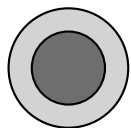


6. A spherical shell of outer radius R and inner radius $\frac{R}{2}$ contains a solid sphere of radius $\frac{R}{2}$ (see figure). The density of the material of the solid sphere is ρ and that of the shell is $\frac{\rho}{2}$. What is the average mass density of the larger sphere thus formed?



- (a) $\frac{3\rho}{4}$ (b) $\frac{9\rho}{16}$
 (c) $\frac{7\rho}{8}$ (d) $\frac{5\rho}{8}$
7. The human eye is like a camera that has a lens with:
- fixed focal length and fixed aperture size.
 - variable focal length and fixed aperture size.
 - fixed focal length and variable aperture size.
 - variable focal length and variable aperture size.
8. Under Article 371A of the Constitution of India, to which of the following items do the Acts of the Parliament of India not apply to the State of Nagaland, unless the Legislative Assembly of the state of Nagaland decides by a resolution?
- Religious or social practices of Nagas.
 - Naga Customary law and procedure.
 - Ownership and transfer of land and its resources.
 - Boundaries of Nagaland with other states.
- Select the answer using the code given below:
- (a) 1 only (b) 2 and 3 only
 (c) 1, 2 and 3 only (d) 1, 2, 3 and 4
9. Under Article 191 of the Constitution of India, a person shall be disqualified for being chosen as, and for being, a member of the Legislative Assembly or Legislative Council of a state if the person holds any office of profit under:
- the Government of India.
 - any State Government.
- Select the correct answer using the code given below:
- (a) 1 only (b) 2 only
 (c) Both 1 and 2 (d) Neither 1 nor 2
10. Consider the following UN Declarations/Covenants:
- Universal Declaration of Human Rights
 - Convention on the Elimination of All forms of Discrimination Against Women
 - International Covenant of Economic, Social and Cultural Rights
 - Convention on Refugees
- Which one of the following is the correct chronological order (starting with the earliest) of the above?
- (a) 1, 4, 3, 2 (b) 1, 2, 3, 4
 (c) 1, 3, 2, 4 (d) 4, 1, 2, 3
11. Which one of the following statements regarding the objectives of the 2nd Five-Year plan is *not* correct?
- Development of the basic and heavy industry sector.
 - Increase in national income to raise living standards.
 - Expansion of the consumer goods sector.
 - Expansion of employment opportunities.
12. Consider the following statements about the emergence of urban centres in India from circa 6th Century BCE:
- All of them developed away from the capitals of Mahajanpadas.
 - Major towns were located along routes of communication.
 - Many were bustling centres of commercial, cultural and political activity.
- How many of the above statements is/are correct?
- (a) 1 (b) 2
 (c) 3 (d) None
13. Consider the following statements about ancient Indian inscriptions:
- The earliest inscriptions are in Sanskrit.
 - Kharosthi script, used in inscriptions in the north-west, was deciphered with the help of coins of Indo-Greek kings who ruled over the area.
 - Most of the inscriptions mention grand, unique events and routine agricultural practices do not find mention.
- How many of the above statements is/are correct?
- (a) 1 (b) 2
 (c) 3 (d) None
14. The relative atomic mass of boron (which exists in two isotopic forms ^{10}B and ^{11}B) is 10.81. What will be the abundance of ^{10}B and ^{11}B , respectively (consider a sample of 100 atoms)?
- (a) 19% and 81% (b) 81% and 19%
 (c) 38% and 62% (d) 62% and 38%
15. Which among the following are essential constituents of Portland cement?
- Sand, lime, clay
 - Silica, alumina, lime

- (c) Silica, lime, graphite powder
(d) Sand, graphene, clay

16. Litmus, a well-known acid-base indicator, is derived from:

- (a) fungi (b) Lichens
(c) Bacteria (d) Termite

17. What is the oxidation state of Vanadium in V_2O_5 ?

- (a) + 2 (b) + 4
(c) + 3 (d) + 5

18. Match List-I with List-II and select the correct answer using the code given below the Lists:

| List-I (Allotrope of Carbon) | List-II (Property) |
|------------------------------------|------------------------------------|
| A. Graphite | 1. Thinnest and strongest material |
| B. Diamond | 2. Hardest natural substance |
| C. Fullerene | 3. Very light and strong material |
| D. Graphene | 4. Soft and slippery material |

Code:

- | A | B | C | D |
|-------|---|---|---|
| (a) 4 | 2 | 3 | 1 |
| (b) 4 | 3 | 2 | 1 |
| (c) 1 | 3 | 2 | 4 |
| (d) 1 | 2 | 3 | 4 |

19. Consider the following statements regarding the International Date Line:

- It is roughly 180° meridian, which deviates slightly East and West to avoid land areas surrounded by the Atlantic Ocean.
- The date to the East of this line is (24 hours) earlier than to the West.

Which of the statements given above is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

20. Which of the following statements regarding 'aurora' is/are correct?

- The solar wind upon reaching the Earth's atmosphere is directed towards two magnetic poles and a colourful display of lights is seen in the night sky.
- The particles interact with the different gases of the atmosphere and each gas glows with a particular colour.
- In April 2023, aurora was captured in the night sky in India by the Indian Astronomical Observatory at Hanle, Ladakh.

Select the answer using the code given below:

- (a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

21. Which of the following statements regarding *Barchan* is/are correct?

- It is a crescent-shaped mound of sand, which is deposited by the wind blowing constantly from one direction in a desert.
- The windward side has a convex steep slope with maximum height at the centre.
- Two ends of *Barchan* are called horns and point opposite to the direction the wind blows.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

22. Which of the following statements regarding Regur soil is/are correct?

- It is a light coloured, clayey and fertile soil.
- It is developed on Deccan basaltic lava under hot and humid conditions.
- Cotton is extensively cultivated in this soil.

Select the answer using the code given below:

- (a) 1 and 2 (b) 2 and 3
(c) 2 only (d) 3 only

23. Which of the following statements regarding clouds is/are correct?

- Clouds are classified on the basis of altitude and their form.
- According to altitude they are classified as High, Middle and Low clouds.
- Stratus, Nimbostratus and Stratocumulus are high clouds.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

24. Consider the following statements regarding 'fronts':

- The movement of a front causes a slow change in weather in the area over which it moves.
- Cold fronts are associated with thunderstorms.
- Warm front is the boundary between an advancing mass of warm air where it is overriding and rising above a mass of colder air.

Which of the statements given above is/are correct?

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

25. Consider the following statements regarding soils:

- Soils having a very high content of sodium and calcium and pH of more than 7.0 are alkaline soils.
- Black cotton soil had developed on the Deccan basaltic lava under hot and humid conditions.

3. Laterite soils are characterised by a deep weathered layer from which silica has been leached.

Which of the statements given above is/are correct?

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

26. Consider the following characteristics of a grassland:

1. An extensive area of mid-latitude grasslands are devoid of trees and shrubs.
2. The climate is characterised by hot summers, cold winters and relatively low rainfall occurring mainly in spring and summer.
3. In humid parts, grasses grow to a metre or more in height.

On the basis of the above characteristics, select the correct grassland from the options given below:

- (a) Steppes (b) Prairies
(c) Savanna (d) Pampas

27. Which of the following statements regarding animal cell membrane is correct?

- (a) They are composed of phospholipids only
(b) They are composed of proteins only.
(c) They are composed of phospholipids and proteins only.
(d) They are composed phospholipids, proteins and cholesterol (lipid).

28. Which of the following is *not* a part of compound microscope?

- (a) Mirror (b) Stage
(c) Clip (d) Retina

29. Which one of the following is the correct sequence in increasing complexity?

- (a) Protein–Organism–Tissue–Organ
(b) Protein–Organ–Tissue–Organism
(c) Protein–Organism–Organ–Tissue
(d) Protein–Tissue–Organ–Organism

30. Consider the following cell types:

1. Monocyte
2. Chondrocyte
3. Basophil
4. Lymphocyte

How many of the above belong to animal cell types?

- (a) 1 (b) 2
(c) 3 (d) 4

31. In the human digestive system, which one among the following is the role of the pancreas?

- (a) Secretion of surfactants to break up lipid droplets
(b) Storage and regulated release of bile
(c) Secretion of lipase, amylase and protease
(d) Neutralising stomach acids

32. Consider the following statements:

1. DNA replication takes place when chromatin is opened up.
2. Chromatin organises itself into rod-shaped chromosomes before cell division.
3. Both prokaryotes and eukaryotes have the same process for cell division.

Which of the statements given above is/are correct?

- (a) 1 only (b) 1 and 2 only
(c) 1, 2 and 3 (d) 3 only

33. A uniform meter scale of mass 0.24 kg is made of steel. It is kept on two wedges, W_1 and W_2 , in a horizontal position. W_1 is at a distance of 0.2 m from one of its ends, while W_2 is at distance of 0.4 m from the other end. If the force on the scale is N_1 due to W_1 and N_2 due to W_2 , then : (take $g = 10.0 \text{ m s}^{-2}$)

- (a) $N_1 = 1.6 \text{ N}$ and $N_2 = 0.8 \text{ N}$
(b) $N_1 = 0.8 \text{ N}$ and $N_2 = 1.6 \text{ N}$
(c) $N_1 = 0.6 \text{ N}$ and $N_2 = 1.8 \text{ N}$
(d) $N_1 = 1.8 \text{ N}$ and $N_2 = 0.6 \text{ N}$

34. Escape speed from the Earth is close to 11.2 km s^{-1} . On another planet whose radius is half of the Earth's radius and whose mass density is four times that of the Earth, the escape speed in km s^{-1} will be close to:

- (a) 11.2 (b) 15.8
(c) 5.6 (d) 7.9

35. Which one of the following does *not* apply to sound waves in fluids?

- (a) They transport energy.
(b) They need a medium to travel.
(c) They are transverse.
(d) They travel faster in liquids than in gases.

36. A ball of 0.1 kg mass is dropped on a hard floor from a height of 0.45 m and rises to a height of 0.20 m. If it was in touch with the floor for 0.1 s, the net force it applied on the floor while bouncing is : (take the gravitational acceleration $g = 10 \text{ m s}^{-2}$)

- (a) 1.0 N (b) 6.0 N
(c) 3.0 N (d) 5.0 N

37. Which one of the following statements regarding simple pendulum is correct?

Simple pendulum has a time period independent of amplitude :

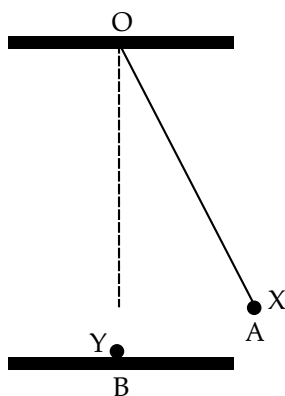
- (a) only for small amplitudes because then the net force on its bob is independent of its displacement.
(b) for any amplitude because the net force on the bob is always proportional to its displacement.
(c) for any amplitude because the net force on the bob is independent of its displacement.

(d) only for small amplitudes because then the net force on its bob is proportional to its displacement.

38. Which one of the following about different frictional forces is correct?

- (a) Kinetic friction > Static friction > Rolling friction
 (b) Static friction > Rolling friction > Kinetic friction
 (c) Static friction > Kinetic friction > Rolling friction
 (d) Static friction > Kinetic friction = Rolling friction

39. A metallic bob X of mass m is released from position A. It collides elastically with another identical bob Y placed at rest at position B on a horizontal frictionless table. The angle AOB is 30° .



How high does the bob X rise immediately after the collision?

- (a) To the same height as that of position A on the other side in the same trajectory.
 (b) To half the height as that of position A on the other side along the same trajectory.
 (c) The same height at position A.
 (d) It stops at position B.

40. Consider the two statements given below:

Statement 1: Infrared waves are also called heat waves.

Statement 2: Water molecules readily absorb infrared waves.

Select the correct answer using the code given below:

- (a) Both the statements are individually true and Statement 2 is the correct explanation of Statement 1.
 (b) Both the statements are individually true, but Statement 2 is *not* the correct explanation of Statement 1.
 (c) Statement 1 is true, but Statement 2 is false.
 (d) Statement 2 is true, but Statement 1 is false.

41. Which of the following statements are correct?

1. British 'trade surplus' with India in the nineteenth century meant that the value of British exports to India was much higher than the value of British imports from India.
2. India played a crucial role in the late-nineteenth-century world economy by helping Britain balance its deficits.
3. Britain grew opium in India and exported it to China and, therefore, for a while after the 1820s, opium became India's single largest export.
4. The nineteenth century saw export of Indian raw materials decline and that of manufactured goods increase.

Select the answer using the code given below :

- (a) 1 and 2 only (b) 3 and 4 only
 (c) 1, 2, 3 and 4 (d) 1, 2 and 3 only

42. Match List-I with List-II and select the correct answer using the code given below the Lists :

List-I
 (Unit in use in
 early India)

- A. *Muhurta*
 B. *Raktika*
 C. *Angula*
 D. *Pada*

List-II
 (Content)

1. Measure of weight
2. Measure of time
3. Metre of poetry
4. Measure of length

Code:

- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 2 | 1 | 4 | 3 |
| (b) | 2 | 4 | 1 | 3 |
| (c) | 3 | 4 | 1 | 2 |
| (d) | 3 | 1 | 4 | 2 |

43. First coins in Indian history bearing the names and images of rulers were issued by the:

- (a) Mauryas (b) Pushyabhutis
 (c) Guptas (d) Indo-Greeks

44. Social theorists in the nineteenth and twentieth centuries emphasised the emergence of industrialisation, urbanisation, secularisation and bureaucratisation as hallmarks of:

- (a) Modernity (b) Feudalism
 (c) Kingship (d) Medievalism

45. Consider the following events:

1. Launch of Non-Cooperation Movement
2. All-India Khilafat Conference in delhi
3. Passing of the Rowlatt Act
4. Jallianwala Bagh incident

Which one of the following is the correct chronological order of the given events (earliest to latest)?

- (a) 1, 2, 3, 4 (b) 3, 4, 2, 1
 (c) 3, 2, 4, 1 (d) 2, 3, 4, 1

46. Match List-I with List-II and select the correct answer using the code given below the Lists:

| List-I (System/Category) early India) | List-II (Description) |
|---|---|
| A. <i>Upari</i> | 1. Peasants directly responsible for the payment of revenue |
| B. <i>Pattadar</i> | 2. Category of tenancy tenure held under the Marathas |
| C. <i>Mirasidar</i> | 3. Gifts of land or land revenue |
| D. <i>Inam lands</i> | 4. Co-parcenary title holder and designated revenue payer in southern India |

Code:

| | A | B | C | D |
|-----|---|---|---|---|
| (a) | 2 | 1 | 4 | 3 |
| (b) | 2 | 4 | 1 | 3 |
| (c) | 3 | 4 | 1 | 2 |
| (d) | 3 | 1 | 4 | 2 |

47. Which of the following statements about Vijayanagara king Krishnadevaraya's expeditions are correct?

- In the early years of his reign he marched against the ruler of Orissa.
 - In 1520 CE, he captured the fort of Raichur from Ismail Adil Khan.
 - Krishnadevaraya restored Sultan Mahmud Shah to power and assumed the title of *Yavana-rajya-sthapan-acharya*.
- (a) 1 and 3 only (b) 2 and 3 only
(c) 1, 2 and 3 (d) 1 and 2 only

48. Water gas is a mixture of:

- (a) CO_2 and H_2 (b) CO and H_2
(c) CO_2 and H_2O (d) CO and H_2O

49. Human body works in the pH range of:

- (a) 6.8 – 7.2 (b) 7.0 – 7.8
(c) 6.5 – 7.5 (d) 7.5 – 8.0

50. Which one among the following statements with reference to the properties of water is *not* correct?

- (a) The specific heat of water is abnormally high.
(b) Latent heat of fusion of water is very low.
(c) Density of water is higher than ice.
(d) Pure water is a non-conductor of electricity.

51. Which one among the following compounds has a sweet and fruity smell?

- (a) Ethyl alcohol (b) Acetic acid
(c) Ethyl acetate (d) Acetophenone

52. What is the coordination number of Na^+ and Cl^- ions in NaCl lattice?

- (a) 6, 1 (b) 1, 6
(c) 6, 6 (d) 5, 5

53. Which one among the following is present in the nettle leaf hairs that causes burning pain?

- (a) Methanoic acid (b) Ethanoic acid
(c) Benzoic acid (d) Acetic acid

54. Which one among the following is known as Milk of Magnesia?

- (a) Magnesium bicarbonate
(b) Magnesium carbonate
(c) Magnesium sulphate
(d) Magnesium hydroxide

55. Soap with water forms:

- (a) Metallotropic liquid crystal
(b) Thermotropic liquid crystal
(c) Homogeneous solution
(d) Lyotropic liquid crystal

56. Which among the following is the correct composition of Borax?

- (a) Sodium, Boron, Magnesium and Hydrogen
(b) Sodium, Boron, Oxygen and Hydrogen
(c) Potassium, Boron, Oxygen and Hydrogen
(d) Sodium, Boron, Nitrogen and Hydrogen

57. Which one among the following oxides has the highest melting point?

- (a) Na_2O (b) MgO
(c) Fe_2O_3 (d) CuO

58. Which of the following statements regarding neap tides is/are correct?

- It occurs every 14-15 days, which coincides with the first and third quarter of the Moon.
- This tide has a small tidal range because the gravitational forces of the Moon and the Sun are in quadrature.

Select the answer using the code given below:

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

59. Which of the following statements regarding earthquakes is/are correct?

- The point on the Earth's surface directly above the focus is called the epicentre of the earthquake.
- Earthquakes generate Primary and Secondary waves that radiate outward from the earthquake focus.
- Deep-focus earthquakes are likely to cause more damage than shallow-focus earthquakes.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

60. Which of the following statements regarding air temperature is/are correct?

1. Air temperature is measured at a standard height of 1.2 m (4.0 feet) above the ground surface.
2. The average rate of temperature decrease with height is termed as the environmental temperature lapse rate.

Select the answer using the code given below:

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

61. Which of the following statements regarding humidity is/are correct?

1. It is a ratio between the actual amount of water vapour present in the atmosphere and the maximum amount it can hold at a given temperature.
2. When the relative humidity is high, more water evaporates from the skin.
3. Higher the air temperature lower the relative humidity of the air.

Select the answer using the code given below:

- (a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

62. Which of the following statements regarding cyclones and anti-cyclones is/are correct?

1. In the Northern Hemisphere, cyclones rotate counter-clockwise and anticyclones rotate clockwise.
2. Cyclones are often associated with cloudy or rainy weather, whereas anticyclones are often associated with fair weather.
3. In the Southern Hemisphere, the cyclonic spiral will be clockwise because the Coriolis force acts to the left.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

63. Identify the sea-port in India on the basis of the given characteristics:

1. It is more than a century old port on the west coast of India.
2. It is a natural harbour protected by a breakwater and also by a mole.
3. A deep draft channel of about 14 metres depth permits large vessels to enter the harbour.

Select the correct sea-port from the options given below:

- (a) Mormugao Port
(b) Deendayal Port
(c) Cochin Port
(d) Jawaharlal Nehru Port

64. Identify the Iron and Steel Plant on the basis of the given characteristics:

1. It receives coal from Jharia and iron-ore from Sundargarh and Kendujhar.
2. Power for the electric furnaces is procured from Hirakund.
3. Water is obtained from Koel and Sankh rivers.

Select the correct Iron and Steel Plant from the options given below:

- (a) Bhilai Steel Plant
(b) Durgapur Steel Plant
(c) Rourkela Steel Plant
(d) Bokaro Steel Plant

65. Which of the following statements regarding Earth's internal structure is/are correct?

1. The oceanic crust is heavier than the continental crust.
2. Most of the Earth's internal heat is contained within the mantle.
3. Large convective cells in the crust circulate heat and drive plate-tectonic processes.

Select the answer using the code given below:

- (a) 3 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

66. Which of the following statements regarding the given river is/are correct?

1. Tsangpo crosses over into India under the name of Dihang.
2. Godavari has the second largest river basin covering about 10 percent of the area of India.
3. Rivers Chambal and Betwa are the important tributaries of river Ganga which join river Ganga directly in Uttar Pradesh.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

67. Which of the following statements regarding the World Climate Types and their relation with the Inter tropical Convergence Zone (ITCZ) is/are correct?

1. Tropical Wet Climate is one of the world's rainiest due to the dominance of the ITCZ over it.
2. Tropical Savanna Climate experiences a distinctive alternation of wet and dry seasons, caused chiefly by the seasonal shift in latitude of the subtropical highs and ITCZ.
3. The Tropical Monsoonal Climate experiences heavy rainfall as a consequence of the nearness of the ITCZ for much of the year.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

68. Which of the following statements regarding tropical cyclones is/are correct?

1. These storms develop during the summer and autumn in every tropical ocean except and South Atlantic and eastern South Pacific Oceans.
2. Tropical cyclones that occur in the North Atlantic and eastern North Pacific Oceans are known as typhoons.
3. Tropical cyclones that occur in the Indian and South Pacific Oceans are called cyclones.

Select the answer using the code given below:

- (a) 3 only (b) 1 and 2 only
(c) 1 and 3 only (d) 1, 2 and 3

69. Identify the land biome on the basis of the given characteristics:

1. Their climates are characterised by high rainfall and temperatures that vary from cold to mild.
2. These forests contain primarily deciduous trees-including maple, oak, hickory and beechwood.
3. Raccoons, opossums, bats and squirrels are found in the trees.

Select the correct land biome from the options given below:

- (a) Tropical forest
(b) Temperate forest
(c) Boreal forest
(d) Mediterranean forest

70. Leaves of most plants appear green because the chlorophyll present in it:

- (a) absorbs red and blue light while reflecting green light.
(b) absorbs green light only.
(c) absorbs green light while reflecting red and blue light.
(d) reflects red light and absorbs blue and green light.

71. In most prokaryotes, the chromosome number is:

- (a) 4 (b) 3
(c) 2 (d) 1

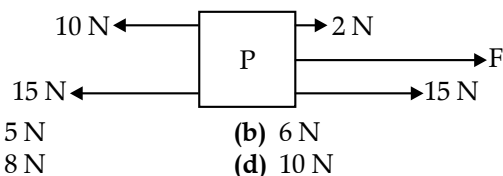
72. Bacterial DNA is referred to as naked because it is *not* associated with:

- (a) any scaffold (b) proteins
(c) ribozymes (d) plasmid

73. Which one among the following cells produces antibodies against a foreign antigen?

- (a) Lymphocytes (b) Erythrocytes
(c) Eosinophils (d) Platelets

74. If the block P as shown in the figure below were to be at rest, what should the magnitude of force F be?

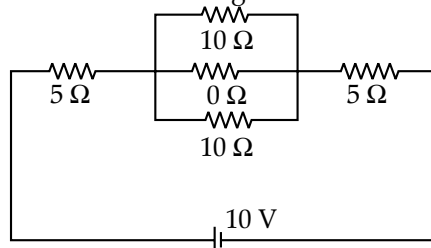


- (a) 5 N (b) 6 N
(c) 8 N (d) 10 N

75. Of the following, which does *not* belong to a nuclear reactor?

- (a) A turbine
(b) A heat exchanger
(c) A mechanism to reduce CO₂ emission
(d) A reaction chamber

76. Consider the following electric circuit:



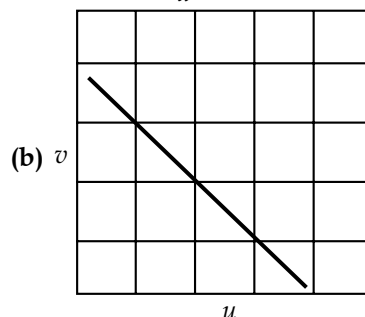
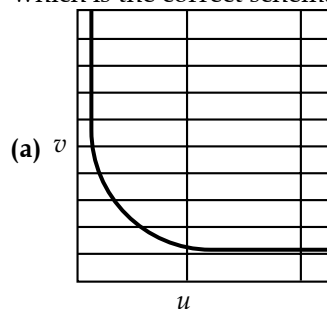
The current in the above electric circuit is:

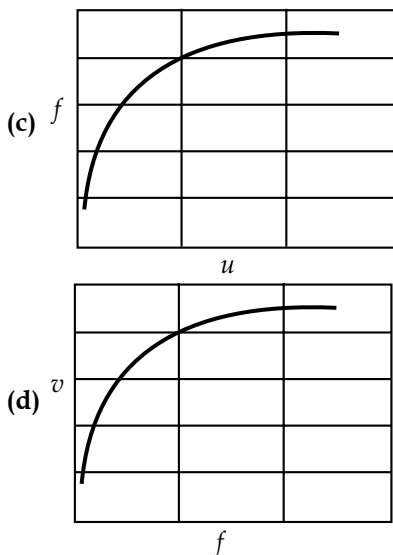
- (a) 1 A (b) $\left(\frac{10}{15}\right)$ A
(c) 2 A (d) 1.5 A

77. A microscope may be a combination of:

- (a) two convex lenses.
(b) a convex and a concave lens.
(c) two concave lenses.
(d) a convex lens and a convex mirror.

78. For a human eye, where u is the distance of an object from the eye, f is the focal length of the lens and v is the distance of image from the eye, which is the correct schematic graph?





79. Which of the following statements with regard to the phenomenon of the primary rainbow formation by water droplets is/are correct?

1. It involves refraction and one internal reflection of sunlight.
2. It involves refraction of sunlight only.
3. It is formed as the inner bow.
4. It may involve more than one internal reflection as well as refraction of sunlight.

Select the answer using the code given below:

- (a) 1 only (b) 1 and 3
(c) 3 and 4 (d) 2 and 3

80. Which one of the following scientists mentioned that an electron in an atom could revolve in certain stable orbits without the emission of radiant energy?

- (a) Ernest Rutherford (b) J.J. Thomson
(c) Niels Bohr (d) Albert Einstein

81. LIGO experiment confirmed one of the predictions of:

- (a) String theory
(b) Special theory of relativity
(c) Quantum mechanics
(d) General theory of relativity

82. A block of mass 2 kg, moving with the initial speed of 3 m/s comes to rest on a rough horizontal surface after travelling a distance of 3 m, The magnitude of the frictional force is:

- (a) 9 N (b) 3 N
(c) 18 N (d) 1 N

83. Which one of the following is primarily responsible for conduction of current in a metal?

- (a) Bound electrons
(b) Free electrons
(c) Both bound and free electrons
(d) Ions

84. Which of the following were features of the postal system of India as described by Ibn Battuta?

1. The foot post carries a ringing bell in one hand.
2. The horse post is called *uluq*, stationed at a distance of every four miles.
3. The foot post or *dawa* has one station at every four *kos* of distance.
4. The foot post is quicker than horse post.

Select the correct answer using the code given below:

- (a) 1, 2 and 4 (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 3 and 4

85. Which one of the following texts is a commentary written by Chakrapanidatta (11 Century CE from Bengal) on the Sushrut Samhita?

- (a) Sabdachandrika (b) Bhanumati
(c) Nitiratnakara (d) Lohasarvasava

86. Consider the following statements about the arrival of tobacco in India:

1. Tobacco plant arrived first in the Deccan.
2. Tobacco spread to northern India in the early years of the seventeenth century.

Which of the statements given above is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

87. Consider the following Women's Associations and their important associates in early twentieth century India:

1. Women's Indian Association of 1917 : Margaret Cousins
2. National Council of Women in India of 1925 : Sarala Devi Chaudhurani
3. Bharat Stree Mahamandal of 1910 : Lady Meherbai Tata

Which of the above pairs is/are correctly matched?

- (a) 1, 2 and 3 (b) 2 and 3 only
(c) 1 and 2 only (d) 1 only

88. Consider the following statements about the issue of separate electorates during the early decades of the twentieth century in India as a means to secure adequate representation for the deprived social categories in the absence of universal adult franchise:

1. The All India Depressed Classes Association led by M.C. Rajah was staunchly in favour of joint electorates
2. The All India Depressed Classes Leaders' Conference demanded separate electorate.
3. The Communal Award in September 1932 recognised the right to separate electorates for the 'untouchables'.

Which of the statements given above are correct?

- (a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

89. Which of the following statements with regard

to the famous 'silk routes' are correct?

1. Silk routes refer to East-bound European silk cargoes along these routes.
2. There were several silk routes, over land and by sea, joining together vast regions of Asia with Europe and northern Africa.
3. They are known to have existed since before the Christian Era and thrived almost till the fifteenth century.
4. Besides silk, Chinese pottery, textiles and spices from India and South-east Asia travelled the same route.

Select the answer using the code given below :

- (a) 1, 2 and 3 (b) 1, 3 and 4
(c) 2, 3 and 4 (d) 1, 2 and 4

90. Consider the following statements about Ajanta paintings:

1. The surface of the rock was coated with clay mixed with rice husk and gum and a coat of lime was applied over this.
2. The outline drawing was done first on the lime coating and colours were added subsequently.

Which of the statements given above is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

91. Which of the following statements with regard to the Square Kilometer Array (SKA) project is/are correct?

1. SKA is a state of the art, mega science international facility to build the world's biggest and most sensitive radio telescope for addressing a wide variety of cutting-edge science goals.
2. The Government of India has accorded its approval for India's participation in the international mega science project.

Select the answer using the code given below:

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

92. Exercise Desert Cyclone is a joint military exercise between India and:

- (a) Kuwait
(b) Saudi Arabia
(c) United Arab Emirates
(d) Oman

93. Which of the following statements with regard to the constitution of Finance Commission is/are correct?

1. The Government of India has recently constituted the Sixteenth Finance Commission under the Chairmanship of Dr. Arvind Panagariya.
2. Finance Commission is constituted in pursuance to Article 263 of the Constitution of India.

Select the answer using the code given below:

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

94. Recently the Ministry of Environment, Forest and Climate Change has submitted three nominations from India for Wetland City Accreditation (WCA) under the Ramsar Convention on Wetlands. Which one among the following cities is *not* one among them?

- (a) Indore (b) Bhopal
(c) Udaipur (d) Jodhpur

95. Which of the following statements is/are correct?

1. In India, 12th March is celebrated as the National Youth Day.
2. National Youth day is celebrated to commemorate the birth anniversary of Swami Vivekananda.

Select the answer using the code given below:

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

96. Consider the following statements about *INS Sagardhwani*:

1. It is an oceanographic research vessel of Naval Physical and Oceanographic Laboratory (NPOL) of DRDO.
2. Recently it embarked on the Sagar Maitri Mission-4 to establish long-term scientific partnerships with Indian Ocean Rim countries in Ocean Research and Development.

Which of the statements given above is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

97. Who among the following is the Chairman of the Committee constituted by the Government of India to examine the issue of holding simultaneous elections in the country and to make recommendations thereon?

- (a) Union Home Minister Shri Amit Shah
(b) Chief Justice of India Shri Dhananjaya Yeshwant Chandrachud
(c) Former President of India Shri Ram Nath Kovind
(d) Chief Election Commissioner of India Shri Rajiv Kumar

98. In January 2024, India's first all-girls' Sainik School was inaugurated at:

- (a) Bhopal (b) Kohima
(c) Vrindavan (d) Namsai

99. In February 2024, Government of India has decided to scrap the Free Movement Regime (FMR) between India and :

- (a) Myanmar (b) Bhutan
(c) Bangladesh (d) Nepal

100. Who among the following is the author of the book *Why Bharat Matters*?

- (a) L.K. Advani (b) S. Jaishankar
(c) Mohan Bhagwat (d) Pranab Mukherjee

Answer Key

| Q. No | Answer Key | Topic's Name | Chapter's Name |
|-------|------------|---|------------------------------|
| 1 | b | Combination of Resistors | Current Electricity |
| 2 | c | Series and Parallel Combination of Cell | Current Electricity |
| 3 | d | Electric Current | Current Electricity |
| 4 | a | Electric Charges | Electrostatics |
| 5 | d | Fundamental Forces | Physical World |
| 6 | b | Density | Physical World |
| 7 | d | Human Eye | Ray Optics |
| 8 | c | Elementary study of Indian constitution and administration | History and Freedom Movement |
| 9 | c | Elementary study of Indian constitution and administration | History and Freedom Movement |
| 10 | a | United Nations | History and Freedom Movement |
| 11 | c | Elementary Knowledge of Five Year Plans | History and Freedom Movement |
| 12 | b | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 13 | b | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 14 | a | Average Atomic Mass | Structure of Atom |
| 15 | a | Rocks and their classification | Geography |
| 16 | b | Lichens | Biological Classification |
| 17 | d | Oxidation States | Redox Reaction |
| 18 | a | Allotropes of Carbon | Carbon and its Compound |
| 19 | d | International Date Line | Geography |
| 20 | d | Latitudes and Longitudes | Geography |
| 21 | b | Major Natural regions of the world | Geography |
| 22 | b | Regional Geography of India | Geography |
| 23 | b | Condensation and Precipitation | Geography |
| 24 | d | Atmospheric Pressure | Geography |
| 25 | d | Regional Geography of India | Geography |
| 26 | a | Major Natural regions of the world | Geography |
| 27 | d | Animal Cell and Plant Cell | Cell and Cell Organelles |
| 28 | d | Microscopy | Microscopic World |
| 29 | d | Cells | Cell and Cell Organelles |
| 30 | d | Animal cells | Cell and Cell Organelles |
| 31 | c | Digestive System | Human Digestive System |
| 32 | b | DNA Replication | DNA Replication |
| 33 | c | Torque | Rotational Motion |
| 34 | a | Escape Velocity | Gravitation |
| 35 | c | Properties of Sound Waves | Waves |
| 36 | d | Work-Energy Theorem | Work, Energy and Power |
| 37 | d | Time Period of Simple Pendulum | Oscillations |
| 38 | c | Friction | Laws of Motion |
| 39 | d | Elastic Collision | Laws of Motion |
| 40 | b | Properties of EMW | EMW |
| 41 | d | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 42 | a | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 43 | d | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 44 | a | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 45 | c | Freedom movement in India | History and Freedom Movement |
| 46 | a | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |

| | | | |
|-----|---|---|------------------------------|
| 47 | c | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 48 | b | Water Gas Composition | Hydrogen |
| 49 | b | Human body pH | Human Circulatory System |
| 50 | b | Latent Heat | States of Matter |
| 51 | c | Ester | Carbon and its Compounds |
| 52 | c | Ionic Compounds | Metal and Non Metals |
| 53 | a | Chemical Formula | Carbon and its Compounds |
| 54 | d | Antacid | Acid, Base and Salt |
| 55 | d | Soap | Solution |
| 56 | b | Composition of Borax | s-block |
| 57 | b | Melting Point of Compound | Metal and Non Metals |
| 58 | c | Ocean Current and Tides | Geography |
| 59 | b | Earthquakes and Volcanoes | Geography |
| 60 | b | Temperature and Atmospheric Pressure | Geography |
| 61 | c | Humidity | Geography |
| 62 | d | Cyclones and Anticyclones | Geography |
| 63 | a | Important Sea ports | Geography |
| 64 | c | Mineral and Power Resources | Geography |
| 65 | b | Earth | Geography |
| 66 | b | Regional Geography of India | Geography |
| 67 | d | Types of climates | Geography |
| 68 | c | Cyclones and Anticyclones | Geography |
| 69 | b | Types of Biomes | Ecosystem |
| 70 | a | Plant Cell | Plant and Animal Cell |
| 71 | d | Prokaryotic Cells | Cell and Cell Organelles |
| 72 | b | Prokaryotic Cells | Cell and Cell Organelles |
| 73 | a | Antibodies | Immune System |
| 74 | c | Force | Work, Energy and Power |
| 75 | c | Nuclear Reactor | Nuclei |
| 76 | a | Combination of Resistors | Current Electricity |
| 77 | a | Microscope | Ray Optics |
| 78 | c | Human Eye | Ray Optics |
| 79 | b | Rainbow | Ray Optics |
| 80 | c | Radiant Energy | Structure of Atom |
| 81 | d | Gravitaional Waves | Gravitation |
| 82 | b | Force | Work, Energy and Power |
| 83 | b | Conductors | Semiconductor Electronics |
| 84 | a | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 85 | b | Impact of Science and Technology on Society | History and Freedom Movement |
| 86 | c | Exploration and Discovery | History and Freedom Movement |
| 87 | d | Freedom movement in India | History and Freedom Movement |
| 88 | d | Elementary study of Indian constitution and administration | History and Freedom Movement |
| 89 | c | Exploration and Discovery | History and Freedom Movement |
| 90 | c | A broad survey of Indian History, with emphasis on culture and civilisation | History and Freedom Movement |
| 91 | c | Latest events around the world | Current Affairs |
| 92 | c | Latest events in India | Current Affairs |
| 93 | a | Latest events in India | Current Affairs |
| 94 | d | Latest events in India | Current Affairs |
| 95 | b | Cultural activity in India | Current Affairs |
| 96 | c | Latest events in India | Current Affairs |
| 97 | c | Latest events in India | Current Affairs |
| 98 | c | Latest events in India | Current Affairs |
| 99 | a | Latest events in India | Current Affairs |
| 100 | b | Prominent National Personality | Current Affairs |

ANSWERS WITH EXPLANATION**1. Option (b) is correct.***Explanation:* Equivalent Resistance,

$$y = R + R \parallel y$$

$$\Rightarrow y = R + \frac{R \times y}{R + y}$$

$$\Rightarrow y = \frac{R^2 + Ry + Ry}{R + y}$$

$$\Rightarrow Ry + y^2 = R^2 + 2Ry$$

$$\Rightarrow y^2 - 4y - 16 = 0$$

$$\Rightarrow R_{eq} \text{ or } y = 2 + 2\sqrt{5} \text{ ohm}$$

2. Option (c) is correct.*Explanation:*

$$\begin{aligned} \text{Equivalent voltage} &= \frac{\varepsilon_1 r_1 + \varepsilon_2 r_2}{r_1 + r_2} \\ &= \frac{1 \times 0.1 + 5 \times 0.1}{0.1 + 0.1} \\ E_{eq} &= \frac{0.6}{0.2} = 3 \text{ V} \end{aligned}$$

From first circuit, we have

$$i = \frac{\varepsilon}{R + r}$$

Value of r is very less can be neglected as compared to R

$$\text{Now, } i = \frac{\varepsilon}{R}$$

$$10^{-3} = \frac{1}{R}$$

$$R = 10^3 = 1000 \text{ ohm}$$

Now, from second circuit

$$i_1 = \frac{E_{eq}}{R + r_{eq}} = \frac{3}{1000}$$

$$i_1 = 3 \times 10^{-3} = 3 \text{ mA}$$

3. Option (d) is correct.*Explanation:* Given, $i = 15 \text{ A}$,

$$t = 10 \times 60 = 600 \text{ s}$$

$$q = it = 15 \times 600 = 9000 \text{ C}$$

4. Option (a) is correct.*Explanation:* Lightning rods are always pointed to attract charges towards it.**5. Option (d) is correct.***Explanation:* All of these are four fundamental force in nature.**6. Option (b) is correct.***Explanation:* Average density = $\frac{\text{Total mass}}{\text{Total volume}}$

$$= \frac{\rho_1 V_1 + \rho_2 V_2}{V}$$

$$= \frac{\rho \times \frac{4}{3} \pi \left(\frac{R}{2}\right)^3 + \rho \left[\frac{4}{3} \pi R^3 - \frac{4}{3} \pi \left(\frac{R}{2}\right)^3\right]}{\frac{4}{3} \pi R^3}$$

$$= \frac{\rho \times \frac{4}{3} \pi \frac{R^3}{8} + \rho \left[\frac{4}{3} \pi R^3 - \frac{4}{3} \pi \frac{R^3}{8}\right]}{\frac{4}{3} \pi R^3}$$

$$= \frac{\rho}{8} + \frac{\rho}{2} \left[1 - \frac{1}{8}\right] = \frac{\rho}{8} + \frac{\rho}{2} \left[\frac{7}{8}\right] = \frac{\rho}{8} + \frac{7\rho}{16}$$

$$= \frac{2\rho + 7\rho}{16} = \frac{9\rho}{16}$$

7. Option (d) is correct.*Explanation:* Human eye changes its focal length according to distance and aperture according to intensity of light.**8. Option (c) is correct.***Explanation:* Article 371A states that no act of Parliament shall apply to Nagaland in respect of the religious or social practices of the Nagas, the Naga customary law and procedure, the administration of civil and criminal justice involving decisions according to the Naga customary law and the ownership and transfer of land and its resources, unless the Nagaland Legislative Assembly decides otherwise by a resolution.

9. Option (c) is correct.

Explanation: Article 191 of the Indian Constitution is related to the disqualifications for membership of the State Legislative Assembly or Legislative Council. A person will be disqualified if:

- He or she holds any office of profit under the Government of India or of any state specified in the First Schedule, other than the ones approved as exceptions.
- A person is declared to be of unsound mind by a competent court.
- The person is an undischarged insolvent.
- The person does not hold Indian citizenship, or he has voluntarily acquired the citizenship of a foreign State, or he owes allegiance or adherence to a foreign State.
- A person is disqualified by or under any law made by Parliament.
- A person can be disqualified on grounds of defection under the Tenth Schedule of the Constitution. This includes changing party affiliation before or after an election.

10. Option (a) is correct.

Explanation: The Universal Declaration of Human Rights (UDHR) was adopted by the UN General Assembly in 1948 and is related to the rights and freedoms of all human beings. The Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) was adopted by the UN General Assembly in 1979 and came into effect on September 3, 1981. The International Covenant on Economic, Social and Cultural Rights (ICESCR) was adopted by the United Nations General Assembly (GA) on December 16, 1966, and it came into force on January 3, 1976. All the countries that are party to this treaty are expected to work towards granting the economic, social and cultural rights to all individuals living in the respective countries.

The Convention on Refugees is also known as the 1951 Refugee Convention. This convention defines refugees, the rights provided under asylum and the responsibilities of the countries that grant asylum.

11. Option (c) is correct.

Explanation: The Second Five-Year Plan (1956-1961) focused on public sector development and rapid industrialization based on the Mahalanobis Model. The allocated budget was ₹48 billion with a targeted growth rate of 4.5%.

12. Option (b) is correct.

Explanation: The Mahajanapadas (6th-4th centuries BCE) were dominant political entities that emerged after the decline of the early Vedic period. These territorial units or republics coincided with urbanization and state formation. Urban centers displayed advanced planning, infrastructure, and drainage systems.

13. Option (b) is correct.

Explanation: The earliest inscriptions were written in Prakrit language in the Brahmi script. These can be found in the Edicts of Ashoka.

14. Option (a) is correct.

Explanation: Formula used,

$$\text{Average atomic mass} = \frac{\sum \% \text{ abundance} \times \text{atomic mass}}{\sum \text{total abundance}}$$

Let % of B¹⁰ = x

% of B¹¹ = 100 - x

average atomic mass = 10.81

$$10.81 = \frac{x \times 10 + (100 - x) \times 11}{100}$$

$$1081 = 10x + 1100 - 11x$$

$$-19 = -x$$

$$x = 19$$

% of B¹⁰ = 19%

% of B¹¹ = 81%

15. Option (a) is correct.

Explanation: The essential constituents of Portland cement are lime, sand and clay. Clay mainly contain silica (SiO₂) along with the oxides of Al, Fe and Mg.

16. Option (b) is correct.

Explanation: Litmus is derived from lichens, which are symbiotic organisms made up of fungi and either algae or cyanobacteria. Litmus is extracted from certain species of lichens, particularly *Rocella tinctoria* and *Lecanora tartarea*.

17. Option (d) is correct.

Explanation: The oxidation state of vanadium in V₂O₅ = +5

The oxidation state of O-atom is -2.

Let oxidation state of vanadium = x

$$V_2O_5 = 0$$

$$2x + (-2 \times 5) = 0$$

$$2x - 10 = 0$$

$$2x = +10$$

$$x = \frac{+10}{2} = +5$$

18. Option (a) is correct.*Explanation:*

- | | |
|--------------|-------------------------------------|
| A. Graphite | 4. Soft and slippery |
| B. Diamond | 2. Hardest natural substance |
| C. Fullerene | 3. Very light and strong material |
| D. Graphene | 1. Thinnest and strongest material. |

19. Option (d) is correct.

Explanation: The International Date Line (IDL) is an imaginary line running from the North Pole to the South Pole. It serves as the boundary between one calendar day and the next. On crossing IDL from West to East, one day is subtracted. Conversely, on moving from east to west, one day is added. It roughly follows the 180th meridian of longitude.

20. Option (d) is correct.

Explanation: All the given statements are correct.

21. Option (b) is correct.

Explanation: The two ends of Barchan are called horns and they are downwind in direction, which means they point in the direction toward which the wind is blowing and where the sand is being deposited or accumulated.

22. Option (b) is correct.

Explanation: Regur soil is also known as black soil and is ideal for growing cotton. It is commonly found in the northwest Deccan plateau and is rich in Magnesium, lime, potash and calcium carbonate. The soil can hold moisture and is poor in phosphoric content.

23. Option (b) is correct.

Explanation: The clouds can be classified based on the altitude at which they are formed. Cirrus, Cirrostratus and Cirrocumulus are the high clouds. Altostratus and Altocumulus are the middle clouds. Stratocumulus and Nimbostratus are Low clouds. Cumulus and Cumulonimbus are the clouds with extensive vertical development.

24. Option (d) is correct.**25. Option (d) is correct.****26. Option (a) is correct.**

Explanation: All the given characteristics are of steppe grassland.

27. Option (d) is correct.

Explanation: The animal cell membrane, primarily composed of phospholipids, contains proteins, cholesterol and carbohydrates.

Phospholipids form a lipid bilayer, providing structural integrity and regulating molecule passage. Proteins, embedded or peripheral, facilitate transport, signaling and cell recognition. Cholesterol maintains fluidity, while carbohydrates serve in cell recognition and adhesion.

28. Option (d) is correct.

Explanation: A compound microscope consists of essential components including the eyepiece for observation, objective lenses for magnification, a stage to hold the specimen, and stage clips for securing slides. Adjustment knobs enable focusing, while the illuminator and condenser provide illumination and light control. Together, these parts facilitate detailed microscopic examination.

29. Option (d) is correct.

Explanation: In terms of complexity, proteins are the simplest of the four, comprising chains of amino acids with diverse functions. Tissues are organized assemblies of similar cells, forming the next level of complexity. Organs consist of multiple tissues working together, exhibiting higher complexity. Finally, organisms represent the highest level, comprising multiple organ systems, exhibiting the greatest complexity.

30. Option (d) is correct.

Explanation: All the cell types mentioned, Monocyte, Chondrocyte, Basophil and Lymphocyte, belong to animal cell types.

31. Option (c) is correct.

Explanation: The pancreas plays a crucial role in the digestive system by producing enzymes and hormones necessary for the breakdown of food and regulation of blood sugar levels. Its exocrine function involves producing digestive enzymes such as amylase, lipase and proteases, which are released into the small intestine to break down carbohydrates, fats and proteins into smaller molecules for absorption.

32. Option (b) is correct.

Explanation: DNA replication occurs when chromatin unwinds, facilitating access for DNA polymerase. Chromatin condenses into rod-shaped chromosomes before cell division. Prokaryotes undergo binary fission, while eukaryotes undergo mitosis or meiosis, differing in complexity. Thus, statements 1 and 2 are correct. Statement 3 is incorrect; prokaryotes and eukaryotes have distinct cell division processes.

33. Option (c) is correct.

Explanation: As the scale is in equilibrium, net torque must be zero,

$$\begin{aligned} N_1 d_1 - N_2 d_2 &= 0 \\ N_1 \times 0.3 &= N_2 \times 0.1 \\ 3N_1 &= N_2 \end{aligned}$$

Also, force must be balance,

$$\begin{aligned} N_1 + N_2 &= W(mg) \\ N_1 + 3N_2 &= 0.24 \times 10 \\ 4N_1 &= 2.4 \\ N_1 &= 0.6\text{N} \\ N_2 &= 3N_1 = 3 \times 0.6 = 1.8\text{N} \end{aligned}$$

34. Option (a) is correct.

Explanation: Escape velocity is given by,

$$v = \sqrt{2gR}$$

$$\Rightarrow v = \sqrt{2 \frac{GM}{R^2} \times R} = \sqrt{2 \frac{GM}{R}}$$

$$\Rightarrow v = \sqrt{2G \times \rho \times \frac{4}{3} \pi R^2} = 11.2$$

Also
$$v' = \sqrt{2G \times 4\rho \times \frac{4}{3} \pi \frac{R^2}{4}} = 11.2$$

Hence, escape velocity remains same.

35. Option (c) is correct.

Explanation: Sound is transmitted through liquids and gases as longitudinal waves. However through solids it can be transmitted as both longitudinal waves and transverse wave.

36. Option (d) is correct.

Explanation: As per conservation of energy,

$$\frac{1}{2} mu^2 = mgh$$

$$\begin{aligned} \Rightarrow u &= \sqrt{2gh} \\ &= \sqrt{2 \times 10 \times 0.45} \\ &= \sqrt{9} = 3 \text{ m/s} \end{aligned}$$

After rebound some of its kinetic energy gets lost and remaining gets converted into Potential energy

Hence,
$$\frac{1}{2} mv^2 = mgh'$$

$$\begin{aligned} \Rightarrow v &= \sqrt{2gh'} \\ &= \sqrt{2 \times 10 \times 0.20} \\ &= \sqrt{4} = 2 \text{ m/s} \end{aligned}$$

We know that,
$$F = \frac{mv - mu}{t} = \frac{m(v - u)}{t}$$

Taking sign consideration

$$F = \frac{0.1(-2-3)}{0.1} = \frac{-0.5}{0.1}$$

$$= -5\text{N}$$

(-ve sign indicated retarding force)

37. Option (d) is correct.

Explanation: We have

$$T = 2\pi\sqrt{\frac{l}{g}}, \text{ also } F = -kx$$

For small amplitudes the restoring force on the pendulum bob is directly proportional to its displacement. This leads to simple harmonic motion, where the time period is independent of the amplitude. For larger amplitude the restoring force is no longer directly proportional to displacement, Consequently the time period slightly dependent on the amplitude.

38. Option (c) is correct.

Explanation: Static friction > Kinetic friction > Rolling friction

In static condition interlocking between two surfaces are high. In rolling two points are in contact for least time also point of contact keeps on changing.

39. Option (d) is correct.

Explanation: When two bodies of same mass undergo elastic collision, their velocities are just interchanged. After collision bob X will come to rest and bob Y would move with velocity of X and will rise to the same height.

40. Option (b) is correct.

Explanation: Infra-red waves are also known as heat waves because they raise the temperature of the object on which they fall. Water molecules readily absorb infrared radiation and their thermal motion increases and therefore, they heat their surroundings. Hence both statements are correct but statement 2 is not correct explanation of statement 1.

41. Option (d) is correct.

Explanation: There was no decline of the export of raw material in the nineteenth century.

42. Option (a) is correct.

Explanation:

| | |
|---------|---|
| Muhurta | Measure of time |
| Raktika | Measure of weight |
| Angula | Measure of length |
| Pada | Metre of Poetry (It is the basic metre unit of Vedic poetry.) |

43. Option (d) is correct.

Explanation: The first coins in Indian history bearing the names and images of rulers were issued by the Indo-Greeks. The Indo-Greeks had established their rule over the northwestern part of the Indian subcontinent by the second century BC. The Kushan dynasty introduced gold coins in India.

44. Option (a) is correct.

Explanation: The emergence of urbanisation, industrialisation, secularisation, and bureaucratisation were considered as hallmarks of modernity during the nineteenth and twentieth centuries.

45. Option (c) is correct.

Explanation: Passing of the Rowlatt Act (March 1919): This act gave British authorities special powers to detain and imprison people suspected of revolutionary activities without trial.

All-India Khilafat Conference in Delhi (November 1919): This conference aimed to rally Indian Muslims in support of the Ottoman Caliphate after World War I.

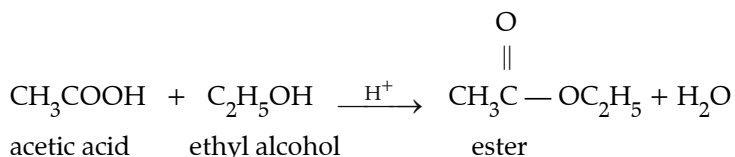
Jallianwala Bagh incident (April 1919): This massacre involved British troops firing on a peaceful gathering of protestors in Amritsar, killing hundreds.

Launch of Non-Cooperation Movement (1920-1922): Mahatma Gandhi led this movement in response to the Rowlatt Act and the Jallianwala Bagh massacre. It aimed to achieve swaraj (self-rule) through non-violent resistance.

51. Option (c) is correct.

Explanation: Ethyl acetate $\text{CH}_3\text{C}-\text{OC}_2\text{H}_5$

Ethyl acetate is an ester which is formed by the combination of 1 mole acetic acid and 1 mole ethyl alcohol.

**52. Option (c) is correct.**

Explanation: The coordination number of Na^+ and Cl^- ions in NaCl lattice are 6 : 6.

In NaCl, Na^+ ion are present in octahedral void while Cl^- ion are present in corner as face centre.

53. Option (a) is correct.

Explanation: The nettle leaf hairs that cause burning pain is methanoic acid.

46. Option (a) is correct.

Explanation:

| | |
|------------|--|
| Upari | Category of tenancy tenure held under the Marathas |
| Pattadar | Peasants directly responsible for the payment of revenue. |
| Mirasidar | Co- parcenary title holder and designated revenue payer in Southern India. |
| Inam Lands | Gifts of land or land revenue |

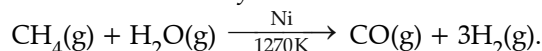
47. Option (c) is correct.

Explanation: All the given statements are correct.

48. Option (b) is correct.

Explanation: Water gas is a mixture of CO & H_2 . It is also known as synthesis gas or Syn gas.

It is formed by the reaction of CH_4 & H_2O at 1270K & Ni as catalyst

**49. Option (b) is correct.**

Explanation: The human body typically functions within a narrow pH range to maintain homeostasis. The normal pH range for most bodily fluids, including blood, is approximately 7.35 to 7.45, slightly alkaline.

50. Option (B) is correct.

Explanation: The latest heat of fusion of water is not very low.

The latent heat of fusion = 80 cal/g

It is the amount of heat required to convert 1 g solid ice into liquid water at its melting point.

The molecular formula of methanoic acid is HCOOH . It is also known as formic acid found in Red ant also.

54. Option (d) is correct.

Explanation: Milk of magnesia contains magnesium hydroxide. It is mainly present in antacid used to cure acidity.

55. **Option (d) is correct.**

Explanation: A mixture of soap and water is an everyday example of a lyotropic liquid crystal.

56. **Option (b) is correct.**

Explanation: The chemical formula of Borax = $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$
In the borax, the elements present are sodium, Boron, oxygen and hydrogen.

57. **Option (b) is correct.**

Explanation: The oxides which has the highest melting point is MgO

| Compound | Melting Point |
|-------------------------|---------------|
| Na_2O | 1132°C |
| MgO | 2852°C |
| Fe_2O_3 | 1565°C |
| CuO | 1326°C |

MgO is an ionic compound whose lattice energy is very high \therefore its melting point is high.

58. **Option (c) is correct.**

Explanation: Both the given statements are correct.

59. **Option (b) is correct.**

Explanation: Deep-focus earthquakes occur in the Earth's mantle and occur deeper than 300 kilometers below the surface. Their impact on the Earth's surface is less destructive than shallow-focus earthquakes as the seismic energy has to travel through a greater distance of Earth's material before reaching the surface.

60. **Option (b) is correct.**

Explanation: To measure temperature, the sensor should be mounted 5 feet +/- 1 foot above the ground.

61. **Option (c) is correct.**

Explanation: When the relative humidity is high, less water evaporates from the skin as there is already sufficient water in the atmosphere.

62. **Option (d) is correct.**

Explanation: All the given statements are correct.

63. **Option (a) is correct.**

Explanation: The given characteristics are of Mormugao Port, which is situated in Mormugao town, Goa. It falls on the western coast of India. It was commissioned in 1885 and is one of the oldest ports of India.

64. **Option (c) is correct.**

Explanation: Rourkela steel plant is situated in Rourkela, Odisha and is operated by the Steel Authority of India (SAIL). It was established on

February 3, 1959. It obtains water from Sankh and Koel rivers. The power for the electric furnace is procured from Hirakud. It receives coal from Jharia and iron-ore from Sundargarh and Kendujhar.

65. **Option (b) is correct.**

Explanation: Mantle convection is the slow movement of solid silicate mantle material, transferring heat from Earth's interior to the surface. Driven by heat from radioactive decay and residual heat from formation, hot mantle material rises, cools, and sinks back down. This circulation regulates Earth's temperature and influences plate tectonics and volcanic activity.

66. **Option (b) is correct.**

Explanation: Chambal River is a tributary of the Yamuna River and flows through Madhya Pradesh, Rajasthan, and Uttar Pradesh. It ultimately joins the Yamuna River in Uttar Pradesh.

Betwa River is one of the main tributaries of the Yamuna River and flows through Madhya Pradesh and Uttar Pradesh. It ultimately joins the Yamuna River and the confluence of both rivers takes place in Hamirpur, Uttar Pradesh.

67. **Option (d) is correct.**

Explanation: All the given statements are correct.

68. **Option (c) is correct.**

Explanation: Typhoons are tropical cyclones that originate in the northwestern Pacific Ocean. These form over warm ocean waters, typically with sea surface temperatures. They are characterised by strong winds, heavy rainfall, storm surges, and sometimes tornadoes. Hurricanes are tropical cyclones that form in the Atlantic Ocean and the eastern Pacific Ocean. They are also known as cyclones in the Indian Ocean and the South Pacific.

69. **Option (b) is correct.**

Explanation: The characteristics provided describe the temperate forest biome. These forests experience ample rainfall and varying temperatures from cold to mild. Dominated by deciduous trees like maple and oak, they harbour diverse wildlife, including raccoons, opossums, bats, and squirrels, thriving in the canopy and undergrowth of these ecosystems.

70. **Option (a) is correct.**

Explanation: Leaves appear green due to the presence of chlorophyll, a pigment crucial for

photosynthesis. Chlorophyll absorbs sunlight, particularly blue and red wavelengths, while reflecting green light. This reflected green light is what our eyes perceive, giving leaves their characteristic green color.

71. Option (d) is correct.

Explanation: Prokaryotes typically have a single circular chromosome. This chromosome contains the genetic information necessary for the prokaryotic cells function and reproduction.

72. Option (b) is correct.

Explanation: Bacterial DNA is considered “naked” because it lacks the protective membrane-bound nucleus found in eukaryotic cells. In bacteria (which are prokaryotes), the DNA is located in the cytoplasm, and it is not associated with histone proteins or organized into chromatin structures as in eukaryotic cells.

73. Option (a) is correct.

Explanation: Antibodies, also known as immunoglobulins, are produced by a type of white blood cell called B lymphocytes, or B cells. These cells are a crucial component of the adaptive immune system.

74. Option (c) is correct.

Explanation: $F_{\text{net}} = (10 + 15) - (2 + F + 15)$
 $\Rightarrow 0 = 25 - F - 17$
 $\Rightarrow F = 8\text{N}$

75. Option (c) is correct.

Explanation: Nuclear reactor harvests nuclear energy to produce steam and run turbine, its carbon emissions are very less but it doesn't have specific mechanism to reduce CO₂ emission.

76. Option (a) is correct.

Explanation: $R_{\text{eq}} = 5 + 0 + 5 = 10\text{ ohm}$
 (0 ohm means it is short circuiting other two 10 ohm resistors)

$$I = \frac{V}{R_{\text{eq}}} = \frac{10}{10} = 1\text{A}$$

77. Option (a) is correct.

Explanation: In compound microscope two convex lenses are used one is close to eye and another one is close to sample or object.

78. Option (c) is correct.

Explanation: When object distance increase, in order to maintain image at retina, focal length increases initially, later for extreme distance it becomes constant. Hence, option (c) is correct.

79. Option (b) is correct.

Explanation: A rainbow formation involves refraction, dispersion and internal reflection. In primary rainbow only one internal reflection occurs. In secondary it occurs twice. Also due to sun, condition for internal reflection and position of observer it always appear in inner curved shape.

80. Option (c) is correct.

Explanation: Neils Bohr suggest that an electron in an atom could revolve in certain stable orbit without the emission of radiant energy in its model called Bohr atomic model.

81. Option (d) is correct.

Explanation: LIGO experiment confirmed existence of gravitational waves, a concept related to general theory of relativity.

82. Option (b) is correct.

Explanation: Given, $m = 2\text{ kg}$, $u = 3\frac{m}{s}$, $v = 0$

Using, $v^2 - u^2 = 2as$
 $\Rightarrow 0 - 9 = 2 \times a \times s$
 $\Rightarrow -9 = 6a$, $a = -1.5\text{ m/s}^2$

Now, $F = ma = 2(-1.5) = -3\text{ N}$
 Negative sign indicates it is retarding force, hence magnitude of friction is 3 N.

83. Option (b) is correct.

Explanation: In metals electric current flows primarily due to the presence of free electrons. These electrons experience a weaker attraction to the nucleus allowing them to move throughout the metal lattice. This mobility of free electrons enables metals to conduct electricity effectively.

84. Option (a) is correct.

Explanation: The footpost had three stations per mile that were known as dawa.

85. Option (b) is correct.

Explanation: Bhanumati is the commentary on the Sushruta Samhita written by Chakrapani Datta. He was a renowned ancient Indian physician and commentator on Ayurvedic texts. The Sushruta Samhita is attributed to Sushruta, an ancient Indian physician and surgeon believed to have lived around the 6th century BCE.

86. Option (c) is correct.

Explanation: Tobacco cultivation in India was introduced by the Portuguese in 1605. Initially, tobacco was grown in the Kaira and Mehsana districts of Gujarat and later spread to other areas of the country.

87. Option (d) is correct.*Explanation:*

| | |
|--|--|
| Women's Indian Association of 1917 | Annie Besant, Margaret Cousins, Dorothy Jinarajadasa |
| National Council of Women in India of 1925 | Lady Aberdeen and Lady Meherbai Tata |
| Bharat Stree Mahamandal of 1910 | Sarala Devi Chaudhurani |

88. Option (d) is correct.*Explanation:* All the given statements are correct.**89. Option (c) is correct.***Explanation:* The Silk Road was a complex network of ancient trade routes that connected the East and West, facilitating the exchange of goods, ideas, and culture between regions of Asia, Europe, and Africa. These included overland and maritime routes. It facilitated the spread of religions such as Buddhism, Christianity, Islam, and Zoroastrianism, as well as the transmission of knowledge, scientific discoveries, and artistic styles.**90. Option (c) is correct.***Explanation:* Both the given statements are correct.**91. Option (c) is correct.***Explanation:* Both the given statements are correct.**92. Option (c) is correct.***Explanation:* The exercise Desert Cyclone is a joint military exercise between India and UAE. It was held in January 2024 in Rajasthan and it aims to enhance interoperability by learning & sharing best practices in Urban Operations.**93. Option (a) is correct.***Explanation:* The finance commission is constituted under Article 280 of the Indian constitution.**94. Option (d) is correct.***Explanation:* The Ministry of Environment, Forest, and Climate Change (MoEF&CC) submitted three nominations from India for Wetland City Accreditation (WCA) of Indore (Madhya

Pradesh), Bhopal (Madhya Pradesh) and Udaipur (Rajasthan) under the Ramsar Convention on Wetlands. The wetlands situated in and around these cities provide a plethora of benefits to its citizens in terms of flood regulation, livelihood opportunities and recreational and cultural values.

95. Option (b) is correct.*Explanation:* The National Youth Day in India is celebrated on January 12 every year since 1985. As a part of National Youth Day celebrations, India organises an annual National Youth Festival from January 12 to 16. The theme of the NYD-2024 festival was 'MYBharat-Viksit Bharat@2047- By the Youth, For the Youth.'**96. Option (c) is correct.***Explanation:* Both the given statements are correct.**97. Option (c) is correct.***Explanation:* The central government constituted a High-Level Committee under the former President, Shri Ram Nath Kovind to examine the issue relating to holding simultaneous elections (One Nation One Election) in the country and make recommendations. The idea of 'One Nation, One Poll' or 'One Nation, One Election' refers to holding simultaneous elections across the country, which means, polls for Lok Sabha and state assemblies will be held together.**98. Option (c) is correct.***Explanation:* India's first all-girls Sainik School, Samvid Gurukulam Girls Sainik School, was inaugurated in Vrindavan, Uttar Pradesh, by Defence Minister Rajnath Singh. It offers both CBSE curriculum and military training.**99. Option (a) is correct.***Explanation:* The Ministry of Home Affairs (MHA) scrapped the Free Movement Regime (FMR) between India and Myanmar to ensure the internal security of the country and to maintain the demographic structure of India's North Eastern States bordering Myanmar.**100. Option (b) is correct.***Explanation:* The Book 'Bharat Matters' is authored by India's External Affairs Minister S. Jaishankar.