

PART- A : ENGLISH

ANTONYMS

1. (d) The meaning of the word, 'deplorable' is morally bad or deserving disapproval. The antonym for deplorable will be commendable meaning deserving praise.
2. (a) The meaning of the word, 'counteract' is to reduce the effect of something by acting against it. The antonym for counteract will be 'exacerbate' meaning to make something worse, could be a disease or problem.
3. (a) The meaning of the word, 'persevere' is to continue trying to achieve something that is difficult. The antonym for persevere will be 'to give up' meaning not wanting to work on a difficult situation after a certain period of time.
4. (b) The meaning of the word, 'hideous' is very ugly or unpleasant. The antonym for hideous will be beautiful.
5. (d) The meaning of the word, 'squander' is to waste time or money. The antonym for squander will be manage.

CLOZE TEST

6. (b) Continually: The mentioned word will be appropriately placed in the blank since the sentence talks about climate which is something that keeps changing continuously.
7. (a) The mentioned word will follow the first statement, i.e., changes have already been stated previously, hence, it is a continuation of it.
8. (c) Since the activities listed ahead are carried out by the humankind, hence the appropriate word is 'human'.
9. (a) The word 'assimilate' means to be taken in or absorbed. The sentence will be: 'emissions from industry and transport, etc. which have led to the assimilation of gases....
10. (c) Article, 'the' will be the correct word to fill in the blank since the sentence is a stated fact.
11. (a) The greenhouse effect allows the greenhouse gases to trap the heat from the earth's surface and raise air temperatures.
12. (d) The greenhouse gases act on the surface of the earth, i.e., the planet in order to protect it.
13. (a) The preposition 'for' will appropriately be placed in the sentence here since it talks about assessment of climate change.
14. (d) have initiated. This will correctly fit into the sentence since the research has initiated.
15. (b) The preposition 'at' will complete the sentence since the activity takes places at regular intervals.

SENTENCE COMPLETION

16. (b) The complete sentence will be - "He paused for a few moments." The remaining options will be grammatically incorrect if used.
17. (a) In relation to vehicles, they 'break down' when something goes wrong in their functioning.
18. (b) In the sentence, it states that "all countries signed the treaty", therefore, only the remaining two will when mentioned will have 'except' before them.
19. (a) In the case of electricity, the lights are always 'turned off' or "switched off".
20. (c) When you refer to an individual, you use 'who'. It refers to 'first person' in this context.
21. (a) When referring to months, the preposition 'at' or 'in' will be used. It can be used in multiple contexts such as telling time or location.
22. (b) The determiner 'that' is used to modify or introduce a noun in any sentence.
23. (b) In this sentence, the grammatically correct sentence will be- "The thieves denied stealing the money."
24. (b) The correct sentence will be- "Did you drop in to see Sunita on your way home?" The phrase 'drop in' refers to a casual visit one makes.
25. (b) "Would you like to meet her?" will be the grammatically correct sentence.

IDIOMS AND PHRASES

26. (c) The idiom, 'be bad news' refers to 'someone who is considered undesirable'.
27. (c) The idiom, 'back to the drawing board' refers to starting planning again because the previous plan has failed.
28. (d) The idiom, 'Be in the eye of the storm' refers to be in the midst of a controversy which affects or interests a lot of people.
29. (d) The idiom, 'Life in the fast lane' refers to an exciting and eventful lifestyle, especially one which brings wealth and success.
30. (b) The idiom, 'To pass the buck' refers to shifting the responsibility of something to someone else.

ORDERING OF WORDS IN A SENTENCE

31. (a) The correct sentence formed will be- "The fundamental rights are basic rights and include basic freedoms guaranteed to the individual."
32. (a) The correct sentence formed will be- "The Indian nation is the product of a historical process that has been in the making for many millennia."
33. (a) The correct sentence formed will be- "India's Independence represented for its people the start of an epoch that was imbued with a new vision."
34. (c) The correct sentence formed will be- "All students have been instructed to be present before the principal for a discussion on the forthcoming science and mathematics exhibition."
35. (c) The correct sentence formed will be- "With the selection of another player to the new team, the team now has two bowlers and two batsmen respectively."

WORD CLASSES

36. (a) In this sentence, the word 'abode' is a noun. It refers to a residence, dwelling or habitat.
37. (d) The word, 'beyond' is used as an adverb in this sentence.
38. (d) In the above mentioned sentence, 'except' acts as a conjunction.
39. (b) In the given sentence, 'nicely' is used as an adverb.
40. (a) In the given sentence, 'this' has been used as a demonstrative determiner.

Passage

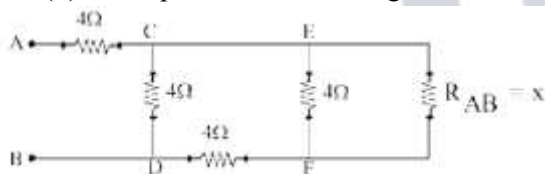
41. (b) Human belongs to abiotic community.
42. (b) The nature of biotic community largely depends on abiotic components.
43. (c) Algae is a living organism, so it does not belong to abiotic community.
44. (b) Aquatic community refers to the biotic community living in water.
45. (c) Species are defined on the basis of both similarities as well as differences.

SYNONYMS

46. (a) Deported is a synonym for banished.
47. (a) Brilliant is a synonym for dazzling.
48. (b) Rejected is a synonym for rebuffed.
49. (b) Abandoned is a synonym for disowned.
50. (c) Doubtful is a synonym for skeptical.

PART – B : GENERAL KNOWLEDGE

51. (b) The equivalent circuit diagram is



∴ The net resistance between points E & F is

$$R_{EF} = \frac{4x}{4 + x}$$

The net resistance between points C & D is

$$R_{CD} = \frac{4 \left(4 + \frac{4x}{4 + x} \right)}{4 + 4 + \frac{4x}{4 + x}} = 4 \left(\frac{4 + 2x}{8 + 3x} \right)$$

The net resistance between points A & B is

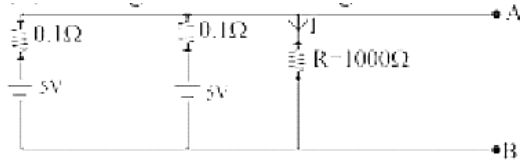
$$R_{AB} = 4 + R_{CD} = 4 \left(1 + \frac{4 + 2x}{8 + 3x} \right)$$

$$\Rightarrow x = 4 \left(\frac{12 + 5x}{8 + 3x} \right) \Rightarrow x^2 - 4x - 16 = 0$$

$$\therefore x = \frac{(-4) \pm \sqrt{(-4)^2 - 4 \times 1 \times (-16)}}{2 \times 1}$$

$$= (2 \pm 2\sqrt{5})\Omega$$

52. (d) The given circuit diagram is



The potential difference across points A & B is

$$V = \frac{5}{\frac{1}{0.1} + \frac{1}{0.1} + \frac{1}{1000}} = \frac{10^5}{20001} \text{ V}$$

∴ Current through resistor R is

$$I = \frac{V_{AB}}{R} = \frac{10^5}{20001 \times 1000} \approx 5 \text{ mA}$$

53. (d) For electrical machine,

$$I = 15 \text{ A}, t = 10 \text{ min} = 10 \times 60 \text{ s}$$

$$\therefore \text{Current flow, } Q = If = 15 \times 10 \times 60 = 9000 \text{ C}$$

54. (a) The lightning conductor is made of metal rod with a sharp pointed edge on its top in order to provide low resistance for conducting path. The electric discharge from the lightning smoothly fed into earth.

55. (d) There are four fundamental forces in nature:

- (i) Gravitational forces
- (ii) Electromagnetic forces
- (iii) Strong nuclear forces
- (iv) Weak nuclear forces

56. (b) For the large sphere,

$$\rho_1 = \rho, \rho_2 = \frac{\rho}{2}$$

$$V_1 = \frac{4}{3}\pi \left(\frac{R}{2}\right)^3 = \frac{1}{8}\left(\frac{4}{3}\pi R^3\right) \propto \frac{1}{8}$$

$$V_2 = \frac{4}{3}\pi \left(R^3 \left(\frac{R}{2}\right)^3\right) = \frac{7}{8}\left(\frac{4}{3}\pi R^3\right) \propto \frac{7}{8}$$

∴ Equivalent density is

$$\rho_e = \frac{\rho_1 V_1 + \rho_2 V_2}{V_1 + V_2} = \frac{\rho \left(\frac{1}{8}\right) + \frac{\rho}{2} \left(\frac{7}{8}\right)}{\frac{1}{8} + \frac{7}{8}} = \frac{9\rho}{16}$$

57. (d) The pupil of human eye acts as aperture and its size changes with the intensity of light. Also, the eye can focus the image of both far-off and near objects by changing the focal length of eye lens. So, human eye has a lens with variable focal length and variable aperture size.

58. (c) Article 371 A 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.

59. (c) Article 191. Disqualifications for membership of the the person.

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 he holds any office of profit under the Government of India or the Government of any State specified in the First Schedule, other than an office declared by the Legislature of the State by law not to disqualify its holder.

60. (a)

Convention	Adopted on
The Universal Declaration of Human Rights	10 December 1948

The Convention Relating to the Status of Refugees / Refugee Convention or the Geneva Convention	28 July 1951
The International Covenant on Economic, Social and Cultural Rights	16 December 1966
The Convention on the Elimination of all Forms of Discrimination Against Women	1979

61. (c) The main objectives of the Second Plan are an increase of 25 per cent in real national income over the five-year period 1956-57 to 1960-61; a large expansion of employment opportunities; rapid industrialization; and reduction of economic inequalities.
62. (b) Second urbanization means the emergence of sixteen Mahajanapadas from Janapadas during ancient India in the period of 500 to 600 BC in the Indian subcontinent.
63. (a) The earliest deciphered inscriptions in India are the Edicts of Ashoka, written in Prakrit using the Brahmi script in the 3rd century BCE.
64. (a)
Let the % abundance of $B - 10 = x$
% Abundance of $B - 11 = (100 - x)$
 $10.8 = 10.013x + (100 - x)11/100$
 $\Rightarrow 10.8 = 10.013x + 1100.9 - 11.009x \Rightarrow x = 19.00\%$
 $\therefore$ Abundance of $B - 10 = 20.98\%$, Abundance of $B - 11 = 100 - 19.00 = 81\%$
65. (b) Portland cement consists essentially of compounds of lime (calcium oxide, CaO) mixed with silica (silicon dioxide, SiO_2) and alumina (aluminium oxide, Al_2O_3). The lime is obtained from a calcareous (lime-containing) raw material, and the other oxides are derived from an argillaceous (clayey) material.
66. (b) Litmus is a natural indicator derived from lichens, specifically species like *Rocella tinctorum* and *Lecanora tartarea*. It's a mixture of organic compounds that turns red in acidic solutions and blue in alkaline solutions.
 $\text{V}_2\text{O}_5 = 0$
 $2 \times V + 5 \times -2 = 0$
67. (d) $2V - 10 = 0$
 $V = 10/2$
 $V = 5$
68. (a) Graphite is soft and slippery material. Diamond is the hardest natural substance. Fullerene is very light and strong material. Graphene is thinnest and strongest material.
69. (a) IDL does not cut across any country. The IDL is at 180 degrees longitude, not because it is just opposite to prime meridian but because it passes majorly through the oceans. The IDL is intentionally made so that it doesn't pass from any country's landmass, and the problem of two different dates in one country does not arise.
70. (d)
71. (d)
72. (b) The Black soil is also known as regur soil and is formed by the weathering of Igneous rocks that form the Deccan plateau. Black soil is developed over Deccan lava granite rocks under semi-arid conditions.
73. (b)
Clouds are indeed classified based on their altitude (height above the Earth's surface) and their form (shape and appearance).

Clouds are commonly classified into three altitude categories: high clouds (cirrus, cirrostratus, cirrocumulus), middle clouds (altostratus, altocumulus), and low clouds (stratus, stratocumulus, nimbostratus).

74. (d)

75. (c) Alkali soil have high in pH (above 8.5), making it basic. These clay-rich soils often contain sodium carbonate/bicarbonate, leading to poor drainage and limited nutrient availability for plants. Krishna Deva Raya invaded the Raichur Doab and completely crushed the Adil Shahi of Bijapur. Then he attacked Gulbarga and captured the city of Raichur in c. 1520 CE. He restored the Bahmani Sultanate to Muhammad Shah, and took the title of Yavanarajya sthapanacharya.

76. (a) Based on the provided characteristics, the correct answer is Steppes. Here's a detailed explanation:

Characteristics of Grasslands

Extensive Mid-Latitude Grasslands Devoid of Trees and Shrubs:

The Steppes are well-known for their vast expanses without trees and shrubs. This is mainly due to the semi-arid climate that does not support the growth of large vegetation.

These grasslands are typically found in regions with continental climates, where temperature and precipitation patterns are not conducive to tree growth.

Climate:

The Steppes experience hot summers and cold winters, characteristic of mid-latitude regions with continental climates. Rainfall in these regions is generally low, averaging between 250 to 500 mm annually, and mostly occurs during the spring and summer months.

Grass Height in Humid Parts:

In the more humid areas of the Steppes, grasses can grow to a meter or more in height due to increased humidity and slightly better soil moisture conditions.

In drier parts of the Steppes, the grass remains shorter due to the lack of sufficient moisture.

Additional Information

Geographical Distribution:

Steppes are extensive plains found in regions such as Central Asia, Eastern Europe, and parts of North America. They are characterized by a semi-arid climate, which limits the growth of trees and large shrubs.

Historically, the Steppes have been home to various nomadic tribes and civilizations.

Comparison with Other Grasslands:

Prairies:

Found in North America, particularly in the United States and Canada.

Prairies also experience hot summers and cold winters, but they receive more rainfall compared to the Steppes, supporting taller grasses and even some isolated trees.

Savanna:

A type of grassland found in tropical regions, such as Africa, South America, and Australia.

Savannas are characterized by a mix of grasses and scattered trees and experience a distinct wet and dry season.

Pampas:

Vast plains located in South America, particularly in Argentina and Uruguay.

The Pampas have a more moderate climate and receive more rainfall than the Steppes, supporting lush grasslands suitable for agriculture and cattle ranching.

Conclusion

Based on the characteristics provided, including the extensive areas devoid of trees and shrubs, hot summers and cold winters, relatively low rainfall occurring mainly in spring and summer, and tall grasses in humid parts, the correct grassland is:

77. (d)

Animal cell membranes are primarily composed of three major components: phospholipids, proteins, and cholesterol. Phospholipids form a bilayer that provides the fundamental structure of the membrane.

Proteins are embedded within this bilayer and serve various functions such as transport, signal transduction, and acting as enzymes.

Cholesterol is interspersed within the phospholipid bilayer, providing stability and fluidity to the membrane.

This structure is often referred to as the fluid mosaic model because of the flexible nature of the lipid bilayer and the mosaic-like distribution of proteins.

78. (d) A compound microscope is a sophisticated device used to magnify small objects

using multiple lenses. The key components of a compound microscope include the eyepiece (ocular lens), objective lenses, stage, mirror or light source, clips to hold the slide, and adjustment knobs among others.

Let's break down the options provided:

Option a: Mirror

A mirror is indeed a part of many compound microscopes, used to reflect light up through the specimen for clearer viewing.

Option b: Stage

The stage is a critical part of the compound microscope. It is the platform where the specimen slide is placed for observation.

Option c: Clip

Clips are also part of a compound microscope. They are used to hold the slide in place on the stage.

Option d: Retina

The retina is not a part of the compound microscope. The retina is actually a part of the human eye, not the microscope. It is the light-sensitive layer at the back of the eye that helps in vision.

Therefore, the correct answer is: Option d: Retina

79. (d) The correct sequence in increasing complexity is Option D : Protein - Tissue – Organ Organism.

Let's break down each component to understand the progression of complexity :

Protein : Proteins are complex molecules formed by chains of amino acids. They are fundamental units that carry out various functions within cells, including enzymatic, structural, and signaling roles.

Tissue : Tissues are groups of cells that work together to perform a specific function. There are several types of tissues, such as muscle tissue, nervous tissue, and epithelial tissue.

Organ: Organs are structures made up of different types of tissues that work together to perform specific functions. Examples include the heart, lungs, and liver.

Organism : An organism is a complete living entity capable of independent life. It is composed of various organ systems that function collectively to sustain life. Organisms can be as simple as a single-celled bacterium or as complex as a multicellular human being.

Hence, the hierarchy in increasing complexity is correctly represented by Option D : Protein - Tissue Organ - Organism.

80. (d) All of the listed cell types-monocyte, chondrocyte, basophil, and lymphocyte-are animal cell types. To elaborate:

1. **Monocyte :** A type of white blood cell that is part of the immune system. It can differentiate into macrophages and dendritic cells which are crucial for immune response.

2. **Chondrocyte :** These are the only cells found in healthy cartilage. They produce and maintain the cartilaginous matrix, which is an important part of the skeletal system.

3. **Basophil :** Another type of white blood cell. Basophils are involved in inflammatory reactions and produce histamine and heparin during allergic responses.

4. **Lymphocyte :** These are a subtype of white blood cells found in the lymphatic system. They play a vital role in the immune system, with types including B cells, T cells, and natural killer cells.

Since all four types are indeed animal cell types, the correct answer is d :

81. (c) The pancreas plays a crucial role in the human digestive system by secreting a variety of digestive enzymes. These enzymes include:

Lipase: This enzyme is responsible for breaking down fats into fatty acids and glycerol, aiding in the digestion and absorption of dietary fats.

Amylase: This enzyme helps in the digestion of carbohydrates by breaking down starches into sugars such as maltose and glucose.

Protease: These enzymes, including trypsin and chymotrypsin, break down proteins into smaller peptides and amino acids, which can then be absorbed by the body.

Collectively, these enzymes are essential for the proper digestion and absorption of nutrients from the food we eat. The pancreas secretes these enzymes into the small intestine, where they play a vital role in the digestive process.

82. (b) Let's analyze each statement one by one:

Statement 1: DNA replication takes place when chromatin is opened up.

DNA replication indeed occurs when the chromatin is in a more relaxed and open state. This allows the replication machinery to access the DNA strands and perform the copying process. Hence, statement 1 is correct.

Statement 2: Chromatin organises itself into rod-shaped chromosomes before cell division.

Before cell division, particularly during mitosis or meiosis, chromatin condenses and forms the distinct rod-shaped structures known as chromosomes. This condensation is crucial for the proper segregation of chromosomes into daughter cells. Hence, statement 2 is also correct.

Statement 3: Both prokaryotes and eukaryotes have the same process for cell division.

This statement is incorrect. Prokaryotes divide by a process called binary fission, which is simpler and involves the duplication and segregation of a single, circular DNA molecule. Eukaryotes, on the other hand, undergo more complex processes such as mitosis or meiosis, involving multiple linear chromosomes and various stages (prophase, metaphase, anaphase, telophase). Therefore, statement 3 is not correct.

83. (c) To solve this problem, we need to consider both the conditions of equilibrium: the translational equilibrium (sum of vertical forces must be zero) and rotational equilibrium (sum of torques about any point must be zero).

Let's denote:

N_1 as the force exerted by wedge W_1

N_2 as the force exerted by wedge W_2

mg as the weight of the meter scale

Given:

Mass of meter scale, $m = 0.24$ kg

Acceleration due to gravity, $g = 10.0$ m/s²

W_1 is at a distance of 0.2 m from one end

W_2 is at a distance of 0.4 m from the other end

First, let's find the weight of the meter scale:

The weight, $mg = 0.24$ kg $\times$ 10.0 m/s² = 2.4 N

Next, for translational equilibrium, the sum of vertical forces must be zero:

$$N_1 + N_2 = mg$$

So,

$$N_1 + N_2 = 2.4 \text{ N (Equation 1)}$$

For rotational equilibrium, we need to consider the torques about any point. We choose the point where one of the forces is applied to simplify the calculations. Let's take torques about the point where W_1 is placed.

Distance of center of mass of the meter scale from W_1 :

The center of mass for a uniform meter scale is at its midpoint, i.e., 0.5 m from either end. Therefore, the distance of the center of mass from W_1 (at 0.2 m from the end) is:

$$0.5 \text{ m} - 0.2 \text{ m} = 0.3 \text{ m}$$

Torque due to the weight of the meter scale about W_1 :

$$\tau_w = mg \times 0.3 \text{ m} = 2.4 \text{ N} \times 0.3 \text{ m} = 0.72 \text{ Nm}$$

Distance of W_2 from W_1 :

The total distance W_2 is from W_1 :

$$1 \text{ m} - 0.2 \text{ m} - 0.4 \text{ m} = 0.4 \text{ m}$$

Torque due to the force N_2 about W_1 :

$$\tau_{N_2} = N_2 \times 0.4 \text{ m}$$

Applying rotational equilibrium (sum of torques about W_1 equals zero):

$$0.72 \text{ Nm} = N_2 \times 0.4 \text{ m}$$

Therefore,

$$N_2 = \frac{0.72 \text{ Nm}}{0.4 \text{ m}} = 1.8 \text{ N}$$

Substitute the value of N_2 back into Equation 1 to find N_1 :

$$N_1 + 1.8 \text{ N} = 2.4 \text{ N}$$

Therefore,

$$N_1 = 2.4 \text{ N} - 1.8 \text{ N} = 0.6 \text{ N}$$

So, the forces are:

$$N_1 = 0.6 \text{ N}$$

$$N_2 = 1.8 \text{ N}$$

84. (b) The escape velocity from a planet is given by the formula:

$$v_e = \sqrt{\frac{2GM}{R}}$$

where G is the gravitational constant, M is the mass of the planet, and R is the radius of the planet. For the given problem, we need to find the escape velocity for a planet whose radius is half of Earth's radius and whose mass density is four times that of Earth.

Step by Step Solution:

Step 1

Let the radius of Earth be R and the density of Earth be ρ . The escape velocity from Earth is given by:

$$v_{e, \text{Earth}} = \sqrt{\frac{2GM_{\text{Earth}}}{R}}$$

Step 2

The mass of Earth M_{Earth} can be written as $M_{\text{Earth}} = \rho \cdot \frac{4}{3}\pi R^3$

Step 3

For the new planet, the radius $R_{\text{new}} = \frac{R}{2}$ and the density $\rho_{\text{new}} = 4\rho$. The mass of the new planet M_{new} is:

$$M_{\text{new}} = \rho_{\text{new}} \cdot \frac{4}{3}\pi R_{\text{new}}^3 = 4\rho \cdot \frac{4}{3}\pi \left(\frac{R}{2}\right)^3 = 4\rho \cdot \frac{4}{3}\pi \cdot \frac{R^3}{8} = \rho \cdot \frac{4}{3}\pi R^3 = M_{\text{Earth}}$$

Step 4

Thus, the mass of the new planet is the same as the mass of Earth. The escape velocity for the new planet is:

$$v_{e, \text{new}} = \sqrt{\frac{2GM_{\text{new}}}{R_{\text{new}}}} = \sqrt{\frac{2GM_{\text{Earth}}}{\frac{R}{2}}} = \sqrt{\frac{2GM_{\text{Earth}} \cdot 2}{R}} = \sqrt{2} \cdot v_{e, \text{Earth}}$$

Step 5

Given that the escape velocity from Earth $v_{e, \text{Earth}} = 11.2 \text{ km/s}$, the escape velocity for the new planet is:

$$v_{e, \text{new}} = \sqrt{2} \cdot 11.2 \approx 15.8 \text{ km/s}$$

85. (c) Sound waves in fluids (liquids and gases) are longitudinal waves, not transverse

waves. In longitudinal waves, the oscillations of the particles of the medium are parallel to the direction of wave propagation. This means that particles in the medium move back and forth in the same direction that the wave is traveling.

Let's break down the other options to see why they do apply to sound waves in fluids:

Option a: They transport energy

Sound waves indeed transport energy. As a sound wave propagates through a medium, it transfers energy from one particle to another through the medium.

Option b: They need a medium to travel

Sound waves require a medium (solid, liquid, or gas) to travel. They cannot propagate in a vacuum because there are no particles to transmit the vibrations.

Option d: They travel faster in liquids than in gases

Sound waves generally travel faster in liquids than in gases. This is because particles in liquids are more closely packed than in gases, allowing the sound waves to transmit vibrations more efficiently.

Therefore, Option c is the correct answer since sound waves in fluids are not transverse waves.

86. (d) To determine the net force the ball applies on the floor while bouncing, we need to

follow these steps:

Step 1: Calculate the velocity of the ball just before it hits the floor

Using the equation of motion:

$$v^2 = u^2 + 2gh$$

where,

u = initial velocity (0 m/s, since the ball is dropped), g = acceleration due to gravity (10 m/s²), h = height from which the ball is dropped (0.45 m).

Therefore,

$$v^2 = 0 + 2 \cdot 10 \cdot 0.45$$

$$v^2 = 9$$

$$v = \sqrt{9}$$

$$v = 3 \text{ m/s}$$

Step 2: Calculate the velocity of the ball just after it bounces off the floor

Using the same equation of motion, but this time with the final height the ball reaches:

$$v^2 = u^2 + 2gh$$

where,

h = height ball rises to (0.2 m).

$$v^2 = 0 + 2 \cdot 10 \cdot 0.2$$

$$v^2 = 4$$

$$v = \sqrt{4}$$

$$v = 2 \text{ m/s}$$

However, this velocity is upward (after the bounce). Thus, we should take it as negative for our momentum calculation to show the direction change.

Step 3: Calculate the change in momentum

Momentum before the bounce:

$$p_1 = mv = 0.1 \cdot 3 = 0.3 \text{ kg m/s}$$

Momentum after the bounce:

$$p_2 = m(-v) = 0.1 \cdot (-2) = -0.2 \text{ kg m/s}$$

Change in momentum:

$$\Delta p = p_2 - p_1 = -0.2 - 0.3 = -0.5 \text{ kg m/s}$$

Step 4: Calculate the net force

Using Newton's second law:

$$F = \frac{\Delta p}{\Delta t}$$

where, Δt = time of contact (0.1 s).

Thus,

$$F = \frac{-0.5}{0.1} = -5 \text{ N}$$

The magnitude of the force is 5 N . However, we are interested in the net force applied on the floor, which is the positive value of this calculation.

Thus, the net force applied on the floor while bouncing is:

5.0 N

87. (d) In order to accurately describe the behavior of a simple pendulum, we need to analyze its

physics in detail. A simple pendulum consists of a mass (known as the bob) attached to a string of length L and fixed at a pivot point. When displaced from its equilibrium position and released, it oscillates back and forth under the influence of gravity.

The restoring force acting on the bob is provided by the component of the gravitational force that acts along the direction of the arc. This force can be expressed as:

$$F = -mg\sin(\theta)$$

where:

F is the restoring force,

m is the mass of the bob,

g is the acceleration due to gravity,

θ is the angular displacement from the vertical.

For small angular displacements (small amplitudes), $\sin(\theta)$ can be approximated by θ (when θ is measured in radians). Thus, the restoring force becomes:

$$F \approx -mg\theta$$

Since $\theta = \frac{x}{L}$ where x is the linear displacement and L is the length of the pendulum, the force can be rewritten as:

$$F \approx -\frac{mg}{L}x$$

This shows that the restoring force is directly proportional to the displacement, characteristic of simple harmonic motion. The time period T of a simple pendulum is then given by:

$$T = 2\pi \sqrt{\frac{L}{g}}$$

Note that this time period is independent of amplitude, but the approximation $\sin(\theta) \approx \theta$ only holds for small amplitudes. Therefore, the correct statement regarding the simple pendulum is:

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

88. (d)

89. (d) To solve this problem, we need to consider the principles of conservation of

momentum and conservation of energy. The collision between the two bobs is elastic, meaning both kinetic energy and momentum are conserved.

First, let's denote the initial height from which the bob X is released as h . When bob X is released from position A, it converts its potential energy into kinetic energy just before the collision :

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

Solving for the velocity v just before collision :

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

Since the bobs are identical (same mass m) and the collision is elastic, the velocities of the bobs after the collision can be derived using the following properties of an elastic collision: the moving object will come to rest, and the object at rest will move with the velocity of the moving object. Therefore, after the collision, the bob Y will move with the initial velocity of bob X, and bob X will come to a stop.

Because bob X comes to a stop immediately after the collision, it does not rise to any height after the collision.

90. (a) Statement 1 : Infrared waves are also called heat waves. This is true. Infrared

radiation is a type of electromagnetic radiation that we perceive as heat. Objects with a temperature above absolute zero emit infrared radiation.

Statement 2 : Water molecules readily absorb infrared waves. This is also true. The molecular structure of water allows it to effectively absorb infrared radiation, which is why infrared heating is often used in industrial processes to dry materials that contain water.

The connection : The reason why infrared waves are called heat waves is precisely because they are readily absorbed by water molecules. When infrared radiation is absorbed by water molecules, it causes them to vibrate faster, which increases their kinetic energy and thus their temperature. This is how we feel heat.

91. (d) Statement 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."

This statement is incorrect. A trade surplus means that the value of exports exceeds the value of imports. In the case of India in the nineteenth century, Britain had a trade surplus with India because the value of British imports (i.e., raw materials like cotton, tea, and opium) from India was much higher than the value of British exports (mostly manufactured goods) to India. This trade surplus allowed Britain to finance its trade deficits with other countries.

Statement 2: "India played a crucial role in the late-nineteenth-century world economy by helping Britain balance its deficits."

This statement is correct. India indeed played a significant role in supporting Britain's balance of payments. The trade surplus with India provided a critical source of revenue for Britain, which helped it to manage its deficits with other countries.

Statement 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."

This statement is correct. The British colonial administration grew opium in India and exported it to China. Opium became a significant export commodity for India during the nineteenth century, especially after the 1820 s, and played a key role in the economic interactions between Britain, India, and China.

Statement 4: "The nineteenth century saw export of Indian raw materials decline, and that of manufactured goods increase."

This statement is incorrect. In the nineteenth century, there was an increase in the export of Indian raw materials, such as cotton, tea, and opium, to Britain. At the same time, Indian manufactured goods faced stiff competition from British manufactured goods, leading to a decline in the export of Indian manufactured goods.

92. (a) To solve the given matching problem, we need to correctly align the units from List-I

with their corresponding content descriptions from List-II. Let's analyze each unit and its logical match:

A. Muhurta: Muhurta is a traditional Hindu unit of time. Hence, it corresponds to 2. Measure of time.

B. Raktika: Raktika is an ancient Indian unit of weight, often used in weighing precious substances like gold. Thus, it should match with 1 . Measure of weight.

C. Angula: Angula is an ancient unit of length in India, where it is often translated as 'finger.' Therefore, it aligns with 4. Measure of length.

D. Pada: Pada is a Sanskrit term that often refers to a specific foot or segment of a verse in poetry, thus it is associated with 3 . Metre of poetry.

Based on the above analysis, the correct matching should be:

$A - 2, B - 1, C - 4, D - 3$

93. (d) The first coins in Indian history bearing the names and images of rulers were issued by the Indo-Greeks. This issuance marked a significant development in the numismatic history of India.

The Indo-Greeks were successors of Alexander the Great's empire in the northwestern parts of the Indian subcontinent. They contributed significantly to the coinage system, introducing the practice of placing a ruler's image

and name on the coins, which was a break from the earlier punch-marked coinage system used by Indian dynasties including the Mauryas.

94. (a) Modernity refers to a period marked by a shift from agrarian economies to industrial economies, leading to profound changes in the social, cultural, and economic landscape. This period includes the following key features:

Industrialisation: The development and adoption of industrial methods of production which led to mass production, mechanisation, and factory systems. This was a significant shift from traditional handicrafts and agrarian ways of life.

Urbanisation: The movement of populations from rural areas to urban centres in search of employment, leading to the growth of cities and changes in living conditions and lifestyles.

Secularisation: A move away from religious and superstitious explanations of the world, with an increased focus on rationality, science, and secular ideologies.

Bureaucratisation: The creation and expansion of organised administrative systems and institutions to manage the complexities of modern states, economies, and societies.

These features collectively describe the transformation inherent in the concept of modernity, as opposed to the characteristics of earlier social orders such as feudalism, kingship, or medievalism. Feudalism typically relates to the social structures and hierarchies of the Middle Ages, Kingship refers to the rule by a king or monarch, and Medievalism pertains to the customs, culture, and thought of the medieval period.

95. (b) To determine the correct chronological order of the given events, let's review each event and its historical timeline:

1. Launch of Non-Cooperation Movement

The Non-Cooperation Movement was launched by Mahatma Gandhi in September 1920 as a response to the Jallianwala Bagh massacre and the Rowlatt Act. The movement sought to resist British rule through nonviolent means.

2. All-India Khilafat Conference in Delhi

The All-India Khilafat Conference was held in Delhi in November 1919. The Khilafat Movement sought to protect the Ottoman Caliphate and rally Muslim support against British rule.

3. Passing of the Rowlatt Act

The Rowlatt Act was passed by the British government in March 1919. This act allowed the government to imprison any person suspected of terrorism without trial, causing widespread unrest in India.

4. Jallianwala Bagh incident

The Jallianwala Bagh massacre occurred on April 13, 1919, in Amritsar. British troops, under the command of General Dyer, fired upon a peaceful gathering of Indians, resulting in the death of hundreds of unarmed civilians.

Now, arranging these events in chronological order:

Passing of the Rowlatt Act (March 1919)

Jallianwala Bagh incident (April 1919)

All-India Khilafat Conference in Delhi (November 1919)

Launch of Non-Cooperation Movement (September 1920)

96. (a) To solve this matching problem, let's first break down the terms in List-I and match them with their appropriate descriptions in List-II:

List-I (System/Category)

Upari: This refers to a category of tenancy tenure held under the Marathas.

Pattadar: This represents peasants who are directly responsible for the payment of revenue.

Mirasidar: This is a co-parcenary title holder and designated revenue payer in southern India.

Inam lands: These are gifts of land or land revenue.

List-II (Description)

1: Peasants directly responsible for the payment of revenue.

2: Category of tenancy tenure held under the Marathas.

3: Gifts of land or land revenue.

4: Co-parcenary title holder and designated revenue payer in southern India.

Now, we can correctly match them:

Matching:

A. Upari → 2. Category of tenancy tenure held under the Marathas.

B. Pattadar → 1. Peasants directly responsible for the payment of revenue.

C. Mirasidar → 4. Co-parcenary title holder and designated revenue payer in southern India.

D. Inam lands → 3. Gifts of land or land revenue.

97. (c) To evaluate the correctness of the statements regarding the expeditions of the

Vijayanagara king Krishnadevaraya, let's analyze each statement individually.

Statement 1: In the early years of his reign he marched against the ruler of Orissa.

This statement is correct. Krishnadevaraya did launch campaigns against the Gajapati rulers of Orissa. This was part of his effort to consolidate and expand his kingdom.

Statement 2: In 1520 CE, he captured the fort of Raichur from Ismail Adil Khan.

This statement is also correct. The Battle of Raichur in 1520 CE was a significant military engagement where Krishnadevaraya defeated Ismail Adil Shah of the Bijapur Sultanate and captured the fort of Raichur.

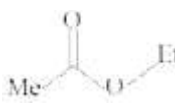
Statement 3: Krishnadevaraya restored Sultan Mahmud Shah to power and assumed the title of Yavana-rajya-sthapan-acharya.

This statement is correct as well. Krishnadevaraya did restore Sultan Mahmud Shah, the Bahmani Sultan, to power and took the title of Yavana-rajya-sthapan-acharya (which roughly translates to "restorer of the Yavana kingdom").

98. (b) Water gas is a fuel gas that's primarily a mixture of carbon monoxide (CO) and hydrogen (H₂) in equal proportions.

99. (b) The human body functions within a pH range of 7.0 to 7.8, which is slightly alkaline.

100. (b) The latent heat of fusion of water is usually high.

101. (c) Ethyl acetate  has a sweet and fruity smell.

102. (c) Coordination number of cation and Anion in NaCl lattice is 6,6.

103. (a) Methanoic acid, also called formic acid is present in the nettle leaves.

104. (d) Magnesium hydroxide is a chemical compound with the formula Mg(OH)₂, commonly known as milk of magnesia.

105. (d) A mixture of soap with water forms Lyotropic liquid crystal.

106. (b) Borax with the chemical formula Na₂H₂₀ B₄O₁₇ (also written as Na₂H₂₀ B₄O₁₇ · 10H₂O)

107. (b) MgO has the highest melting point due to the strong ionic bonding between Mg²⁺ and O²⁻

108. (c)

109. (b)

110. (c)

Environmental temperature lapse rate is the rate at which the temperature of air decreases with altitude over a specific time and place. It's also known as the standard lapse rate. The lapse rate is positive when the temperature decreases with height, and negative when it increases. The standard rate is estimated to be 6.5 degrees Celsius per kilometer or 1000 meters.

According to IMO Air temperature should be measured at a standard height of 1-2 meters (4-6 feet) above the ground surface. This is done to minimize the influence of local factors like ground heating or shading from buildings.

111. (c)

112. (b) Cyclone

Cyclones are rapid inward air circulation around a low-pressure area. The air circulates in an anticlockwise direction in the Northern hemisphere and clockwise in the Southern hemisphere.

Cyclones are usually accompanied by violent storms and bad weather.

cyclones rotate counterclockwise in the Northern Hemisphere because of the Coriolis effect, which causes air currents to deflect to the right.

113. (a) Mormugao Port

Mormugao Port, located on India's western coast in the state of Goa, is one of the country's oldest ports, commissioned in 1885. It boasts a naturally protected open-harbor at the southern mouth of the Zuari River. This natural harbor is further secured by a breakwater and a mole, which extends from the breakwater and runs parallel to the wharfs.

114. (c) Rourkela Steel plant

The Rourkela Steel plant was set up in 1959 in the Sundargarh district of Orissa in collaboration with Germany. The plant was located on the basis of proximity to raw materials, thus, minimising the cost of transporting weight losing raw material. This plant has a unique locational advantage, as it receives coal from Jharia (Jharkhand) and iron ore from Sundargarh and Kendujhar. The Hirakud project supplies power for the electric furnaces and water is obtained from the Koel and Sankh rivers.

115. (b)

116. (b) The Brahmaputra River, known as the Yarlung Tsangpo in Tibet, enters India

through the Arunachal Pradesh region, where it is called the Dihang (or Siang) River before it merges with other rivers and becomes the Brahmaputra.

The Godavari, with its sources from Trimbakeshwar, Maharashtra, is the river that has the second largest river basin in India.

The Chambal and Betwa rivers are indeed important tributaries, but they join the Yamuna River, which is a major tributary of the Ganga. Therefore, they do not join the Ganga directly.

117. (b) The Intertropical Convergence Zone (ITCZ) is a major contributor to the heavy rainfall in tropical wet climates. This belt of low pressure encircling Earth near the equator, where trade winds from the Northern and Southern Hemispheres converge, causes rising air, frequent thunderstorms, and heavy rain. The seasonal movement of the Intertropical Convergence Zone (ITCZ) and subtropical highs is a major cause of the distinct wet and dry seasons in tropical savanna climates.

Tropical monsoon climates experience warm temperatures year-round, similar to tropical rainforests, but with abundant rainfall concentrated during the highsun season.

118. (c)

119. (b) The temperate climates (C-climates) are characterised by an average temperature of the coldest month between -3°C and 18°C , and an average temperature of the warmest month above 10°C . They dominate in the midlatitudes but may also occur at higher elevations in lower latitudes.

These forests contain primarily deciduous trees including maple, oak, hickory and beechwood.

Raccoons, opossums, bats and squirrels are found in the trees.

120. (a) The chlorophyll present in green leaves absorbs blue and red light and reflects green light, hence it looks green.

121. (d) The chromosome number in prokaryotic cell is 1 .

122. (a) Bacterial DNA is referred to as naked as it is not associated with any scaffold or covered with membrane.

123. (a) Lymphocytes will produce antibodies against any foreign antigen.

124. (c) At equilibrium of the block P,

$$\Sigma f_x = 0 \Rightarrow (2 + F + 15) - (10 + 15) = 0$$

$$\therefore F = 8 \text{ N}$$

125. (c) The various components of a nuclear reactor are turbine, heat exchanger, reaction chamber etc. Nuclear reactor inherently do not produce CO_2 emissions during their operation.

126. (a) Potential difference across 10Ω resistor

$$\Delta V = I \times 0 = 0 \Rightarrow 10\Omega, V = 10 \text{ V resistor are short circuited. } \therefore R_{\text{net}} = 5 + 5 = 10\Omega,$$

$$\therefore \text{Current} = I = \frac{V}{R_{\text{net}}} = \frac{10}{10} = 1 \text{ A}$$

127. (a) A microscope may be a combination of two convex lenses. The lenses facing eye and object are called eyepiece and objective respectively.

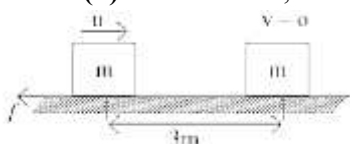
128. (c) The eye lens has power of accomodation, due to which it maintain formation of image at the retina for different positions of the object. With increase of object distance, the focal length of eye lens increases and finally it becomes constant.

129. (b) For the formation of primary rainbow by water droplet, there are more than one refraction and only one internal reflection. The primary rainbow formed as inner bow, and its colours are visible in the sequence of red on the outer edge to violet on the inner edge.

130. (c) Niels Bohr mentioned that the electron in an atom revolves only in a certain fixed orbit in which angular momentum of electron is integral multiple of $\frac{h}{2\pi}$.

131. (d) The LIGO (Laser Interferometer Gravitational Wave Observatory) experiment detects gravitational wave produced by accelerating masses like binary black holes, which confirms a major prediction of "General Theory of Relativity".

132. (b) For the block,



$$m = 2 \text{ kg}, u = 3 \text{ m/s}, v = 0$$

By work-energy theorem,

$$W_f = \Delta K = 0 - \frac{1}{2}mu^2 = -\frac{1}{2} \times 2 \times (3)^2 = -9$$

$$\Rightarrow -f \times 3 = -9 \therefore \text{Friction, } f = 3 \text{ N}$$

133. (b) Metals have a lattice of positively charged ions surrounded by a 'sea' of free electrons. When an electric field is applied across the ends of a metallic conductor, the free electrons start drifting in the direction opposite to applied electric field, which constitutes conduction of electric current in the conductor.
134. (a)
135. (b) Bhanurnati is a commentary written by Cakrapanidatta on Susruta Samhita, which is also called Susrutatparva- tika.
136. (d) Tobacco cultivation in India was introduced by Portuguese in 1605. Initially tobacco was grown in Kaira and Mehsana districts of Gujarat and later spread to other areas of the country. Attempt to improve Indian tobacco has begun with the establishment of the Calcutta Botanical gardens in Howrah in 1787.
137. (c) Women's Indian Association (WIA): Founded in 1917 at Adyar, Madras by Annie Besant, Margaret Cousins, Dorothy Jinarajadasa, and others.
National Council of Women in India: Founded in 1925 by Sarala Devi Chaudhurani.
Bharat Stree Mahamandal: Established in 1910 by Lady Meherbai Tata
138. (d)
139. (c)
140. (c) The Ajanta cave paintings were created using a technique that involved preparing the rock surface with a mixture of clay, rice husk, and gum. This preparation was then coated with a layer of lime plaster to create a smooth surface suitable for painting. In the creation of Ajanta paintings, artists first sketched the outlines of the images on the prepared lime-coated surface. After the outlines were completed, the artists filled in the colors, which were derived from natural sources like minerals and plants.
141. (c)
142. (c) The two-week-long joint military exercise 'Desert Cyclone' between India and UAE held in the arid landscape of Rajasthan. The first edition of the IndiaUAE military exercise aims to enhance interoperability through exchanging knowledge and sharing best practices in military operations.
143. (a) The Government of India, in adherence to Article 280(1) of the Constitution, has established the Sixteenth Finance Commission, appointing Dr. Arvind Panagariya, former Vice-Chairman of NITI Aayog and Professor at Columbia University, as its Chairman.
144. (d) In January 2024, the Ministry of Environment, Forest and Climate Change (MoEF&CC) nominated three cities in India for Wetland City Accreditation (WCA) under the Ramsar Convention on Wetlands: Indore, Bhopal and Udaipur.
145. (b) National Youth Day, also known as Vivekananda Jayanti, is celebrated on 12 January, being the birthday of a Hindu monk, Swami Vivekananda. In 1984, the Government of India declared this day as National Youth Day and since 1985 the event is celebrated in India every year.
146. (c)
147. (c) High-level Committee on Simultaneous Elections, constituted under the chairmanship of Shri Ram Nath Kovind, former President of India, has proposed simultaneous elections for Lok Sabha, state Assemblies, and local bodies in India.
148. (c) Raksha Mantri inaugurated first all-girls Sainik School at Vrindavan, Uttar Pradesh. This initiative is part of the plan to establish 100 new Sainik Schools in a partnership mode with NGOs/ Public/State Government Schools in all states. The announcement was made on January 01, 2024
149. (a) Union Home Ministry on February 8 decided to scrap the Free Movement Regime (FMR) along Myanmar border to ensure the internal security of the country and to maintain the demographic structure of India's North Eastern States.

150. (b) Why Bharat Matters is a 2024 non-fictional book written by Indian politician and author S. Jaishankar, and published by Rupa Publications. Jaishankar was the incumbent of the Government of India in the Second Modi ministry at the time of publishing

