use the given idiom in a situation where a person speaks the truth about something frankly or unapologetically.
 - **Example** : *She makes no bones about the fact that she is bad at keeping in touch with her friends.*

Hence, the correct answer is **option 1.**

99. Answer: d

Explanation:

The correct answer is "**Adjacent**"

★ Key Points

- Let's look at the **meaning** of the **given word** :
 - **Proximal** : situated close to the center, median line, or point of attachment or origin .
- Let's look at the **meaning** of the **given options** :
 - **Frontier**: a border between two countries ,especially one with official points where people or vehicles cross.
 - **Obscure**: not clear and difficult to understand or see
 - **Remote**: (of a place) situated far from the main centers of population; distant.
 - **Adjacent**: next to or adjoining something else.
- As per the meaning of the given words, "**adjacent**" is the one that best expresses the meaning of the given word.
 - **Example** : *The plot adjacent to your house is up for sale.*

Hence, the correct answer is **option 4.**

100. Answer: d

Explanation:

The correct answer is "Teacher asked the children if they had prepared well for the finals."

★ Key Points

- The given sentence is in **direct speech** so it will be changed to **indirect speech**.
- There are a few rules when changing a sentence from **direct** to **indirect** speech.
 - If the reporting verb is in the **past tense** of the direct speech, the tense of the sentence will change in indirect speech.
 - The given sentence is in the **present tense** in direct speech so it will change to the **past tense** in indirect speech.
 - The auxiliary verb "**have**" in direct speech will change to "**had**" in indirect speech.
 - The **interrogative sentence** in the direct speech will have the conjunction "**if or whether**" in the direct speech.
 - The second-person pronoun "**you**" in direct speech will change to the third-person pronoun "**they**" in indirect speech.
- Only **option 4** has the correct indirect speech sentence.

Hence, the correct answer is **option 4**.