

## National Level ScienceX Olympiads

ScienceX Olympiad | Level 3

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Exam Instructions

1. The timer has been set for the exam, and a countdown will display the remaining time. When the timer runs out, the exam will end automatically. No further action will be required after that.
2. You can flag any question that you want.
3. If you don't want to submit any of your provided answers, you can clear them.
4. If you choose to drop this exam, it will not be submitted, and no result will be generated.
5. Once you finish the exam, you cannot resume it.

### Secure Exam Advice

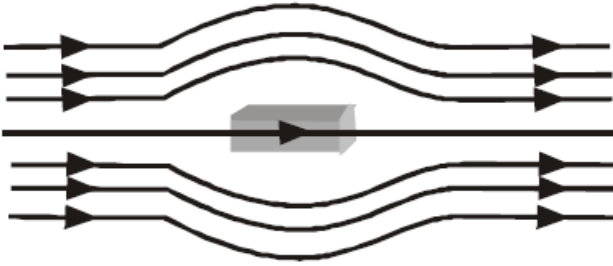
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- Minimizing the browser
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The given figure represents a material which is



Please mark (✓) for the correct answer.

- A. ferromagnetic
  B. diamagnetic  
 C. paramagnetic
  D. none of these

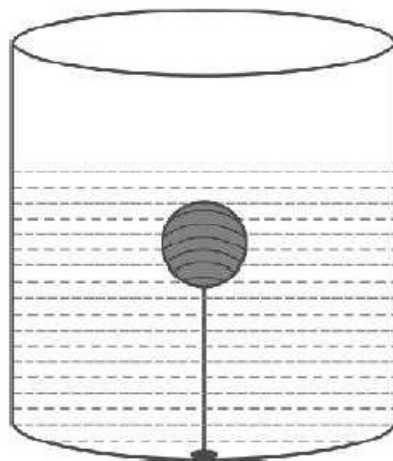
A body is thrown vertically upwards with a velocity  $u$ . Select the incorrect statements from the following.

- I. Both velocity and acceleration are zero at its highest point  
 II. Velocity is maximum and acceleration is zero at the highest point.  
 III. Velocity is maximum and acceleration is  $g$  downwards at its highest point.

Please mark (✓) for the correct answer.

- A. I and III
  B. II and III  
 C. I and II
  D. I, II and III

A solid sphere of density  $\eta$  ( $>1$ ) times lighter than water is suspended in a water tank by a string tied to its base as shown in fig. If the mass of the sphere is  $m$ , then the tension in the string is given by



Please mark (✓) for the correct answer.

- A.  $\left(\frac{\eta - 1}{\eta}\right)mg$ 
 B.  $\eta mg$   
 C.  $(\eta - 1)mg$ 
 D.  $\left(\frac{mg}{\eta - 1}\right)$

What will be the final pressure if an ideal gas in a cylinder is compressed adiabatically to 1/3rd of its volume?

Please mark (✓) for the correct answer.

- A. Change in pressure will be less than three times the initial pressure.
- B. Final pressure will be three times less than initial pressure.
- C. Change in pressure will be more than three times the initial pressure.
- D. Final pressure will be three times more than initial pressure.

A particle is executing SHM along a straight line. Its velocities at distances  $x_1$  and  $x_2$  from the mean position are  $V_1$  and  $V_2$ , respectively. Its time period is

Please mark (✓) for the correct answer.

- A.  $2\pi \sqrt{\frac{x_1^2 - x_2^2}{V_1^2 - V_2^2}}$
- B.  $2\pi \sqrt{\frac{V_1^2 + V_2^2}{x_1^2 + x_2^2}}$
- C.  $2\pi \sqrt{\frac{V_1^2 - V_2^2}{x_1^2 - x_2^2}}$
- D.  $2\pi \sqrt{\frac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$

Which of the following would be predicted if Henle's loop is absent from a mammalian nephron?

Please mark (✓) for the correct answer.

- A. No urine would form
- B. The urine would be more concentrated
- C. There would be very little variation in the amount and quality of urine created
- D. The urine would be more diluted.

Leydig cells are found in

Please mark (✓) for the correct answer.

- A. Kidney of human
- B. Testes of frog
- C. Testes of rabbit
- D. Kidney of frog

**Assertion:** Gram-negative bacteria lack the ability to preserve the stain after exposure to alcohol.

**Reason:** This inability stems from the composition of their outer membrane, specifically the presence of alcohol-soluble lipopolysaccharides.

Please mark (✓) for the correct answer.

- A. If both the Assertion and Reason are incorrect.
- B. If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
- C. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- D. If Assertion is correct but Reason is incorrect.

Out of the following statements about enzymes, which statement (s) are **incorrect**?

(i) Enzymes having slightly different molecular structure but performing identical activities are homoenzymes.

(ii) An allosteric enzyme has an additional binding site for effector molecules other than the active site.

(iii) The Turn over number is the maximal number of molecules of substrate converted to product per active site per unit time.

(iv) Enzymes are sensitive to light, pH, wind and temperature.

Please mark (✓) for the correct answer.

- A. (i) and (iv)
- B. (i) and (iii)
- C. (i) and (ii)
- D. (i), (iii) and (iv)

**Assertion:** The imbalance in concentration of  $\text{Na}^+$ ,  $\text{K}^+$  and proteins generates resting potential.

**Reason:** To maintain the unequal distribution of  $\text{Na}^+$  &  $\text{K}^+$ , the neurons use electrical energy.

Please mark (✓) for the correct answer.

- A. If the Assertion is correct but Reason is incorrect.
- B. If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- C. If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- D. If both the Assertion and Reason are incorrect.

Which of the following is incorrect?

Please mark (✓) for the correct answer.

- A. Mn shows oxidation state of +7 in  $\text{MnF}_7$
- B. Fe and Co shows +3 oxidation state in  $\text{FeX}_3$  and  $\text{CoF}_3$ .
- C. Cu does not shows +2 oxidation state with  $\text{I}^-$ .
- D. V shows oxidation state of + 5 in  $\text{VF}_5$ .

The adsorption of a gas on a solid surface varies with pressure of the gas in which of the following manner

Please mark (✓) for the correct answer.

- A. Independent of the pressure → fast → slow
- B. Fast → slow → independent of the pressure
- C. Slow → fast → independent of the pressure
- D. Independent of the pressure → slow → fast

Which of the following sequence of T and F is true for given statements. Here T stands for true statement and F stands for false statement?

- (i) Frenkel defect results in increase in density of the solid.
- (ii) ZnS, AgCl, AgBr and AgI shows Frenkel defect.
- (iii) Schottky defect results in decrease in density of the solid.
- (iv) AgBr shows Schottky defect only.
- (v) For NaCl there is one Schottky defect per  $10^{16}$  ions.

Please mark (✓) for the correct answer.

- A. TTTFT
- B. FTTF
- C. TTTFF
- D. FTTF

Larger number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being

Please mark (✓) for the correct answer.

- A. more energy difference between 5f and 6d than between 4f and 5d orbitals
- B. 4f orbitals more diffused than the 5f orbitals
- C. lesser energy difference between 5f and 6d than between 4f and 5d orbitals
- D. more reactive nature of the actinoids than the lanthanoids

Which of the following statement(s) is/are correct ?

- (i) Classical smog is a mixture of smoke, fog and sulphur dioxide.
- (ii) Classical smog is also called oxidising smog
- (iii) Hydrocarbons, NO<sub>2</sub> and PAN are components of photochemical smog.

Please mark (✓) for the correct answer.

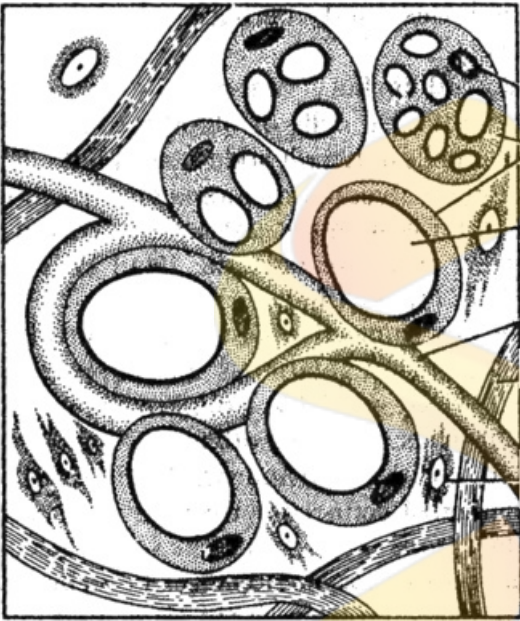
- A. (i) and (ii)
- B. (iii) only
- C. (i), (ii) and (iii)
- D. (i) and (iii)

The least resistance obtained by using  $2\ \Omega$ ,  $4\ \Omega$ ,  $1\ \Omega$  and  $100\ \Omega$  is

Please mark (✓) for the correct answer.

- A.  $> 2\ \Omega$ 
 B.  $< 4\ \Omega$   
 C.  $< 1\ \Omega$ 
 D.  $< 100\ \Omega$

Identify the figure with its correct function



Please mark (✓) for the correct answer.

- A. Areolar connective tissue – Provide flexibility  
 B. Dense regular tissue – Provide strength and elasticity  
 C. Dense irregular tissue – Serves as a support framework for epithelium  
 D. Adipose tissue – Store fats and act as heat insulators {c}

**Assertion:** Sponges have body organization of "cellular level".

**Reason:** There is some physiological division of labour.

Please mark (✓) for the correct answer.

- A. If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion. {c}  
 B. If both the Assertion and Reason are incorrect.  
 C. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.  
 D. If Assertion is correct but Reason is incorrect.

Assertion (A): As the speed of the coil in the motor increases, there is a reduction in the current flowing through it. Reason (R): During rotation in an electric motor, some induced current is produced.

Please mark (✓) for the correct answer.

- A. (A) is correct and (R) is incorrect
- B. Both (A) and (R) are correct, but (R) is not the correct explanation of (A)
- C. Both (A) and (R) are correct but (R) is the correct explanation of (A)
- D. (A) is incorrect and (R) is correct

Match the Column I with Column II

Column I	Column II
A. Algae	i. <i>Dryopteris</i>
B. Moss	ii. <i>Penicillium</i>
C. Fern	iii. <i>Ulothrix</i>
D. Fungus	iv. <i>Funaria</i>

Please mark (✓) for the correct answer.

- A. A→i, B→iv, C→ii, D→iii
- B. A→iii, B→iv, C→i, D→ii
- C. A→iii, B→i, C→iv, D→ii
- D. A→i, B→ii, C→iii, D→iv

Addition reactions are undergone by

Please mark (✓) for the correct answer.

- A. both alkenes and alkynes
- B. saturated hydrocarbons (alkanes)
- C. only alkenes
- D. only alkynes

**Assertion:** Chemosynthesis is an autotrophic nutrition.

**Reason:** Chemoautotrophs do not contain chlorophyll pigments.

Please mark (✓) for the correct answer.

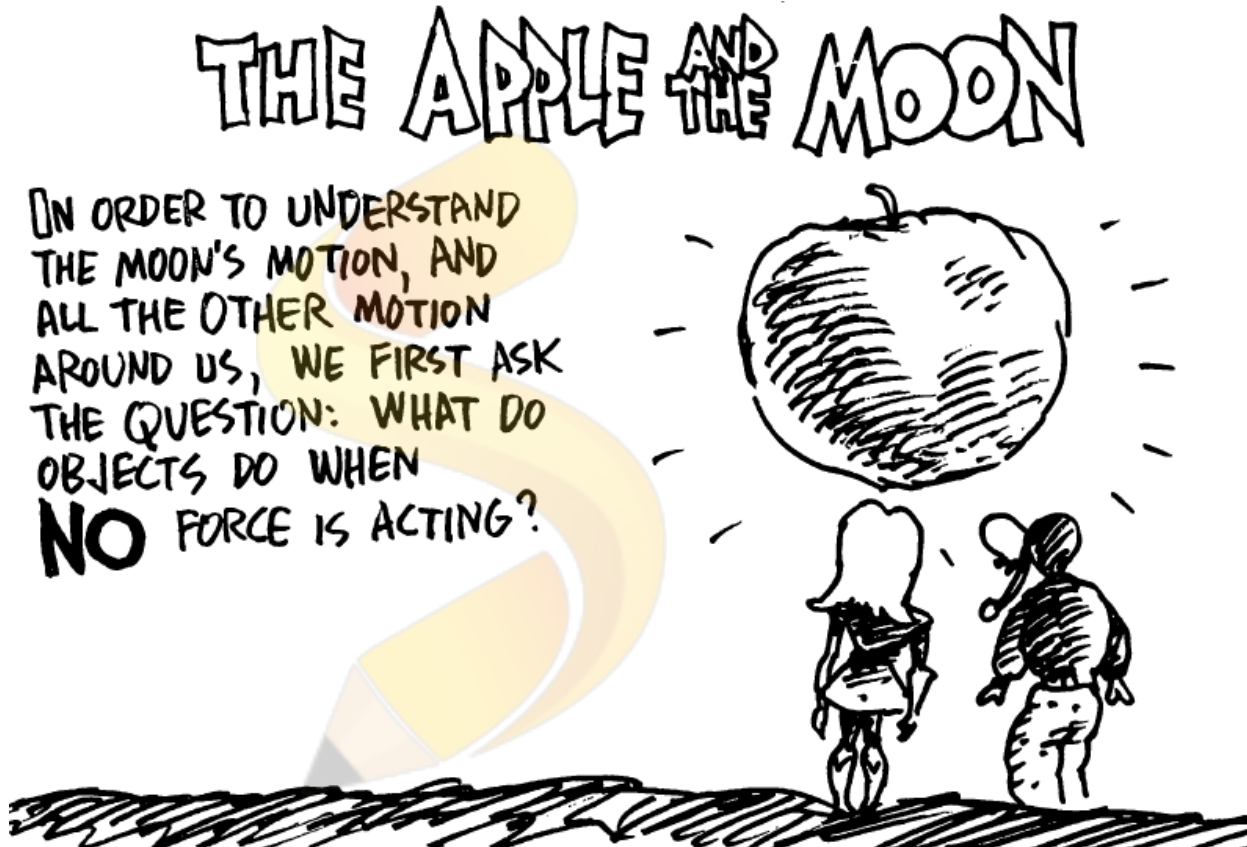
- A. If both the Assertion and Reason are incorrect.
- B. If Assertion is correct but Reason is incorrect. {c}
- C. If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
- D. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

An image of an object produced on a screen which is about 36 cm using a convex lens. The image produced is about 3 times the size of the object. What is the size of the object?

Please mark (✓) for the correct answer.

- A. 39 cm
- B. 33 cm
- C. 108 cm
- D. 12 cm

Read the below image and answer the question.



Please mark (✓) for the correct answer.

- A. Accelerate
- B. Fall with non uniform acceleration
- C. Fall
- D. Decelerate

Why gravitational force is always attractive?

Please mark (✓) for the correct answer.

- A. Due to heavy Masses
- B. Mass-Time Effect
- C. Conservation of Mass
- D. Space -Time curvature



An alpha particle is also known as:

Please mark (✓) for the correct answer.

- A. subatomic particle
- B. a neutral particle
- C. an unionised helium atom
- D. a doubly-charged helium ion

Three beakers labelled as A, B and C each containing 25 ml of water were taken. A small amount of NaOH, anhydrous CuSO<sub>4</sub> and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solution contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statement(s) is (are) correct? (i) In beakers A and B, exothermic process has occurred. (ii) In beakers A and B, endothermic process has occurred. (iii) In beaker C exothermic process has occurred. (iv) In beaker C endothermic process has occurred.

Please mark (✓) for the correct answer.

- A. (ii) only
- B. (i) and (iv)
- C. (i) only
- D. (iv), (ii) and (iii)

A student studies that a convex lens always forms a virtual image irrespective of its position. What causes the convex mirror to always form a virtual image?

Please mark (✓) for the correct answer.

- A. Because the reflected ray converges at a single point
- B. Because the reflected ray never intersects
- C. Because the incident ray traces its path back along the principal axis
- D. Because the incident ray of a convex mirror gets absorbed in the mirror

A key of a mechanical piano struck gently and then struck again but much harder this time. In the second case

Please mark (✓) for the correct answer.

- A. sound will be louder and pitch will also be higher
- B. sound will be louder but pitch will be lower
- C. sound will be louder but pitch will not be different
- D. both loudness and pitch will remain unaffected

DNA is present in

Please mark (✓) for the correct answer.

- A. Chromosomes and dictyosomes
- B. Chloroplasts and lysosomes
- C. Mitochondria and chloroplasts
- D. Mitochondria and endoplasmic reticulum

Which of the following are exothermic processes?(i) Reaction of water with quick lime (ii) Dilution of an acid (iii) Evaporation of water (iv) Sublimation of camphor (crystals)

Please mark (✓) for the correct answer.

- A. (i) and (ii)
- B. (ii) and (iii)
- C. (ii) and (iv)
- D. (i) and (iv)

Out of the given statements, find out the correct statement (s):

- I. Birds are homeothermic.
- II. All echinoderms are viviparous.
- III. Roundworm do not have circulatory system.
- IV. Earthworm has closed circulatory system.

Please mark (✓) for the correct answer.

- A. I, II
- B. I, II and III
- C. II, III and IV
- D. I, III and IV

If a heterozygous purple flower plant is crossed with homozygous white flower plant, the offsprings will be

Please mark (✓) for the correct answer.

- A. No purple flower plants
- B. All White flower plants
- C. All purple flower plants
- D. Half purple flower plants

**Question: 34 of 50**

QID: 569

Marks: 4

Which of the following represents 12 u?

Please mark (✓) for the correct answer.

- A. Mass of 0-16 atom
- B. Mass of 1 hydrogen atom
- C. Mass of C-12 atom
- D. 1/12th of mass of C-12 atom.

**Question: 35 of 50**

QID: 559

Marks: 4

Which one of the following events is correctly matched with the time period in a normal menstrual cycle?

Please mark (✓) for the correct answer.

- A. Release of egg: 5th day
- B. Rise in progesterone level : 1-15 days
- C. Endometrium secretes nutrients for implantation: 11-18 days
- D. Endometrium regenerates: 5-10 days

**Question: 36 of 50**

QID: 564

Marks: 4

An iron sphere of mass 10 kg has the same diameter as an aluminium sphere of mass is 3.5 kg. Both spheres are dropped simultaneously from a tower. When they are 10 m above the ground, they have the same.

Please mark (✓) for the correct answer.

- A. potential energy
- B. acceleration
- C. momenta
- D. kinetic energy

**Question: 37 of 50**

QID: 554

Marks: 4

Which of the following statement is true?

Please mark (✓) for the correct answer.

- A. Chymotrypsin can digest casein.
- B. Pepsin cannot digest collagen.
- C. Trypsin can digest casein.
- D. Pepsin cannot digest casein.

**Question: 38 of 50**

QID: 553

Marks: 4

A man whose blood group is not known meets with a serious accident and needs blood transfusion immediately, which one of the blood groups readily available in the hospital will be safe for transfusion?

Please mark (✓) for the correct answer.

- A. AB+
- B. O-
- C. AB-
- D. O+

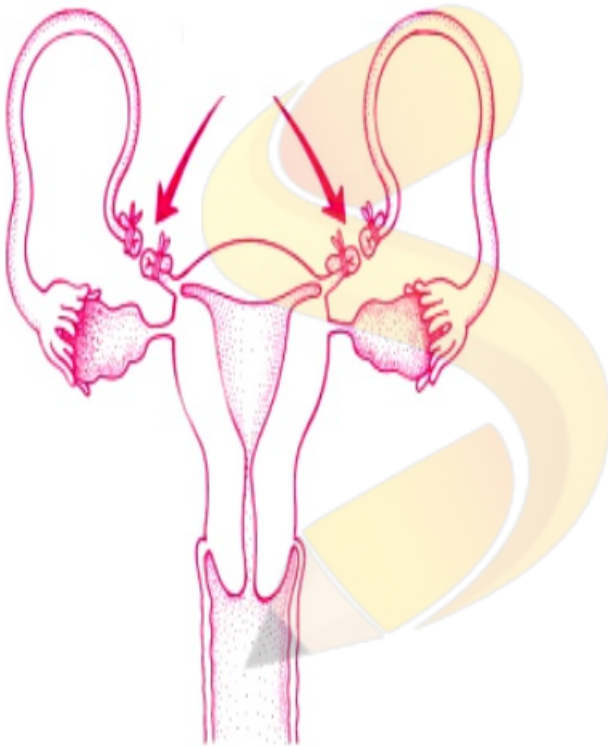
**Assertion:** The earliest organisms that appeared on the earth were non-green and presumably anaerobes.

**Reason:** The first autotrophic organisms were the chemoautotrophs that never released oxygen.

Please mark (✓) for the correct answer.

- A. If both the Assertion and Reason are incorrect.
- B. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- C. If Assertion is correct but Reason is incorrect.
- D. If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

What is the figure given below showing in particular?



Please mark (✓) for the correct answer.

- A. Tubectomy
- B. Vasectomy
- C. Uterine cancer
- D. Ovarian cancer

Which of the following statements are true for pure substances?(i) Pure substances contain only one kind of particles (ii) Pure substances may be compound or mixtures (iii) Pure substances have the same composition throughout (iv) Pure substances can be exemplified by all elements other than nickel

Please mark (✓) for the correct answer.

- A. (ii) and (iii)
- B. (i) and (ii)
- C. (iii) and (iv)
- D. (i) and (iii)

## Question: 42 of 50

QID: 563

Marks: 4

Two army persons A and B each of weight of 500 N climb up a rope through a height of 10 m. A takes 20 s while B takes 40 s to achieve this task. What is ratio of the powers of person A and B?

Please mark (✓) for the correct answer.

- A. 14 : 1
- B. 1 : 4
- C. 1 : 2
- D. 2 : 1

## Question: 43 of 50

QID: 567

Marks: 4

Which of the following correctly represents 360 g of water?(i) 2 moles of H<sub>2</sub>O (ii) 20 moles of water (iii)  $6.022 \times 10^{23}$  molecules of water (iv)  $1.2044 \times 10^{25}$  molecules of water

Please mark (✓) for the correct answer.

- A. (i) and (iv)
- B. (i)
- C. (ii) and (iv)
- D. (ii) and (iii)

## Question: 44 of 50

QID: 570

Marks: 4

Which of the following statements about Rutherford's model of atom are correct? (i) Considered the nucleus as positively charged.(ii) Established that the  $\alpha$ -particles are four times as heavy as a hydrogen atom.(iii) Can be compared to solar system.(iv) Was in agreement with Thomson's model.

Please mark (✓) for the correct answer.

- A. only (i)
- B. (i) and (iv)
- C. (i) and (iii)
- D. (ii) and (iii)

## Question: 45 of 50

QID: 572

Marks: 4

When hydrogen chloride gas is prepared on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

Please mark (✓) for the correct answer.

- A. absorb  $\text{Cl}^-$  ions from the evolved gas
- B. absorb moisture from the gas
- C. absorb the evolved gas
- D. moisten the gas

## Question: 46 of 50

QID: 574

Marks: 4

The highly reactive metals like Sodium, Potassium, Magnesium, etc. are extracted by the

Please mark (✓) for the correct answer.

- A. electrolysis of their molten oxides
- B. reduction by aluminium
- C. reduction by carbon
- D. electrolysis of their molten chloride

For a current in the long straight solenoid, N and S-poles are created at the two ends. Among the following statement, the incorrect statement is:

Please mark (✓) for the correct answer.

- A. The strong magnetic field produced inside the solenoid can be used to magnetise a piece of a magnetic material like soft iron when placed inside the coil
- B. The N and S-poles exchange position when the direction of the current through the solenoid is reversed
- C. The field lines inside the solenoid are in the form of straight lines, which indicates that the magnetic field is the same at all points inside the solenoid
- D. The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.

Out of the given statements, find out the incorrect statement (s):

- I. Bacterial cell wall is made up of chitin.
- II. Viruses can multiply only when they are inside the living cells.
- III. Cyanobacteria are also called blue green algae; they are chemosynthetic heterotrophs.
- IV. Lichens are the symbiotic association between algae and fungi.

Please mark (✓) for the correct answer.

- A. II and IV
- B. I and II
- C. I and III
- D. II and III

What is common between chloroplasts, chromoplasts and leucoplasts?

Please mark (✓) for the correct answer.

- A. Ability to multiply by a fission-like process
- B. Possession of thylakoids and grana.
- C. Storage of starch, proteins and lipids.
- D. Presence of pigments.

Which of the following match is correct?

**Hormone****Effect**

- A. Oxytocin →
- B. Glucagon →
- C. Adrenaline →
- D. Thyroxine →

- Milk ejection hormone
- Decreases blood sugar level
- Decreases heart rate
- Decreases BMR

Please mark (✓) for the correct answer.

A. C

B. D

C. A

D. B

--- END OF QUESTION PAPER ---



## Answer Key

No	Question Type	QID	Correct Answer
Question - 1	Multiple Choice (Radiobutton)	142	B
Question - 2	Multiple Choice (Radiobutton)	109	D
Question - 3	Multiple Choice (Radiobutton)	123	C
Question - 4	Multiple Choice (Radiobutton)	115	C
Question - 5	Multiple Choice (Radiobutton)	131	D
Question - 6	Multiple Choice (Radiobutton)	183	D
Question - 7	Multiple Choice (Radiobutton)	189	B
Question - 8	Multiple Choice (Radiobutton)	173	C
Question - 9	Multiple Choice (Radiobutton)	159	A
Question - 10	Multiple Choice (Radiobutton)	185	A
Question - 11	Multiple Choice (Radiobutton)	249	A
Question - 12	Multiple Choice (Radiobutton)	242	B
Question - 13	Multiple Choice (Radiobutton)	235	D
Question - 14	Multiple Choice (Radiobutton)	247	C
Question - 15	Multiple Choice (Radiobutton)	233	D
Question - 16	Multiple Choice (Radiobutton)	577	C
Question - 17	Multiple Choice (Radiobutton)	551	D
Question - 18	Multiple Choice (Radiobutton)	550	A
Question - 19	Multiple Choice (Radiobutton)	578	C
Question - 20	Multiple Choice (Radiobutton)	548	B
Question - 21	Multiple Choice (Radiobutton)	571	A
Question - 22	Multiple Choice (Radiobutton)	547	B
Question - 23	Multiple Choice (Radiobutton)	579	D
Question - 24	Multiple Choice (Radiobutton)	561	C
Question - 25	Multiple Choice (Radiobutton)	562	D
Question - 26	Multiple Choice (Radiobutton)	566	D
Question - 27	Multiple Choice (Radiobutton)	573	B
Question - 28	Multiple Choice (Radiobutton)	580	B
Question - 29	Multiple Choice (Radiobutton)	565	C
Question - 30	Multiple Choice (Radiobutton)	556	C
Question - 31	Multiple Choice (Radiobutton)	575	A
Question - 32	Multiple Choice (Radiobutton)	549	D
Question - 33	Multiple Choice (Radiobutton)	557	D
Question - 34	Multiple Choice (Radiobutton)	569	C
Question - 35	Multiple Choice (Radiobutton)	559	D
Question - 36	Multiple Choice (Radiobutton)	564	B
Question - 37	Multiple Choice (Radiobutton)	554	A
Question - 38	Multiple Choice (Radiobutton)	553	B
Question - 39	Multiple Choice (Radiobutton)	558	D
Question - 40	Multiple Choice (Radiobutton)	560	A
Question - 41	Multiple Choice (Radiobutton)	568	D
Question - 42	Multiple Choice (Radiobutton)	563	D
Question - 43	Multiple Choice (Radiobutton)	567	C



No	Question Type	QID	Correct Answer
Question - 44	Multiple Choice (Radiobutton)	570	C
Question - 45	Multiple Choice (Radiobutton)	572	B
Question - 46	Multiple Choice (Radiobutton)	574	D
Question - 47	Multiple Choice (Radiobutton)	576	D
Question - 48	Multiple Choice (Radiobutton)	546	C
Question - 49	Multiple Choice (Radiobutton)	552	C
Question - 50	Multiple Choice (Radiobutton)	555	C

--- END OF ANSWER KEY ---

