AP EAPCET 2026 May 19 Shift 2

Question Paper with Solutions (Memory Based)

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General Instructions

(i) The test is of 3 hours duration.

(ii) This test paper consists of 160 questions. The maximum marks are 160.

(iii) Physics and Chemistry contains 40 questions each and Biology contains 80 questions.

(iv) Each question carries +1 marks for correct answer and there is no negative marking for wrong answer.

Physics

1. A charge $q = 2$ C moves with velocity 3 m/s perpendicular to a magnetic field $B = 2$ T. Force on charge is:

(A) 6 N

(B) 12 N

(C) 3 N

(D) 0 N

Correct Answer: (B) 12 N

Solution:

Step 1: Understanding the Question:

The question asks to calculate the magnetic force acting on a moving charge when it enters a uniform magnetic field perpendicularly.

Step 2: Key Formula or Approach:

The magnetic force ($\vec{F}$) acting on a charge q moving with a velocity $\vec{v}$ in a magnetic field $\vec{B}$ is given by the Lorentz force formula:

$$F = q \cdot v \cdot B \cdot \sin\theta$$

where θ is the angle between the velocity vector ($\vec{v}$) and the magnetic field vector ($\vec{B}$).

Step 3: Detailed Explanation:

- The magnetic force on a moving charge arises due to the interaction of the charge's own magnetic field (generated by its motion) with the external magnetic field.
- According to the problem statement, the charge is moving "perpendicular" to the magnetic field.
- This means the angle θ between the velocity vector $\vec{v}$ and the magnetic field vector $\vec{B}$ is 90°.
- We know that the value of $\sin(90^\circ) = 1$. This is the condition for maximum magnetic force.
- We are given the following values:
  Charge, $q = 2$ C
  Velocity, $v = 3$ m/s
  Magnetic field, $B = 2$ T
- Substituting these values into the magnetic force formula:

$$F = (2) \cdot (3) \cdot (2) \cdot \sin(90^\circ)$$

$$F = 2 \cdot 3 \cdot 2 \cdot 1$$

$$F = 12 \text{ N}$$

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- Therefore, the magnitude of the force acting on the charge is 12 N.

- The direction of this force is always perpendicular to both the velocity of the charge and the magnetic field, and can be determined using Fleming's Left-Hand Rule or the Right-Hand Rule.

Step 4: Final Answer:
The magnetic force acting on the given charge is 12 N.

Quick Tip: When a charge moves perpendicular to a magnetic field ($\theta = 90^\circ$), the magnetic force is maximum ($F = qvB$).
If the charge moves parallel or antiparallel to the field ($\theta = 0^\circ$ or 180°), the force is zero ($F = 0$).

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2. At a place, horizontal component of Earth's field is 0.3 T and angle of dip is 60°. Total magnetic field is:

(A) 0.3 T
(B) 0.6 T
(C) 0.15 T
(D) 0.9 T

Correct Answer: (B) 0.6 T

Solution:

Step 1: Understanding the Question:
The question asks to determine the total intensity of the Earth's magnetic field at a specific location, given its horizontal component and the angle of dip.

Step 2: Key Formula or Approach:

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The total magnetic field of the Earth (B) is resolved into two perpendicular components: the horizontal component (B_H) and the vertical component (B_V).
The relationship between the horizontal component, the total magnetic field, and the angle of dip (θ) is given by:

$$B_H = B \cdot \cos\theta$$

Rearranging this formula to solve for the total magnetic field:

$$B = \frac{B_H}{\cos\theta}$$

Step 3: Detailed Explanation:

- The angle of dip (or magnetic inclination) is the angle made by the Earth's total magnetic field vector with the horizontal plane at that place.
- In this problem, the horizontal component of Earth's magnetic field is $B_H = 0.3$ T.
- The angle of dip is given as $\theta = 60^\circ$.
- The total magnetic field B is the vector sum of its horizontal and vertical components. Since B_H is the projection of B along the horizontal direction, we use the cosine trigonometric ratio.
- We know that the value of $\cos(60^\circ) = 0.5 = \frac{1}{2}$.
- Substituting the values of B_H and $\cos(60^\circ)$ into our rearranged equation:

$$B = \frac{0.3}{\cos(60^\circ)}$$

$$B = \frac{0.3}{0.5}$$

$$B = 0.6 \text{ T}$$

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- Thus, the total magnetic field intensity at that place is 0.6 T.

Step 4: Final Answer:

The total magnetic field of the Earth at the given place is 0.6 T.

Quick Tip: Remember the components of Earth's magnetic field:
- Horizontal Component: $B_H = B \cdot \cos\theta$
- Vertical Component: $B_V = B \cdot \sin\theta$
- Ratio of components: $\tan\theta = \frac{B_V}{B_H}$

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3. In an EM wave, electric field amplitude is 300 V/m. Magnetic field amplitude is:

(A) 1×10^{-6} T

(B) 1×10^{-5} T

(C) 1×10^{-7} T

(D) 3×10^{-6} T

Correct Answer: (A) 1×10^{-6} T

Solution:

Step 1: Understanding the Question:

The question asks to find the amplitude of the magnetic field vector in an electromagnetic (EM) wave, given the amplitude of its corresponding electric field vector.

Step 2: Key Formula or Approach:

In any electromagnetic wave propagating in a vacuum or air, the amplitudes of the electric field (E_0) and the magnetic field (B_0) are directly related to the speed of light (c) by the equation:

$$c = \frac{E_0}{B_0}$$

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Rearranging this formula to find the magnetic field amplitude:

$$B_0 = \frac{E_0}{c}$$

where $c \approx 3 \times 10^8$ m/s is the speed of light in vacuum.

Step 3: Detailed Explanation:

- Electromagnetic waves consist of oscillating electric and magnetic fields that are perpendicular to each other and also perpendicular to the direction of wave propagation.
- The ratio of the magnitude of the electric field to the magnitude of the magnetic field at any instant is a constant, which is equal to the velocity of the wave in that medium.
- We are given the electric field amplitude as $E_0 = 300$ V/m.
- The speed of light in vacuum is a fundamental constant, $c = 3 \times 10^8$ m/s.
- Substituting these values into the rearranged relation:

$$B_0 = \frac{300}{3 \times 10^8}$$

$$B_0 = 100 \times 10^{-8} \text{ T}$$

$$B_0 = 1 \times 10^{-6} \text{ T}$$

- Thus, the amplitude of the oscillating magnetic field in this electromagnetic wave is 1×10^{-6} T.

Step 4: Final Answer:

The magnetic field amplitude of the EM wave is 1×10^{-6} T.

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Quick Tip: The magnetic field vector in an EM wave is always much smaller in numerical value than the electric field vector because of the factor of c (3×10^8) in the denominator.
Always express your final answer in standard scientific notation to easily match the options.

Chemistry

4. Which one of the pairs will form a buffer solution?

(A) CH_3COONa & $NaOH$
(B) CH_3COONH_4 & NH_4Cl
(C) NH_4Cl & NH_4OH
(D) CH_3COONa & HCl

Correct Answer: (C) NH_4Cl & NH_4OH

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the given mixtures of chemical species will act as a buffer solution.

Step 2: Detailed Explanation:

- A buffer solution is an aqueous solution that resists changes in its pH level upon the addition of small amounts of a strong acid or a strong base.

- Buffer solutions are of two primary types:
  - **Acidic Buffer:** Formed by mixing a weak acid and its salt with a strong base (e.g., CH_3COOH and CH_3COONa).
  - **Basic Buffer:** Formed by mixing a weak base and its salt with a strong acid (e.g.,

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NH_4OH and NH_4Cl).

- Let us analyze each of the given options:

- **Option (A):** CH_3COONa is a salt of a weak acid and a strong base, and NaOH is a strong base. Since there is no weak acid or weak base present, this pair cannot act as a buffer solution.

- **Option (B):** CH_3COONH_4 is a salt of a weak acid and weak base, and NH_4Cl is a salt of a weak base and strong acid. A mixture of two salts does not form a standard buffer solution.

- **Option (C):** NH_4OH is a weak base, and NH_4Cl is its conjugate salt formed with a strong acid (HCl). This matches the exact definition of a basic buffer solution. Therefore, this pair will form a buffer.

- **Option (D):** CH_3COONa is a salt and HCl is a strong acid. Although they can react to form a weak acid (CH_3COOH), the given pair itself is not a buffer mixture unless mixed in specific non-stoichiometric ratios where the weak acid is generated in excess alongside its salt. Among the direct choices, Option (C) is the classic basic buffer.

Step 3: Final Answer:

The pair that will form a buffer solution is NH_4Cl & NH_4OH.

Quick Tip: To quickly identify a buffer solution:

- Look for a Weak Acid + its conjugate salt (Acidic Buffer).

- Look for a Weak Base + its conjugate salt (Basic Buffer).

Pairs containing strong acids or bases alone (like NaOH) do not form buffers unless they are part of a partial neutralization reaction where the weak component remains in excess.

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5. When 30 ml of 0.2 M NH_4OH is added to 30 ml of 2 M NH_4Cl solution. If the pH of the buffer formed is 8.2, what is the pKb of NH_4OH?

(A) 7.2

(B) 5.8

(C) 6.8

(D) 4.8

Correct Answer: (D) 4.8

Solution:

Step 1: Understanding the Question:

This numerical problem asks to calculate the dissociation constant exponent (pK_b) of a weak base (NH_4OH) in a basic buffer solution of known pH and concentration.

Step 2: Key Formula or Approach:

For a basic buffer solution (weak base + conjugate salt), we use the Henderson-Hasselbalch equation:

$$pOH = pK_b + \log\left(\frac{[Salt]}{[Base]}\right)$$

Also, the relationship between pH and pOH at 298 K is:

$$pH + pOH = 14 \implies pOH = 14 - pH$$

Step 3: Detailed Explanation:

- First, let us calculate the pOH of the buffer solution from the given pH:

$$pOH = 14 - pH$$

$$pOH = 14 - 8.2 = 5.8$$

- Next, we calculate the number of millimoles of the weak base (NH_4OH) and the salt (NH_4Cl) in the mixture:

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- Millimoles of weak base (NH_4OH):

$$\text{Volume} \times \text{Molarity} = 30 \text{ ml} \times 0.2 \text{ M} = 6 \text{ mmol}$$

- Millimoles of salt (NH_4Cl):

$$\text{Volume} \times \text{Molarity} = 30 \text{ ml} \times 2 \text{ M} = 60 \text{ mmol}$$

- Since both components are present in the same total volume of 60 ml, the ratio of their molar concentrations is equal to the ratio of their millimoles:

$$\frac{[\text{Salt}]}{[\text{Base}]} = \frac{60 \text{ mmol}}{6 \text{ mmol}} = 10$$

- Now, we substitute these values into the Henderson-Hasselbalch equation:

$$5.8 = \text{pK}_b + \log(10)$$

- We know that $\log_{10}(10) = 1$. Therefore:

$$5.8 = \text{pK}_b + 1$$

$$\text{pK}_b = 5.8 - 1$$

$$\text{pK}_b = 4.8$$

- Thus, the pK_b of ammonium hydroxide is 4.8.

Step 4: Final Answer:

The pK_b of NH_4OH is 4.8.

Quick Tip: For equal volumes of mixture components, you can use the direct millimoles instead of recalculating the final molarity of the salt and base. This saves valuable calculation time during exams.

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6. The solubility of $Mg_3(PO_4)_2$ is 'S' mol L^{-1}. The solubility product is given by the relation

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(A) S^5

(B) $36S^6$

(C) $6S^5$

(D) $108S^5$

Correct Answer: (D) $108S^5$

Solution:

Step 1: Understanding the Question:

The question asks to find the mathematical relationship between the solubility product constant (K_{sp}) and the molar solubility (S) for the sparingly soluble salt magnesium phosphate, $Mg_3(PO_4)_2$.

Step 2: Key Formula or Approach:

For a sparingly soluble salt of type A_xB_y that dissociates into ions:

$$A_xB_y(s) \rightleftharpoons xA^{y+}(aq) + yB^{x-}(aq)$$

The solubility product (K_{sp}) in terms of molar solubility (S) is given by:

$$K_{sp} = x^x \cdot y^y \cdot S^{(x+y)}$$

Step 3: Detailed Explanation:

- Let us write the balanced chemical equation for the dissociation of magnesium phosphate in its saturated aqueous solution:

$$Mg_3(PO_4)_2(s) \rightleftharpoons 3Mg^{2+}(aq) + 2PO_4^{3-}(aq)$$

- If S is the molar solubility of $Mg_3(PO_4)_2$ in mol L^{-1}, then according to stoichiometry, the equilibrium concentrations of the dissociated ions will be:
  - Concentration of magnesium ions:

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$$[Mg^{2+}] = 3S$$

- Concentration of phosphate ions:

$$[PO_4^{3-}] = 2S$$

- The expression for the solubility product constant (K_{sp}) is:

$$K_{sp} = [Mg^{2+}]^3 \cdot [PO_4^{3-}]^2$$

- Substituting the concentration terms in terms of S into the K_{sp} expression:

$$K_{sp} = (3S)^3 \cdot (2S)^2$$

- Simplifying the mathematical terms:

$$K_{sp} = (27S^3) \cdot (4S^2)$$

$$K_{sp} = (27 \cdot 4) \cdot S^{3+2}$$

$$K_{sp} = 108S^5$$

- This gives the final relationship between the solubility product and molar solubility for this specific salt stoichiometry (3 : 2 electrolyte).

Step 4: Final Answer:

The solubility product of $Mg_3(PO_4)_2$ is given by $108S^5$.

Quick Tip: Keep these common electrolyte relations in mind to quickly solve solubility product questions:

- 1 : 1 electrolyte (e.g., AgCl): $K_{sp} = S^2$
- 1 : 2 or 2 : 1 electrolyte (e.g., CaF_2): $K_{sp} = 4S^3$
- 1 : 3 or 3 : 1 electrolyte (e.g., $AlCl_3$): $K_{sp} = 27S^4$
- 3 : 2 or 2 : 3 electrolyte (e.g., $Mg_3(PO_4)_2$): $K_{sp} = 108S^5$

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Botany

7. The primary purpose of PCR is to:

(A) Cut DNA into fragments

(B) Amplify specific DNA sequences

(C) Translate proteins

(D) Sequence RNA

Correct Answer: (B) Amplify specific DNA sequences

Solution:

Step 1: Understanding the Question:
The question asks to identify the fundamental biological purpose of the Polymerase Chain Reaction (PCR) technique in biotechnology.

Step 2: Detailed Explanation:

- PCR stands for Polymerase Chain Reaction, which is a revolutionary molecular biology technique developed by Kary Mullis in 1983.
- The primary objective of PCR is amplification, which means synthesizing multiple copies (millions to billions) of a specific segment of DNA from a very small initial template sample.
- The process is performed in vitro (in a test tube) and relies on thermal cycling, which consists of repeated cycles of heating and cooling for reaction events.
- Each cycle consists of three fundamental steps:

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- **Denaturation:** High temperature (94–96°C) is used to separate the double-stranded DNA template into single strands by breaking hydrogen bonds.
- **Annealing:** Lower temperature (50–65°C) allows synthetic oligonucleotide primers to bind to their complementary sequences on the single-stranded DNA template.
- **Extension:** An intermediate temperature (72°C) enables a thermostable DNA polymerase (such as *Taq* polymerase) to synthesize new complementary strands by adding dNTPs.

- In contrast, cutting DNA into fragments is done by restriction endonucleases (Option A); translating proteins is a natural ribosome-mediated cellular process (Option C); and sequencing RNA is a different diagnostic or analytical method (Option D).

Step 3: Final Answer:

The primary purpose of PCR is to amplify specific DNA sequences.

Quick Tip: PCR allows for the exponential amplification of DNA. The formula to calculate the number of DNA copies after n cycles is 2^n.
Remember the sequence of steps: Denaturation → Annealing → Extension.

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8. In the fertilization process of Angiosperms, the pollen grain is usually shed at which stage?

(A) 1-celled stage

(B) 2-celled stage (Vegetative and Generative)

(C) 4-celled stage

(D) No specific stage

Correct Answer: (B) 2-celled stage (Vegetative and Generative)

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Solution:

Step 1: Understanding the Question:
The question asks to identify the typical cellular developmental stage at which pollen grains are released (shed) from the anther in the majority of flowering plants (Angiosperms).

Step 2: Detailed Explanation:

- In angiosperms, microspores develop within the anther to form pollen grains, which represent the male gametophyte.

- During this development, the protoplast of the micropore undergoes asymmetric mitotic division to produce two unequal cells:
  - **Vegetative Cell:** This is the larger cell, containing abundant food reserves and a large, irregularly shaped nucleus. It is responsible for pollen tube growth.
  - **Generative Cell:** This is the smaller, spindle-shaped cell with dense cytoplasm and a nucleus, which floats inside the cytoplasm of the vegetative cell. It is responsible for producing the male gametes.

- In over 60% of all angiospermic families, pollen grains are shed from the anthers at this specific 2-celled stage (Vegetative and Generative).

- In the remaining plants (less than 40%), the generative cell undergoes a second mitotic division to form two male gametes before the pollen grains are shed, meaning they are released at the 3-celled stage.

- Therefore, the most common or usual shedding stage across angiosperms is the 2-celled stage.

Step 3: Final Answer:
In most angiosperms, pollen grains are shed at the 2-celled stage (containing a vegetative cell

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and a generative cell).

Quick Tip: Remember the statistic:
- > 60% of angiosperms shed pollen at the 2-celled stage.
- < 40% of angiosperms shed pollen at the 3-celled stage (where the generative cell has already divided into two male gametes).

Zoology

9. Thymectomy (removal of the Thymus) in early childhood would primarily result in:

(A) Lack of antibodies only
(B) Loss of Lymph nodes
(C) Impaired Cell-mediated immunity (Lack of T-lymphocytes)
(D) Hyperactive immune response

Correct Answer: (C) Impaired Cell-mediated immunity (Lack of T-lymphocytes)

Solution:

Step 1: Understanding the Question:
The question asks for the physiological consequence of performing a thymectomy (surgical removal of the thymus gland) during early childhood.

Step 2: Detailed Explanation:

- The thymus is a primary lymphoid organ located in the thoracic cavity, behind the sternum and between the lungs. It plays a fundamental role in the development of the immune system during early life.

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- Immature lymphoid progenitor cells migrate from the bone marrow to the thymus, where they undergo differentiation, maturation, and selection to become functional T-lymphocytes (T-cells).

- T-lymphocytes are the primary mediators of Cell-Mediated Immunity (CMI), which defends the body against intracellular pathogens (like viruses and some bacteria), fungi, parasites, and cancer cells, and is responsible for graft rejection.

- If the thymus gland is removed (thymectomy) in early childhood, the site of T-lymphocyte maturation is lost. This results in a failure of T-cell production.

- A lack of mature T-lymphocytes severely impairs the cell-mediated immune system of the body.

- Although humoral immunity (antibody production by B-lymphocytes) is also affected because Helper T-cells are needed to activate B-cells for most antigens, the primary and most direct impact is the impairment of cell-mediated immunity due to the absence of mature T-cells.

Step 3: Final Answer:
Thymectomy in early childhood would primarily result in impaired cell-mediated immunity due to a lack of functional T-lymphocytes.

Quick Tip: Remember the designations of lymphocytes:
- B-lymphocytes mature in the Bone marrow (associated with humoral / antibody-mediated immunity).
- T-lymphocytes mature in the Thymus (associated with cell-mediated immunity).

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10. The method of "Periodic Abstinence" is based on which physiological fact?

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(A) Ovum remains viable for about 1-2 days.

(B) Sperm survive for about 3 days.

(C) Ovulation occurs around the 14th day of the cycle.

(D) All of the above facts combined.

Correct Answer: (D) All of the above facts combined.

Solution:

Step 1: Understanding the Question:

The question asks to identify the physiological principles and facts that form the basis of the "Periodic Abstinence" natural family planning method.

Step 2: Detailed Explanation:

- Periodic abstinence (or the rhythm method) is a natural method of contraception where couples avoid or abstain from sexual intercourse during the fertile period of the menstrual cycle to prevent fertilization.

- This method relies on several interrelated physiological facts of human reproduction:

- **Timing of Ovulation:** In a standard 28-day menstrual cycle, ovulation (the release of a mature egg from the ovary) typically occurs around day 14. Days 10 to 17 are generally considered the "fertile window" because of cycle variability.

- **Viability of the Ovum:** Once released, the ovum remains viable and capable of being fertilized for a relatively short duration, approximately 24 to 48 hours (1–2 days).

- **Viability of Sperm:** After ejaculation into the female reproductive tract, sperm can remain viable and fertilizing-capable for up to 72 hours (3 days).

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- Therefore, to avoid pregnancy, coitus must be avoided during any period where viable sperm could encounter a viable egg. This safety window spans from a few days before ovulation (due to sperm lifespan) to a couple of days after ovulation (due to egg lifespan).

- Since all three physiological criteria play a vital role in determining this unsafe fertile period, the method is based on all these facts combined.

Step 3: Final Answer:
The method of periodic abstinence is based on all of the given physiological facts combined.

Quick Tip: The fertile period during which couples should abstain from coitus is typically considered to be from day 10 to day 17 of the menstrual cycle, when the chances of fertilization are extremely high.

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11. The hypothesis of the "Hot Dilute Soup" (Prebiotic Soup) regarding the origin of life was proposed by:

(A) Urey
(B) Haldane
(C) Oparin
(D) Darwin

Correct Answer: (B) Haldane

Solution:

Step 1: Understanding the Question:
The question asks for the name of the scientist who proposed the hypothesis of the "Hot Dilute Soup" (also known as the prebiotic soup or primordial soup) regarding the origin of life on primitive Earth.

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Step 2: Detailed Explanation:

- The theory of chemical evolution, proposed independently by Aleksandr Oparin and J.B.S. Haldane in the 1920s, suggests that life arose from non-living organic molecules through a slow process of chemical synthesis.

- J.B.S. Haldane, a British-Indian scientist, proposed in 1929 that the primitive oceans of Earth served as a vast chemical laboratory powered by solar ultraviolet radiation.

- He suggested that the early atmosphere of Earth was reducing (containing methane, ammonia, water vapor, but lacking free oxygen).

- Under these conditions, simple organic compounds were synthesized and accumulated in the primitive oceans. Since there were no living organisms to consume them and no free oxygen to oxidize them, these molecules persisted and grew in concentration.

- Haldane referred to this vast body of warm water containing accumulated simple organic monomers as a "hot dilute soup" or "primordial soup."

- This soup became the environment in which the first simple organic polymers and proto-cells developed.

- Oparin, while agreeing with the general idea of chemical evolution, focused on the formation of coacervates (colloidal droplets), whereas Haldane coined and described the specific concept of the "hot dilute soup."

Step 3: Final Answer:

The hypothesis of the "Hot Dilute Soup" was proposed by Haldane.

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Quick Tip: Remember the contributions:

- Oparin: Coacervates and chemical evolution theory.
- Haldane: Hot Dilute Soup concept.
- Urey & Miller: Experimental validation of the Oparin-Haldane theory in 1953.

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