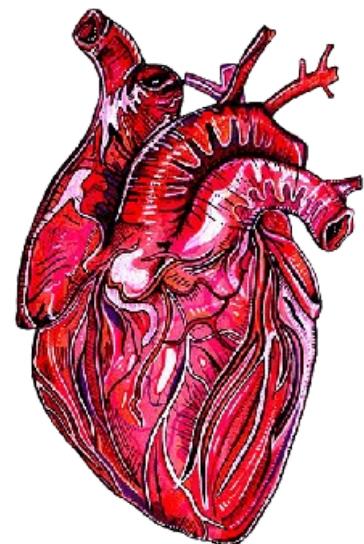
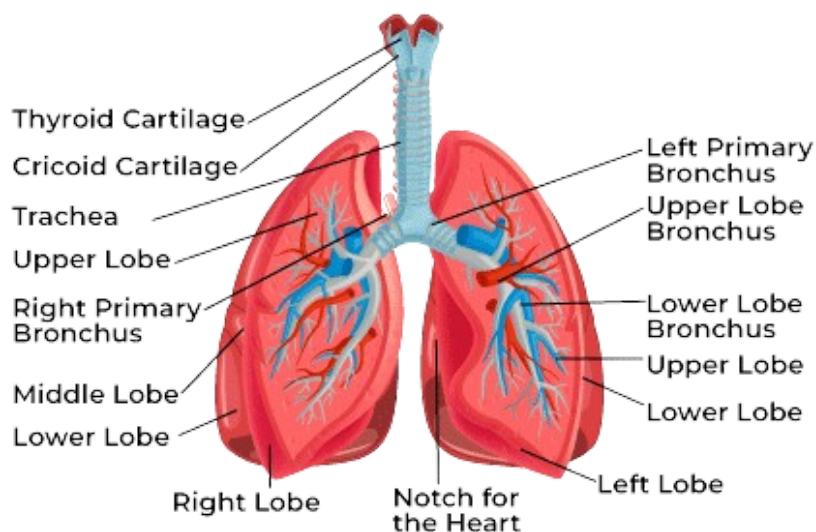




IMAT ANSWER KEY

CODE: FMA90781



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Prepared for :
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Logical reasoning and problem solving

1. E
2. D
3. A
4. B
5. C
6. D
7. E
8. A
9. C

BIOLOGY:

1. A
2. E
3. D
4. E
5. D
6. D
7. D
8. D
9. C
10. D
11. D
12. D
13. C
14. E
15. C
16. E
17. D
18. C
19. A
20. E
21. D
22. E
23. E

Chemistry

1. D
2. A
3. C

- 4. A
- 5. D
- 6. A
- 7. D
- 8. C
- 9. C
- 10. D
- 11. C
- 12. C
- 13. C
- 14. B

Mahematics

- 1. D
- 2. D
- 3. B
- 4. E
- 5. C
- 6. D
- 7. B

Physics

- 1. B
- 2. E
- 3. A
- 4. B
- 5. A
- 6. A

Solutions

Section 1: Logical Reasoning and General Knowledge

- 1. E
- 2. D
- 3. A
- 4. B
- 5. C
- 6. D
- 7. E

8. A
9. C

Section 2: Biology

1. Correct: A

Explanation: Only statement 1 is correct. Insertion or deletion changes the reading frame, leading to a frameshift mutation. Substitution might not affect the protein (silent mutation), and point mutations aren't always harmful.

2. Correct: E

Explanation: All the listed structures (sex chromosomes, genes, mitochondria, and centrioles) are found in animal cells. Starch grains are found in plant cells, not animals.

3. Correct: D

Explanation: Enzymes act as biological catalysts, speeding up reactions by lowering activation energy. They are highly specific due to the shape of their active site matching the substrate.

4. Correct: E

Explanation: Reflexes like pulling your hand away from a hot surface are processed by the spinal cord for speed. They do not require brain involvement initially.

5. Correct: D

Explanation: Catalysts (including enzymes) reduce activation energy, increasing reaction rates and saving energy in industrial processes.

6. Correct: D

Explanation: LH is secreted by the pituitary gland, not the adrenal gland. All the other hormone-gland pairings are correct.

7. Correct: D

Explanation: Dabigatran inhibits thrombin, preventing it from converting fibrinogen to fibrin—essential for blood clot formation.

8. Correct: D

Explanation: Only active transport uses both carrier proteins and ATP. Diffusion, osmosis, and facilitated diffusion are passive and don't require ATP.

9. Correct: C

Explanation: When overhydrated, ADH secretion decreases, leading to less water reabsorption in the kidney, making urine more dilute.

10. Correct: D

Explanation: Gas exchange is a passive process relying on diffusion. Active transport is not involved, as it requires energy input.

11. Correct: D

Explanation: Independent assortment refers to random distribution of chromosomes during meiosis—not exchange. Fertilization, mutation, and crossing over all increase genetic variation.

12. Correct: D

Explanation: In mammals, anaerobic respiration produces lactate; in yeast (and plants), ethanol and CO₂ are produced, not water.

13. Correct: C

Explanation: Spindle fibers pull chromatids apart during anaphase. Spindle formation happens during prophase, not anaphase.

14. Correct: E

Explanation: All contraceptive methods listed are correctly described in terms of their mechanisms of preventing pregnancy.

15. Correct: C

Explanation: Prokaryotes have no nucleus, so transcription (DNA → mRNA) occurs directly in the cytoplasm, unlike eukaryotes.

16. Correct: E

Explanation: The body traps and filters many pathogens before exhalation. Mucus and cilia in the airways prevent virus particles from leaving in high numbers.

17. Correct: D

Explanation: X-linked traits are passed through the X chromosome. A carrier mother can pass the gene to sons, who express it if they inherit the mutated X.

18. Correct: C

Explanation: Translation occurs in the cytoplasm where mRNA is read by ribosomes. Statement 3 is false—proteins are not made during transcription.

19. Correct: A

Explanation: All interventions (insulin, exercise, glucagon inhibition) correctly influence blood glucose. Statement 4 is wrong—insulin does not promote glycogen breakdown.

20. Correct: E

Explanation: Statements 3 (liver regulating glucose), 4 (kidneys balancing water/salts), and 5 (thermoregulation via skin) are all accurate aspects of homeostasis.

21. Correct: D

Explanation: Only statement 2 is correct. Nucleus contains DNA and controls cell activity. The ribosome makes proteins, and mitochondria are for energy—not protein synthesis directly.

22. Correct: E

Explanation: The thin alveolar wall and large surface area facilitate gas exchange. Diaphragm contraction helps ventilation. Goblet cells produce mucus—not involved directly in gas exchange.

23. Correct: E

Explanation: Statement 2 (fat emulsification by bile), 3 (protein digestion by pepsin), and 4 (lipase action) are all accurate. The stomach is acidic, not alkaline.

Section 3: Chemistry

Q1. The standard enthalpy of formation (ΔH_f°) of a compound = the enthalpy change when 1 mole of the compound is formed from its constituent elements in their standard states at 298 K and 1 atm.

Step 2: Identify the elements in methanol (CH_3OH)

- Carbon (C)
- Hydrogen (H)
- Oxygen (O)

Step 3: Write elements in their standard states

- Carbon \rightarrow graphite (solid) $\rightarrow \text{C(s)}$
- Hydrogen \rightarrow diatomic gas $\rightarrow \text{H}_2(\text{g})$
- Oxygen \rightarrow diatomic gas $\rightarrow \text{O}_2(\text{g})$

Step 4: Balance the reaction to make 1 mole of $\text{CH}_3\text{OH(l)}$

CH_3OH contains:

- 1 C
- 4 H
- 1 O

So the balanced equation is : $\text{C(s)} + 2\text{H}_2(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CH}_3\text{OH(l)}$

Step 5: Match with the options

- (A) Wrong \rightarrow uses C(g) (not standard state).
- (B) Wrong \rightarrow uses atomic H and O.
- (C) Wrong \rightarrow also uses atomic H and O.
- (D) Correct $\rightarrow \text{C(s)}, \text{H}_2(\text{g}), \text{O}_2(\text{g}) \rightarrow \text{CH}_3\text{OH(l)}$.
- (E) Wrong \rightarrow starts from CH_4 , not elements.

Final Answer: (D) $\text{C(s)} + 2\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CH}_3\text{OH(l)}$

Q2. Which gas in the atmosphere causes the pH of unpolluted rain to be approximately 6?

- Pure water has pH = 7.
- In the atmosphere, **CO₂ dissolves in rainwater** forming carbonic acid:
$$\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$$
$$\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \quad \text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$$

This weak acid lowers the pH to about 5.6–6 in unpolluted rain.

Correct answer: (A) Carbon dioxide

Q3. What is the product of the addition of chlorine (Cl_2) to propene (C_3H_6)?

- Propene is an alkene. Addition of Cl_2 across the double bond gives a **dihaloalkane**.

- The double bond is between C1 and C2. Chlorine adds across these two carbons.
- Product: $\text{CH}_2\text{Cl}-\text{CHCl}-\text{CH}_3 = \text{1,2-dichloropropane}$.
Correct answer: (C) 1,2-dichloropropane

Q4. Which combination of properties best describes sodium oxide (Na_2O)?

- Na_2O is an ionic compound, so **high melting point**.
- It reacts with water to form sodium hydroxide:

$$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$$

$$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$$
- NaOH is a **strong base**.
Correct answer: (A) High melting point, soluble in water, basic

Q5. Which combination of shape and bond angle is correct for xenon tetrafluoride (XeF_4)?

- XeF_4 has 6 electron domains (4 bonding + 2 lone pairs).
- Lone pairs occupy opposite positions, leaving fluorine atoms in a **square planar** arrangement.
- Bond angles = **90°**.
Correct answer: (D) Square planar, 90°

Q6. Which compound forms an acidic solution when dissolved in water?

Answer: A. FeCl_3

Fe^{3+} undergoes hydrolysis in water to give acidic solutions (Fe^{3+} is a small, highly charged cation). CH_3NH_2 is basic, NaNO_3 is neutral (salt of strong acid/base), Na_2CO_3 is basic.

Q7. Order of increasing first ionization energies (Ar, K, Ca):

Answer: D. K < Ca < Ar

Across the period ionization energy rises: K (lowest) < Ca < Ar (highest, noble gas).

Q8. Product when bromine water adds to propene ($\text{CH}_3\text{CH}=\text{CH}_2$):

Answer: C. $\text{CH}_3\text{CHBrCH}_2\text{Br}$

Addition of Br_2 across the C=C gives the vicinal (1,2-) dibromide.

Q9. pH after adding 450 cm³ water to 50 cm³ HCl solution with initial pH 4:

Answer: C. 5

Total volume becomes 10× larger, so $[\text{H}^+]$ falls by a factor 10: $10^{-4} \rightarrow 10^{-5} \text{ M} \rightarrow \text{pH } 5$.

Q10. Conjugate base of phenol ($\text{C}_6\text{H}_5\text{OH}$)

Answer: C. $\text{C}_6\text{H}_5-\text{O}^-$

Deprotonation of the phenolic OH gives the phenoxide ion, $\text{C}_6\text{H}_5\text{O}^-$.

11. Mass of 1 mole of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Calculation: Cu (63.5) + S (32.1) + O₄ (4×16 = 64.0) = 159.6 for CuSO_4 .

$5\text{H}_2\text{O} = 5 \times 18 = 90$. Total $\approx 159.6 + 90 = 249.6 \approx 250 \text{ g}$.

Answer: D. 250 g

12. Greatest difference in electronegativity

Compare approximate Pauling values: Mg–O ≈ 2.13, Li–F ≈ 3.00, K–F ≈ 3.16, Li–I ≈ 1.68.

Largest is K and F.

Answer: C. K and F

13. Typical properties of ionic compounds

Ionic solids have **high melting points** and **conduct electricity when molten (or in solution), not in the solid state**.

Answer: C. High melting points, conduct electricity in molten state

14. Which molecule is trigonal bipyramidal?

PCl_5 has 5 bonding pairs, no lone pairs \rightarrow trigonal bipyramidal.

Answer: C. PCl_5

15. Equation for the second electron affinity of oxygen

Second electron affinity: adding an electron to O^- to form O^{2-} :

Answer: B. $\text{O}^- (\text{g}) + \text{e}^- \rightarrow \text{O}^{2-} (\text{g})$

Section 4: Maths

1. D

Let's break this down step by step.

Step 1: Possible outcomes when David takes a shape from box A.

Box A contains 4 stars and 2 hearts, so the probability of selecting a star from box A is:

$$P(\text{star from A}) = 4/6 = 2/3$$

The probability of selecting a heart from box A is:

$$P(\text{heart from A}) = 2/6 = 1/3$$

Step 2: After moving a shape from box A to box B, we analyze the contents of box B.

- If David moves a star from A to B, box B will contain 3 stars and 1 heart.
- If David moves a heart from A to B, box B will contain 2 stars and 2 hearts.

Step 3: Probability of drawing a star from box B.

- If a star was added to box B, there are 3 stars and 1 heart in box B, so the probability of drawing a star is:

$$P(\text{star from B} | \text{star added}) = 3/4$$

- If a heart was added to box B, there are 2 stars and 2 hearts in box B, so the probability of drawing a star is:

$$P(\text{star from B} \mid \text{heart added}) = 2/4 = 1/2$$

Step 4: Total probability.

We use the law of total probability to find the overall probability of drawing a star from box B:

$$P(\text{star from B}) = P(\text{star from A}) \cdot P(\text{star from B} \mid \text{star added}) + P(\text{heart from A}) \cdot P(\text{star from B} \mid \text{heart added})$$

Substitute the probabilities:

$$P(\text{star from B}) = 23/34 + 13/34$$

$$P(\text{star from B}) = 6/12 + 1/6$$

$$P(\text{star from B}) = 12/36 + 16/36 = 28/36 = 7/9$$

The probability that the shape drawn from box B is a star is 7/9.

Q2. D

The correct statement is: The resulting number is either a prime number or it has a prime factor that is not in the original list.

This is because the resulting number $N = p_1 p_2 \dots p_n + 1$ is not divisible by any prime in the list, so it must either be prime or have a prime factor not in the list.

Q3. B

Given:

- Richard buys 6 oranges for \$0.43

- Richard sells 8 oranges for \$0.72

- Richard's total profit is \$4.80

Cost per orange := 0.43 / 6 = 0.0717

Selling price per orange = 0.72 / 8 = 0.09

Profit per orange = Selling price per orange - Cost per orange

Profit per orange = 0.09 - 0.0717 = 0.0183

Total profit = Profit per orange Number of oranges sold

4.80 = 0.0183 Number of oranges sold

Number of oranges sold = 4.80 / 0.0183 = 262

Q4. E

The arithmetic mean of X, Y, and Z is 50, so:

$$X + Y + Z = 150$$

The arithmetic mean of $(3X-10)$, $(3Y+20)$, and $(3Z+50)$ is:

$$3(X+Y+Z)+603= 3(150)+603=5103=170$$

Q5. C

If x and y are inversely proportional, then:

$$X \times y = k$$

where k is a constant.

Given that $x = 10$ and $y = 5$, we can find k :

$$10 \times 5 = k$$

Now, to find y when $x = 25$:

$$25 \times y = 50$$

Solving for y :

$$y=50/25=2$$

Thus, when $x = 25$, $y = 2$.

Q6. D

To find the number of degrees representing admissions due to chronic diseases, we first calculate the percentage of admissions for chronic diseases.

The total percentage of all admissions is 100%. Given percentages for other categories:

- Emergency admissions: 43%
- Surgical department: 18%
- Oncology department: 12%
- Out-patients: 7%

The sum of these percentages is:

$$43\%+18\%+12\%+7\%=80\%$$

The percentage for chronic diseases is the remainder:

$$100\%-80\%=20\%$$

Since the total circle is 360° , 20% of the circle represents chronic diseases. To find the number of degrees:

$$\text{Degrees for chronic diseases} = 20/100 \times 360 = 72$$

Thus, 72° of the circle represents admissions due to chronic diseases.

Q7. B

The formula is:

$$X = \frac{1}{2} \rho L A^2$$

When r is halved, i.e., r becomes $r/2$, we substitute $r/2$ into the formula:

$$X = \frac{1}{2} \rho L A^2 = \frac{1}{2} \rho L \left(\frac{r}{2}\right)^2 A = \frac{1}{8} \rho L r^2 A$$

Now compare the new formula with the original one:

Original formula: $X = \frac{1}{2} \rho L A^2 = \frac{1}{2} \rho L (2r)^2 A = 8 \cdot \frac{1}{2} \rho L r^2 A$

New formula after halving r : $X = \frac{1}{8} \rho L r^2 A$

So, X is multiplied by a factor of 8 when r is halved. Therefore, X is multiplied by a factor of **8** when r is halved.

Section 5: PHYSICS

1. **B**
2. **E**

The resistance of a wire is $R = \rho L / A$

Since the wires have the same volume, their areas are inversely proportional to their lengths. Let the length of the 2nd wire be 1.2 times the length of the 1st wire.

The ratio of their resistances is:

$$\frac{R_1}{R_2} = \frac{\rho L_1 / A_1}{\rho L_2 / A_2} = \frac{L_1 / A_1}{L_2 / A_2} = \frac{L_1 / A_1}{1.2 L_1 / A_1} = \frac{1}{1.2} = 0.833$$

Thus, the ratio of the resistance of the 1st wire to the 2nd wire is approximately **0.69**

Q3. A

To calculate the total heat energy:

1. Heating ice from -20°C to 0°C :

$$Q_1 = 2000 \times 2.1 \times 20 = 84,000 \text{ J}$$

2. Melting ice to water:

$$Q_2 = 2000 \times 334 = 668,000 \text{ J}$$

3. Heating water from 0°C to 100°C :

$$Q_3 = 2000 \times 4.18 \times 100 = 836,000 \text{ J}$$

4. Vaporizing water to steam:

$$Q_4 = 2000 \times 2260 = 4,520,000 \text{ J}$$

5. Heating steam from 100°C to 120°C :

$$Q_5 = 2000 \times 2.0 \times 20 = 80,000 \text{ J}$$

Total heat energy:

$$Q_{\text{total}} = 84,000 + 668,000 + 836,000 + 4,520,000 + 80,000 = 6,188,000 \text{ J} = 6.1 \text{ MJ}$$

The total heat energy required is 6.1 MJ.

Q4. C

By Bernoulli's equation between wide section (1) and narrow section (2):

$$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$$

Given: $P_1 = P_0$, $v_1 = v$, $v_2 = 4v$

Substitute:

$$P_0 + \frac{1}{2}\rho v^2 = P_2 + \frac{1}{2}\rho(4v)^2$$

$$P_0 + \frac{1}{2}\rho v^2 = P_2 + \frac{1}{2}\rho(16v^2)$$

$$P_0 + \frac{1}{2}\rho v^2 = P_2 + 8\rho v^2$$

Rearrange for P_2 :

$$P_2 = P_0 + \frac{1}{2}\rho v^2 - 8\rho v^2$$

$$P_2 = P_0 - 7.5\rho v^2$$

Answer: $P_0 - 7.5\rho v^2$ (option: $P_0 - 7.5\rho v^2$)

Q5. A

According to the right-hand rule, if you point the thumb of your right hand in the direction of the current, your fingers will curl around the conductor in the direction of the magnetic field.

Q6.A

In the case of two large parallel plates with equal but opposite surface charge densities ($+\sigma$ and $-\sigma$), the electric field between the plates is uniform and perpendicular to the plates. The equipotential surfaces are parallel to the plates because the potential difference between them is constant across parallel lines