HINTS & SOLUTION

1. *b)* Ensure means to guarantee; Insure means to provide insurance

2. *b)* Adapt means to change; Adopt means to take or accept

3. *c)* Later means future time; Latter means second of two

4. *d)* Hoard means to gather and store; Horde means a large crowd

5. *c)* Emigrate means to leave one's country; Immigrate means to enter a new country

6. *a)* "will" → "would" ; "next week" → "the following week"

7. *d)* Imperative sentence → use "instructed us to…" ; Verb remains in base form.

8. *b)* Imperative → "ordered" ; Use of base verb: "March forward"

9. *b)* "Oh!" → emotional exclamation → "exclaimed with joy" ; "this is" → "that it was"

10. *c)* "He had finished" → "I had finished". No tense shift when reporting verb is in past and original was past perfect.

11. *b)* This idiom refers to a minor problem or flaw that spoils an otherwise perfect situation, just like a fly ruining a pot of ointment.

12. *b)* This expression comes from a 1700s play where a playwright's idea was stolen, and it now means to take credit for something that wasn't originally yours.

13. *a)* This idiom originates from the idea of pulling wool (a fabric) over someone's eyes to blind them, representing deception or trickery.

14. *a)* This idiom means having to choose between two difficult or undesirable situations, similar to being trapped between the devil (a dangerous choice) and the sea (an equally risky situation).

15. *a)* In boxing, a trainer would throw a towel into the ring to signal that their fighter could no longer continue, symbolizing giving up or conceding defeat.

16. *a)* The correct structure for a third conditional sentence is "Had he known," which is the inversion of "If he had known." The past perfect form "Had he known" expresses a hypothetical situation in the past.

17. *a)* "Despite" is used to indicate contrast and does not require the word "of." The phrase "Despite of" is incorrect. Therefore, "Despite the heavy rain" is the correct expression.

18. *c)* The relative pronoun "which" should refer to "the new policy," which is singular. The past tense "was" is used to describe the action of discussion, which occurred in the past.

19. *a)* The third conditional form uses "If I had known" to express an unreal situation in the past. The structure "If I had" is correct, as "would have" is used in the main clause to express the result of the condition.

20. *c)* The subject of the sentence is "The report," which is singular. Therefore, the verb should be "was submitted" instead of "were submitted." The phrase "along with the recommendations" does not affect subject-verb agreement.

21. *c)* After the expression "No sooner had," the correct conjunction is "than," not "when." This is a fixed

expression used for showing that one event happened immediately after another.

22. *c)* After the expression "No sooner had," the correct conjunction is "than," not "when." This is a fixed expression used for showing that one event happened immediately after another.

23. *b)* "People" is plural, so the relative pronoun "who" must be followed by a plural verb. Thus, "believe" is correct, as opposed to "believes," which would be incorrect in this context.

24. *b)* After the phrase "It is high time," the verb should be in the past tense or subjunctive form, which is "finished" in this case. This is a fixed expression that requires the past tense for hypothetical situations.

25. *d)* The sentence is grammatically correct. The present perfect continuous tense "has been studying" is appropriate for describing an ongoing action. The rest of the sentence is also correct.

26. *c)* The term "permeable" suggests that the boundaries between the natural and the engineered are becoming less rigid and more fluid, which aligns with the growing capability of synthetic biology to blur these distinctions.

27. *b)* "Profound" indicates that the ethical and philosophical implications of manipulating genetic material are significant and deep, reflecting the weight of the issue in synthetic biology.

28. *c)* "Emergent" refers to something that is in the process of development or coming into being, fitting the context of genetic manipulation, which is still a relatively new and evolving field.

29. *b)* The "conflict" between proprietary interests (those who wish to profit from genetic modifications) and the commons (public resources and knowledge) reflects a core ethical issue in the commercialization of genetic technologies.

30. *c)* "Nebulous" means vague or unclear, which fits the context of the risks associated with genetic interventions, particularly in relation to climate change, where the long-term consequences are uncertain and not well-defined.

31. *b)*
P starts by introducing innovation and disruption.
S presents the paradox that disruption leads to stability.
Q discusses the historical resistance to radical ideas.
R concludes that embracing change leads to progress.

32. *a)*
P establishes the theme (certainty as an illusion).
Q contrasts this with human craving for predictability.
R explains the contradiction of this situation (progress and anxiety).
S concludes that adaptability is crucial to survival.

33. *a)*
P introduces how ideas shape civilizations.
Q highlights that power influences which ideas survive.
R gives historical evidence of silenced great minds.
S concludes that progress requires challenging authority.

34. *a)*
P introduces the idea that time doesn't heal but buries wounds.
Q clarifies that suppression is not resolution.
R explains that unresolved pain resurfaces.
S concludes that true healing requires confrontation.

35. *a)*
P sets up the idea that intelligence without curiosity is stagnant.

Q explains that knowledge grows through questioning.
R warns that passive acceptance leads to stagnation.
S concludes that inquiry is key to progress.

36. *b)* The passage centers on the debate over whether humanity should be held morally accountable for the environmental impacts attributed to the Anthropocene. It contrasts critics who argue that the term implies human guilt with proponents who believe it underscores the urgency of addressing environmental issues. Hence, the core issue is the ethical implication of responsibility.

37. *b)* The passage highlights the central debate about whether human activities alone are responsible for environmental degradation or whether other factors (like capitalism or technological advancements) play a role. The varying perspectives on human agency are presented as a key challenge in discussing the Anthropocene.

38. *c)* The author acknowledges the conflicting views around the term "Anthropocene." While it is used to highlight the need for urgent action regarding environmental crises, it also raises questions about whether human activities are solely responsible. This duality in interpretation is central to the author's perspective.

39. *b)* The passage suggests that capitalist systems and technological advancements have disproportionately contributed to environmental harm. It highlights the role these systems play in accelerating ecological degradation, framing them as central to the environmental challenges described in the Anthropocene.

40. *b)* The term "collective failure" in the passage refers to how human societies, as a whole, have failed to adequately address the long-term consequences of industrialization and resource exploitation, which have led to environmental harm. It underscores the collective inability to prevent or mitigate the damage caused by human activities.

41. *b)* In this sentence, "down" describes the emotional state of the subject "he," functioning as an adjective. "Down" here means feeling sad or depressed, which qualifies it as an adjective modifying the noun "he."

42. *a)* In this case, "but" means "except" and introduces the exception, i.e., John. It governs the noun "John," which makes it a preposition. The sentence is indicating that everyone was present except for John.

43. *c)* In this sentence, "mean" refers to a mathematical term, specifically the average of a set of numbers. The word "mean" is a noun here, referring to a statistical concept.

44. *b)* In this sentence, "once" is used to connect two clauses: "We should leave" and "the meeting is over." It shows that one action (leaving) will occur after the other (the meeting ending), making "once" a conjunction.

45. a) Here, "running" is a present participle derived from the verb "run," but it functions as an adjective modifying the noun "water." It describes the type or state of water, which is moving or flowing, thus qualifying it as a participle acting as an adjective.

46. *b)* "Tenacious" means determined and persistent, which fits the context of someone refusing to give up despite failures. The other options don't convey perseverance—"vacuous" means lacking intelligence, "ephemeral" means short-lived, and "obsequious" means excessively submissive.

47. *c)* "Unequivocal" means clear and unquestionable, which suits the idea of widespread acceptance. "Sporadic" means occasional (which contradicts "gained acceptance"), "empirical" relates to evidence

but doesn't fit syntactically, and "perfunctory" means done without enthusiasm, which doesn't make sense here.

48. *a)* "Remorse" means deep regret or guilt, which aligns with the idea of struggling with past actions. "Indifference" means lack of concern (opposite of the needed meaning), "hubris" means excessive pride, and "exultation" means extreme happiness—both of which contradict the intended tone.

49. *b)* "Cogent" means clear, logical, and convincing, which explains why critics found it hard to argue against. "Bombastic" means overly exaggerated (which weakens rather than strengthens arguments), "nebulous" means vague (opposite of clarity), and "superfluous" means unnecessary.

50. *c)* "Sui generis" means unique or one of a kind, perfectly fitting the idea of a masterpiece that defies conventional categorization. "Prosaic" means dull (opposite of masterpiece), "derivative" means copied from something else, and "hackneyed" means overused or cliché

51. *c)* The Tidal Hypothesis (Jeans & Jeffreys) and Capture Theory propose that the solar system's planets formed due to external gravitational influences (e.g., passing stars), unlike the Nebular and Planetesimal Hypotheses, which suggest internal condensation and accretion.

52. *a)* The Hadean Eon was marked by intense heat, volcanic activity, and the Moon-forming impact event (Theia hypothesis). The first microbial life and oxygenation occurred much later.

53. *b)* The primordial atmosphere was formed from solar nebula gases, mainly hydrogen and helium. It was later replaced by a secondary atmosphere from volcanic outgassing (CO_2, H_2O, NH_3, CH_4).

54. *a)* Gravitational segregation caused heavier elements (iron, nickel) to sink, forming Earth's core, while accretion of cosmic materials led to planetary growth. Tectonic and volcanic activities were later geological processes.

55. *b)* The time difference per 15° longitude is 1 hour. The difference between 60°E and 15°W is 75° (60 + 15). Since moving westward means subtracting time, 75° = 5 hours. 12:00 noon – 5 hours = 8:00 AM.

56. *c)* Brazil is the only country that is crossed by both the Equator and the Tropic of Capricorn. The Equator passes through its northern region, while the Tropic of Capricorn crosses its southern part. Kenya and Indonesia lie near the Equator but do not extend to the Tropic of Capricorn. Australia, on the other hand, is entirely south of the Equator.

57. *c)* An increased axial tilt would lead to more pronounced seasons. Summers would become hotter and winters colder because of the increased angle of sunlight. Equinoxes would remain the same, and the Prime Meridian would not be affected as it is a human-defined reference.

58. *b)* Cyclones form over warm tropical waters (26°C or above) and require the Coriolis effect, which is weak near the equator (0°–10°). Thus, most cyclones originate between 10° and 30° latitude in both hemispheres.

59. *b)*

Tropical Monsoon Climate → Affected by seasonal shift of ITCZ

Mediterranean Climate → Controlled by subtropical high-pressure shift

Hot Desert Climate → Located under subtropical high-pressure belt

Humid Continental Climate is mainly influenced by latitude and continentality, not shifting pressure belts.

60. *d)* ENSO disrupts global climate patterns:

Australia & Southeast Asia → Droughts due to weakened monsoons
West Coast of South America → Heavy rainfall, warmer waters, and fishery collapse
Sahel region of Africa → Disruptions in monsoon rains, leading to drought
Eastern USA → Unseasonal storms and floods

61. *b)* Siberia has extreme cold winters due to continentality (landlocked nature), polar air masses, and the presence of mountain barriers (e.g., Urals), preventing warm air intrusion. It Is not influenced by warm ocean currents.

62. *b)* Permafrost is a defining feature of the Tundra climate (ET), where ground remains frozen for most of the year.

63. *b)* Anti-cyclones are high-pressure systems where the central pressure is higher than the surrounding areas, so Statement 3 is incorrect. Due to the Coriolis effect, anti-cyclones rotate clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere, making Statement 1 incorrect. At the surface, the winds diverge outward from the center of the anti-cyclone due to the high pressure, which is why Statement 2 is correct. Because of the sinking air and lack of rising motion required for cloud formation, anti-cyclones result in prolonged dry and calm weather conditions, making Statement 4 correct. These systems are often responsible for extended periods of heat waves in summer and cold, clear weather in winter.

64. *b)* A Super Typhoon is a tropical cyclone in the Western Pacific Ocean with sustained wind speeds exceeding 240 km/h (150 mph). It is the most powerful category of tropical cyclones and is similar to Category 5 hurricanes in the Atlantic.

65. *c)* The Coriolis effect, caused by Earth's rotation, is weakest at the equator and increases toward the poles. Cyclones require a minimum Coriolis force to develop a rotating motion, which is why they rarely form between 0° and 5° latitude.

66. *b)* Statement 1 – Incorrect: While most tropical cyclones develop a well-defined eye, not all of them do. Weak tropical storms may lack an eye. Additionally, some intense extratropical cyclones can develop eye-like features, particularly during rapid intensification (bomb cyclogenesis).
Statement 2 – Correct: In rare cases, extratropical cyclones can transition into tropical cyclones if they move over warm ocean waters with favorable conditions (e.g., Hurricane Alex in 2016).
Statement 3 – Correct: Polar cyclones intensify during winter due to the extreme temperature difference between polar air masses and mid-latitude air.
Statement 4 – Incorrect: Mesocyclones form within severe thunderstorms over both land and ocean, not exclusively over oceans. They are the precursors to tornadoes, which occur mostly over land.

67. *c)* India's airspace is divided into five FIRs managed by the Airports Authority of India (AAI):

1. Delhi FIR
2. Mumbai FIR
3. Chennai FIR
4. Kolkata FIR
5. Guwahati FIR (covering the Northeast)

68. *d)* Due to restrictions from Pakistan, India uses the Iranian air corridor for flights to Afghanistan and Central Asia, ensuring geopolitical and strategic connectivity.

69. *a)* Located at 3,256 meters (10,682 feet) above sea level, Leh Airport is one of the highest airports in the world. The high altitude makes takeoffs and landings challenging due to thin air.

70. *b)* Mumbai–Dubai is the busiest international route from India, with multiple daily flights operated by Air India, Emirates, and IndiGo.

71. *a)* 1-B, 2-C, 3-D, 4-A, 5-E

1. Kesavananda Bharati Case (1973) → Established the Basic Structure Doctrine (B)

   This case ruled that while Parliament has the power to amend the Constitution, it cannot alter its basic structure. This doctrine protects fundamental principles like democracy, secularism, and judicial review.
2. Maneka Gandhi Case (1978) → Expanded the scope of Article 21, ensuring due process (C)

   This judgment widened the interpretation of Article 21 (Right to Life and Personal Liberty), ensuring that any law affecting life and liberty must follow due process, not just procedure established by law.
3. SR Bommai Case (1994) → Limited the misuse of Article 356 (D)

   The ruling curtailed the misuse of President's Rule (Article 356), ensuring that state governments cannot be dismissed arbitrarily. It reinforced the federal structure of India.
4. Indra Sawhney Case (1992) → Introduced the "creamy layer" concept in reservations (A)

   This judgment upheld OBC reservations but introduced the creamy layer concept to exclude the affluent sections of OBCs from benefits, ensuring that reservations reach the truly disadvantaged.

72. *a)* Certiorari is issued when a lower court or tribunal has made an incorrect or unlawful decision, allowing a higher court to quash it.
Prohibition is issued to stop an inferior court from continuing proceedings if it is acting beyond its jurisdiction.
Certiorari is corrective as it deals with actions already taken, whereas Prohibition is preventive as it stops an action before it happens.
Certiorari can be issued against judicial, quasi-judicial, and certain administrative bodies performing judicial functions, while Prohibition is limited to judicial and quasi-judicial authorities.
Prohibition cannot be issued after a final judgment is given, making statement 4 incorrect.
Certiorari is not limited to courts alone; it extends to administrative bodies exercising judicial powers, making statement 5 incorrect.

73. *a)* Statement 1 is correct: The First Amendment introduced the Ninth Schedule to shield certain laws from judicial review.
Statement 2 is incorrect: DPSPs are non-justiciable, meaning they cannot be enforced by courts.
Statement 3 is correct: Article 368 outlines different procedures for constitutional amendments.
Statement 4 is incorrect: 'Procedure Established by Law' is from the Japanese Constitution, not the U.S., and does not ensure due process of law.

74. *b)* Statement A Correct. The 42nd Amendment Act, 1976 inserted Article 51A, introducing the Fundamental Duties.
Statement B Incorrect. The 97th Amendment Act, 2011 added Article 43B but not as a DPSP; it was related to the promotion of cooperative societies and also amended Part IXB of the Constitution.
Statement C Correct. The 44th Amendment Act, 1978 modified Article 368, ensuring that Fundamental Rights (especially Articles 20 and 21) cannot be easily amended.
Statement D Incorrect. The 61st Amendment Act, 1989 reduced the voting age from 21 to 18 years, but it amended Article 326, not Article 324.

75. *c)* Immanuel Kant introduced the idea of a global federation of states in his famous work Perpetual Peace (1795). He argued that lasting peace could only be achieved through international cooperation and a system of global governance. His vision laid the

foundation for later concepts of a world state, international organizations, and global unity.

76. *b)* The World Federalist Movement (WFM) was founded in 1947 to advocate for a democratic world government. It believes that global peace is only possible through political unification and that the UN should evolve into a federal world state.

77. *c)* The 2008 Beijing Olympics used the slogan "One World, One Dream" to symbolize global unity and shared aspirations.

78. *b)* The One World idea aligns most closely with Liberalism in international relations, which advocates for international institutions, diplomacy, and global cooperation to achieve peace. Realism, in contrast, focuses on state sovereignty and power struggles, making it incompatible with the One World vision.

79. *c)* The February Revolution of 1917 was triggered by widespread discontent among workers and soldiers. Food shortages, harsh winter conditions, and military defeats in World War I led to strikes and protests in Petrograd (St. Petersburg). On March 8, 1917, workers took to the streets, demanding food and political reforms. The unrest spread rapidly, forcing Tsar Nicholas II to abdicate on March 15, 1917.

80. *b)* The Kronstadt sailors, who had earlier supported the Bolsheviks, rebelled in 1921 against War Communism, demanding more political freedoms and better economic conditions. Lenin crushed the rebellion, but it convinced him to introduce the New Economic Policy (NEP), which temporarily allowed small-scale private enterprise.

81. *b)* Lenin signed the Treaty of Brest-Litovsk with Germany in March 1918 to end Russia's involvement in World War I. As a result, Russia lost vast territories, including Ukraine, Belarus, and the Baltic states, to Germany and its allies. This decision angered many Russians and fueled the Russian Civil War (1918-1922).

82. *b)* When Lenin returned from exile in April 1917, he issued the April Theses, which rejected support for the Provisional Government and called for:
"Peace" (immediate withdrawal from WWI)
"Land" (redistribution of land to peasants)
"Bread" (end to food shortages)
This became the ideological basis for the Bolshevik Revolution in October 1917.

83. *b)* The Panchsheel Principles, or the Five Principles of Peaceful Coexistence, were first formally articulated in the 1954 agreement between India and China. This agreement, signed on April 29, 1954, focused on trade and intercourse between the Tibet region of China and India, emphasizing mutual respect for sovereignty and territorial integrity, non-aggression, non-interference in each other's internal affairs, equality and mutual benefit, and peaceful coexistence.

84. *c)* The Panchsheel Principles were conceptualized by Jawaharlal Nehru and Zhou Enlai as a framework for peaceful coexistence between India and China. The formal agreement was signed on 29 April 1954.

85. b) The Five Principles of Panchsheel are:

1. Mutual respect for each other's territorial integrity and sovereignty
2. Mutual non-aggression
3. Mutual non-interference in each other's internal affairs
4. Equality and mutual benefit
   Peaceful coexistence
   "Mutual assistance in times of war" was not included in the principles.

86. *b)* The term 'Non-Alignment' was first used by V.K. Krishna Menon in a speech at the United Nations in 1953. Subsequently, Jawaharlal Nehru elaborated on

the concept in his 1954 speech in Colombo, outlining the Panchsheel Principles, which later became foundational to the Non-Aligned Movement.

87. *b)* The term 'Non-Alignment' was first used by V.K. Krishna Menon in a speech at the United Nations in 1953. Subsequently, Jawaharlal Nehru elaborated on the concept in his 1954 speech in Colombo, outlining the Panchsheel Principles, which later became foundational to the Non-Aligned Movement.

88. *c)* The Fourth Industrial Revolution (4IR), coined by Klaus Schwab, involves AI, robotics, IoT, genetic engineering, and quantum computing. It differs from earlier industrial revolutions by integrating digital systems into daily life and industry, creating cyber-physical systems.

89. *b)* The Luddites were a group of English workers who destroyed textile machinery, fearing that mechanization would replace skilled labor and lead to unemployment. Their movement symbolizes early resistance to technological change and raises ethical debates about automation and job displacement.

90. *a)* Statement 2 is incorrect: James Watt did not invent the first steam-powered machine; the first crude steam engine was developed by Thomas Newcomen. Watt improved its efficiency, making it viable for industrial use.
Statement 4 is incorrect: Marie Curie's research focused on radioactivity, but the uncertainty principle was formulated by Werner Heisenberg and is part of quantum mechanics.

91. *a)* This pattern represents slow initial growth (lag), rapid exponential growth (log), and a plateau phase (stationary) due to resource limitation.

92. *a)* The epididymis is a coiled tube attached to the testes where sperm are stored and mature before being transported through the vas deferens during ejaculation.

93. *a)*
(A) Correct – Maxwell formulated Maxwell's equations, unifying electricity, magnetism, and optics.
(B) Correct – Curie discovered polonium and radium and won Nobel Prizes in Physics (1903) and Chemistry (1911).
(C) Correct – Pasteur developed vaccines for rabies and anthrax and introduced pasteurization.
Incorrect – Mendeleev developed the periodic table, not quantum mechanics or the uncertainty principle (which was formulated by Werner Heisenberg).

94. *b)* Glycocalyx is a carbohydrate-rich layer on the cell membrane that helps in cell recognition, adhesion, and immune response.

95. *b)* Squamous epithelium is composed of thin, flat cells that allow rapid diffusion of gases. This makes it ideal for locations like the alveoli of lungs, where oxygen and carbon dioxide exchange occur.

96. *c)* The composition of protoplasm is not constant; it continuously changes due to metabolic activities such as enzymatic reactions, exchange of materials, and energy production. Water, ions, proteins, and other biomolecules are dynamically regulated.

97. *b)* Phosphorus is a key component of ATP (Adenosine Triphosphate), NADH (Nicotinamide Adenine Dinucleotide), and phospholipids in cell membranes. It plays a critical role in energy transfer reactions and metabolism.

98. *b)* As a meteoroid enters Earth's atmosphere at speeds of 11–72 km/s, the air in front of it is rapidly compressed, causing adiabatic heating (compression

heating). This, along with friction with air molecules, leads to temperatures over 3,000°C, making the meteor glow.

99. *c)* The Oort Cloud is a hypothetical spherical shell surrounding the Solar System, extending up to 100,000 AU. Long-period comets (with orbital periods over 200 years) originate from this region.

100. c) A total solar eclipse occurs when the Moon completely covers the Sun. This can only happen when:
The Moon is in the new moon phase.
The Sun, Moon, and Earth are in perfect alignment (syzygy).
The observer is located in the umbra (the darkest part of the shadow).
If the alignment is not perfect, a partial eclipse occurs instead.

101. *b)* Decomposition of $CaCO_3$ into $CaO + CO_2$ is a chemical change due to bond breaking.
Burning of magnesium produces MgO, a chemical reaction.
Sublimation of iodine & freezing of mercury are physical changes (no new substance).

102. *b)* Photosynthesis absorbs sunlight (endothermic chemical reaction).
Decomposition of $CaCO_3$ requires heat to produce $CaO + CO_2$ (endothermic).
Melting of ice is physical, and respiration is exothermic.

103. *d)* Carbonates are not reduced by hydrogen gas; they require strong acids or heat for decomposition.
CO_2 is obtained industrially from fermentation, lime kilns, and combustion of carbon compounds.

104. *d)* Statement 1 (Correct): CO_2 is 1.5 times heavier than air, making it settle in low-lying areas. Its non-combustibility makes it an effective fire suppressant. Furthermore, it is a greenhouse gas that absorbs infrared radiation, contributing to global warming.
Statement 2 (Correct): At atmospheric pressure, CO_2 sublimates, meaning it transitions directly from a solid (dry ice) to a gas. Its critical temperature (31.1°C) and critical pressure (73.8 atm) define the conditions beyond which CO_2 exists as a supercritical fluid, a phase with properties of both liquids and gases.
Statement 3 (Incorrect): Although CO_2 dissolves in water to form carbonic acid (H_2CO_3), it undergoes partial ionization, making it a weak acid, not a strong acid that fully dissociates in solution.
Statement 4 (Correct): CO_2 reacts with limewater ($Ca(OH)_2$) to form a milky precipitate of calcium carbonate ($CaCO_3$). In excess CO_2, $CaCO_3$ dissolves, forming calcium bicarbonate [$Ca(HCO_3)_2$]. Additionally, CO_2 plays a key role in the Solvay process, where it reacts with ammonia and brine to synthesize sodium carbonate (Na_2CO_3).
Statement 5 (Correct): CO_2 does not have a liquid phase under standard atmospheric pressure. Instead, it sublimates from solid (dry ice) to gas due to its weak intermolecular forces, making dry ice useful for refrigeration and fog effects.

105. *b)* The pH is given as 4, so the H^+ concentration is 10^{-4} M.
If the acid were strong, it would completely ionize, meaning $[H^+]$ should be equal to its concentration (0.01 M or 10^{-2} M), giving a pH of 2.
Since the actual pH is 4 (which is higher than 2), it indicates partial ionization, meaning the acid is weak.
Thus, the acid must be weak because a strong acid would have given a lower pH.

106. *c)* According to the Brønsted-Lowry theory, acids donate protons (H^+), and bases accept protons. The given option states that Brønsted-Lowry bases donate protons, which is incorrect. They actually accept protons.

107. *c)* A buffer solution consists of a weak acid + its conjugate base.
HCl and NaCl are strong acid + neutral salt (not a buffer).
H_3PO_4 and Na_3PO_4 don't form a strong buffer because Na_3PO_4 is too basic.
Best buffer system = CH_3COOH (weak acid) + CH_3COONa (conjugate base).

108. *b)* $Kw = [H^+][OH^-] = 1 \times 10^{-14}$ at 25°C.
Kw increases with temperature because the ionization of water is endothermic.
If Kw increases, then $[H^+]$ increases, leading to a lower pH.
Even though the solution remains neutral ($[H^+] = [OH^-]$), its pH decreases.

109. *a)* Sodium nitrate ($NaNO_3$) is called "Chile saltpeter" because it was historically mined in large amounts from Chilean saltpeter deposits. It is used in fertilizers and explosives.

110. *b)* Manganese (Mn) exhibits variable valencies of +2, +3, +4, +6, and +7 due to the unstable half-filled 3d and 4s orbitals.
Chromium (Cr) exhibits +2, +3, +6; Vanadium (V) exhibits +2, +3, +4, +5; and Copper (Cu) exhibits +1, +2.

111. *a)* In $Fe(CO)_5$, iron exists in the zero oxidation state due to metal-ligand back bonding, making its effective valency zero.
In SO_4^{2-}, $AlCl_3$, and $CuSO_4$, the central atoms (S, Al, Cu) have nonzero oxidation states.

112. *a)* In superoxide (O_2^-), the total charge is -1.
Since two oxygen atoms share this charge, the oxidation state per oxygen atom is -1/2.

113. *b)* Fluorine always shows -1 valency.
Argon (Ar) is inert and does not exhibit valency.
Magnesium (Mg) always shows +2 valency.
Chlorine (Cl) shows both +1, +3, +5, +7 (in oxoanions) and -1 (in Cl^- ion).

114. *a)* Sulfur is the main fuel in the match head. It burns easily, producing sulfur dioxide gas, which aids combustion.

115. *b)* Potassium chlorate ($KClO_3$) decomposes upon heating, releasing oxygen that helps sulfur and antimony trisulfide burn efficiently.

116. *b)* These questions are designed to test knowledge of recent events and developments relevant to UPSC exam preparation.

117. *c)* Anahat Singh, an emerging talent in Indian squash, won the Indian Open Squash Title in 2025, solidifying her position as one of India's top young athletes.

118. *b)* Exercise Prachand Prahar was a joint military drill involving the Army, Navy, and Air Force in Arunachal Pradesh, focusing on integrated combat strategies in high-altitude warfare scenarios.

119. *a)* The **Sahkar Taxi Service**, launched in March 2025, is a government initiative promoting a **cooperative-based** taxi system. It empowers drivers with ownership stakes, ensuring **fair wages and reduced commissions**, providing a **sustainable alternative** to corporate ride-hailing platforms.

120. *c)* Arun Kapur, a prominent educationist, was recognized for his work in promoting quality education across multiple nations. His contributions significantly impacted education policies in Bhutan and Oman, earning him this prestigious honor.

121. *a)* The Lokpal of India has adopted "Empower Citizens, Expose Corruption" as its new motto. This motto replaces the previous one. The new motto is

designed to reflect the Lokpal's focus on citizen empowerment and combating corruption.

122. *b)* The 'Jhumoir Binandini 2025' festival celebrated the cultural heritage of Assam's tea garden community. It included a large-scale performance featuring thousands of artists performing the traditional Jhumoir dance.

123. *b)* The Indian Naval Academy at Ezhimala, Kerala, is the largest naval academy in Asia and trains future officers for the Indian Navy.

124. *b)* Major Somnath Sharma was the first recipient of the Param Vir Chakra, awarded posthumously for his bravery during the 1947-48 Indo-Pak War in Kashmir.

125. *b)* The Mera Yuva Bharat initiative focuses on engaging the youth of India by promoting volunteerism, leadership, and community development. The initiative aims to build a strong foundation for the youth to contribute positively to society.

126. *b)* Geomagnetic reversals are believed to occur due to changes in the convection currents of molten iron in the Earth's outer core. These variations in flow can disrupt the geomagnetic field and cause it to flip, switching the magnetic poles.

127. *a)* The movement of Earth's magnetic poles over time, known as geomagnetic secular variation, is a gradual change in the magnetic field. It is observed that the magnetic north pole has been drifting towards Siberia at an increasing rate of approximately 40 km per year.

128. *a)*

A) Magnets always have two poles.
B) Magnetic force weakens with distance.
C) Magnetic field lines flow from north to south.
D) Materials like iron can become temporarily magnetized.

The magnetic force is strongest at the poles, not the centre.

129. *a)* Artificial permanent magnets are made by cooling a ferromagnetic material (like steel) in the presence of a strong magnetic field. This process aligns the magnetic domains within the material, giving it permanent magnetism.

130. *a)* Artificial magnets can lose their magnetism if exposed to high temperatures above their Curie point, which causes the alignment of magnetic domains to break down, leading to a loss of magnetism.

131. *c)* Specific heat capacity defines the amount of heat required to raise the temperature of a substance by 1°C. If material A has a higher specific heat, it will absorb more heat without a large increase in temperature compared to material B, which has a lower specific heat.

132. *a)* A calorimeter is based on the law of conservation of energy, which states that energy cannot be created or destroyed, only transferred. The heat gained by one substance equals the heat lost by another.

133. *a)* The formula to calculate heat is $Q = mc\Delta T$, where m is mass, c is specific heat, and ΔT is the change in temperature.

Substitute the values:

$Q = 500 \times 4.18 \times (60 - 20)$

$Q = 500 \times 4.18 \times 40 = 16700$ J

134. *a)* Absolute zero is the temperature at which the volume of an ideal gas becomes zero, and molecular motion stops. It is the point at which the gas law constant is valid and gases behave ideally.

135. *b)* When a substance reaches its boiling point, additional heat goes into changing the phase (from liquid to gas) without increasing the temperature. This heat is called the latent heat of vaporization.

136. *a)* Infrared radiation with shorter wavelengths has higher energy and can transfer heat more efficiently. Longer wavelengths, such as microwaves, are less effective in transferring heat.

137. *c)* Emissivity is the efficiency with which an object radiates heat. A perfect black body, with an emissivity of 1, radiates heat at the maximum possible rate for any given temperature. A higher emissivity corresponds to a better ability to radiate heat.

138. *c)* Given Data:
Length of the rod, L = 2 m
Mass of the rod, m = 3 kg
Gravitational acceleration, g = 9.8m/s2
Weight of the rod, W = mg = 3 × 9.8 = 29.4 N
Position of supports:
X1=0.5 m from one end
X2 =1.5 m from the same end
Center of mass of the rod is at
Xc = L/2 = 1 m from the same end.
Step 1: Applying Torque Balance
Taking torques about 1 (assuming counterclockwise as positive),
N2 × (x2-x1) = W × (xc-x1)
Substituting values:
N2 × (1.5 – 0.5) = 29.4 × (1 – 0.5)
N2 × 1 = 29.4 × 0.5
N2 = 14.7 N
Step 2: Using Force Balance Equation
Since the rod is in equilibrium,
N1 + N2 = W
N1+14.7 29.4
N1 = 14.7 N
Final Answer:
N1 = 14.7 N, N2 = 14.7 N

139. *d)* The escape speed ve from a planet is given by:
Ve = $\sqrt{(2GM/R)}$
Let ME and RE be the mass and radius of Earth.
Given:
Mass of the new planet = 2ME
Radius of the new planet = 3RE
Escape speed from Earth, VeE = 11.2 Km/s
For the new planet, the escape speed Vep is:
VeP = $\sqrt{\{2G(2ME)/3RE\}}$ = $\sqrt{\{(2/3) \times (2GME/RE)\}}$ = $\sqrt{(4/3)} \times$ VeE = $\sqrt{(4/3)} \times 11.2$ = 12.9 Km/s approximately

140. *c)* Deceleration a = -μk g = -1.96 m/s²
Using $v^2 = u^2 + 2as$, solve for s:
S = $10^2 / (2 \times 1.96)$ = 25.5 m

141. *b)* Mass of ball, m = 0.2 kg
Drop height, h_1 = 1.8 m
Rebound height, h_2 = 1.2 m
Contact time, Δt = 0.08 s
Gravitational acceleration, g = 10 m/s²
Step 1: Velocity Before Impact
Using v = $\sqrt{(2gh)}$:
$V_1 = \sqrt{(2 \times 10 \times 1.8)}$ = 6 m/s (downward)
Step 2: Velocity After Rebound
$V_2 = \sqrt{(2 \times 10 \times 1.2)} \approx 4.9$ m/s (upward)
Step 3: Change in Momentum
Momentum before impact:
$P_1 = m \times v_1 = 0.2 \times (-6) = -1.2$ kg·m/s
Momentum after rebound:
$P_2 = m \times v_2 = 0.2 \times 4.9 = 0.98$ kg·m/s
Total change in momentum:
$\Delta p = p_2 - p_1 = 0.98 – (-1.2) = 2.18$ kg·m/s
Step 4: Average Force
F = Δp / Δt = 2.18 / 0.08 = 27.25 N

142. *d)* The horizontal range R is given by R = $(v^2 \sin 2\theta) / g$. Tripling v increases R by 9 times.
The maximum height H is given by H = $(v^2 \sin^2\theta) / (2g)$. Tripling v increases H by 9 times.

143. *b)* Acceleration due to gravity at height h Is given by: $G = g (R/R+h)^2 = g (R/2R)^2 = 9.8 / 4 = 2.45 \text{ m/s}^2$

144. *b)* The block is initially compressed in a spring, so it's initial energy is given by the elastic potential energy formula:
$Us = ½ Kx^2 = ½ 400 \times 0.2^2 = 8 \text{ J}$
This energy is converted in to kinetic energy and then used to move up the incline
Work done against friction on the incline
Force of friction $Ff = umg \cos\emptyset = 0.1 \times 2 \times 10 \times \cos30 = 1.732 \text{ N}$
Work done over a distance s
$Wf = Ff \times s = 1.732 \times s$
The block moves s meters along the incline, so the height gained is:
$h = s \sin30 = s/2$
Work done against gravity is:
$Wg = mgh = 2 \times 10 \times s/2 = 10s$
Applying work energy theorem:
Initial energy = Wg + Wf
$8 = 10s + 1.732s$
$8 = 11.732s$
$s = 0.682$ m approximately

145. *d)* Newton's Third Law: The rocket moves upward as a reaction to the downward expulsion of gases.
Newton's Second Law: The rocket's acceleration is due to the force generated by the changing momentum of expelled gases (F = ma).
Thus, both laws apply.

146. *a)* Using parallelogram law of vector addition, the magnitude of resultant force R is given by:
$R = \sqrt{(F^2 + F^2 + 2FFCos120)}$
$Cos120 = -1/2$
$R = \sqrt{(2F^2 - F^2)} = \sqrt{F^2} = F$

147. *a)* The long pole lowers the overall center of mass, making the tightrope walker more stable. Additionally, the pole increases the moment of inertia, making it harder for the walker to rotate and lose balance. This helps in maintaining equilibrium while walking on the rope.

148. *c)* If two objects are moving with velocities at right angles, their relative velocity is given by the Pythagorean theorem:
$V = \sqrt{(V1^2 + V2^2)} = \sqrt{2}V$ (greater than V but less than 2V)

149. *d)* In a rotating space station, the outward centrifugal pseudo force gives the sensation of gravity. This force makes astronauts feel as if they are being pushed against the outer walls, simulating gravity.

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