Class 12 B

English Holiday Homework

A. Revise the Lessons:

1. The Last Lesson
2. Lost Spring
3. Deep Water
4. The Rattrap

and also prepare the Note Making of the same (Do it in your Notebook)

B. Also write the Notice and the Job Application from the PT 1 Question Paper in your Notebook.

Summer Holiday Homework Subject - Yoga

Prepare Shatkarma in detail (definition, procedure, types, benefits and precautions)

By Shrikant Yadav

PHYSICS

- ✓ Revise the content taught till now.
- ✓ Solve numericals from NCERT and side books.
- ✓ Complete the project as discussed in the class.
- ✓ Solve the following questions on comment sheets and submit the work on the reopening day of school.

1) Why is the direction of electric field due to a charged conducting sphere at any point perpendicular to its surface?
2) Draw the pattern of electric field lines when a point charge +q is kept near an uncharged conducting plate.
3) Plot a graph showing the variation of coulomb force (F) versus $(1/r^2)$, where r is distance between the two charges, of each pair of charges (1 μC, 2 μC) and (2 μC, -3 μC). Interpret the graphs obtained.
4) Two identical point charges, q each, are kept 2m apart in air. A third point charge Q of unknown magnitude and sign is placed on the line joining the charges such that the system remains in equilibrium. Find the position and nature of Q.
5) Given a uniform electric field $E = 5 \times 10^3$ i N/C, find the flux of this field through a square of side 10 cm on a side whose plane is parallel to the Y-Z plane. What would be the flux through the same square if the plane makes an angle of 30° with the X-axis?

6) Two isolated metal spheres A and B have radii R and 2R respectively, and same charge q. Find which of the two have greater energy density just outside the surface of the spheres.
7) A charged particle +q moves in a uniform electric field E in the direction opposite to E. What will be the effect on its electrostatic potential energy during its motion?
8) Obtain an expression for electrostatic potential energy of asystem of three charges q, 2q and -3q placed at the vertices of an equilateral triangle of side a.
9) a) a parallel plate capacitor C_1 having charge Q is connected to an identical uncharged capacitor C_2 in series. What would be the charge accumulated on the capacitor C_2?
b) Three identical capacitors each of capacitance 3 μF are connected in turn in series and in parallel combination to the common source V volt. Find out the ratio of the energies stored in two configurations.
10) A parallel plate capacitor (A) of capacitance C is charged by a battery to voltage V. The battery is then disconnected and an uncharged capacitor B of capacitance 2C is connected across A. Find the ratio of

(i) final charges on A and B

(ii) total electrostatic energy stored in A and B finally and that stored in A initially.

Chemistry holiday assignment

Note :1. Assignment is to be done on the comment sheets.

2. Complete the salt analysis of 8 salts in your practical notebook

3. Learn the confirmatory test to be performed in the lab for the various positive and negative radicals.

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Chapter 1: Solutions

1. Calculate the freezing point of a solution containing 60 g of glucose . (Molar mass = 180 g mol-1) in 250 g of water. (Kf of water = 1.86 K kg mol-1)

2. Give reasons for the following:

(i)Measurement of osmotic pressure method is preferred for the determination of molar masses of macro-molecules such as proteins and polymers.

(ii)Aquatic animals are more comfortable in cold water than in warm water.

(iii)Elevation of boiling point of 1M KCl solution is nearly double than that of 1 M sugar solution.

3. A 10% solution (by mass) of sucrose in water has freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water, if freezing point of pure water is 273.15 K.Given : (Molar mass of sucrose = 342 g mol–1 , Molar mass of glucose = 180 g mol–1)

4. State the formula relating pressure of a gas with its mole fraction in a liquid solution in contact with it. Name the law and mention its two applications.

5. Two liquids A and B boil at 145^0C and 190^0C respectively. Which of them has a higher vapour pressure at 800C?

6. (a) Why is the vapour pressure of a solution of glucose in water lower than that of water?

(b) A 6.90 M solution of KOH in water contains 30% by mass of KOH. Calculate the density of the KOH solution? (molar mass of KOH = 56 g/mol)

7. Define azeotropes. What type of azeotrope is formed by positive deviation from Raoult's law? Give an example.

8. Explain with suitable examples in each case why the molar masses of some substances determined with the help of colligative properties are (i) higher (ii) lower than actual values.

10. Calculate the freezing point of solution when 1.9 g of $MgCl_2$(M=95 g mol–1) was dissolved in 50 g of water, assuming $MgCl_2$ undergoes complete ionization. (Kf for water = 1.86 K kg mol–1)

11. a) Out of 1 M glucose and 2 M glucose, which one has a higher boiling point and why?

b) What happens when the external pressure applied becomes more than the osmotic

pressure of solution ?

12. State Raoult's law for solutions of volatile liquids. Taking suitable examples explain the meaning of positive and negative deviations from Raoult's law. What is the sign of ΔH mix for positive deviation?

13. a) Define the term osmotic pressure. Describe how the molecular mass of a substance can be determined by a method based on measurement of osmotic pressure.

b) Determine the osmotic pressure of a solution prepared by dissolving 0.025g of K_2SO_4 in 2L of water at 25°C, assuming that is completely dissociated.(R=0.0821 L atm/K/mol, molar mass of K_2SO_4= 174g/mol)

14. 15 g of an unknown molecular material was dissolved in 450 g of water. The resulting solution was found to freeze at -0.34°C. What is the molar mass of this material? Kf for water = 1.86 K Kg mol-1)

15. A solution is prepared by dissolving 1.25g of oil of winter green (methyl salicylate) in 99.0g of benzene has a boiling point of 80.31^0C. Determine the molar mass of this compound. (B.P. of pure benzene = 80.10°C and Kb for benzene = 2.53°C kg mol-1)

(152.21 g/mol)

16. A 1.00 molal aqueous solution of trichloroacetic acid (CCl_3COOH) is heated to its boiling point. The solution has the boiling point of 100.18°C. Determine the van't Hoff factor for trichloroacteic acid (Kb for water = 0.512 K Kg mol-1).

MULTIPLE CHOICE QUESTIONS

1. The molality of 98% H_2SO_4 (density = 1.8 g/ml) by weight is:

(a) 6 m (b) 18 m
(c) 10 m (d) 4 m

2. Which of the following does not show positive deviation from Raoult's law?

(a) benzene + chloroform (b) benzene + acetone

(c) benzene + ethanol (d) benzene + CCl4

3. Which solution will have least vapour pressure?

(a) 0.1 M $BaCl_2$ (b) 0.1 M Urea
(c) 0.1 M Na_2SO_4 (d) 0.1 M Na_3PO_4

4. Which condition is not satisfied by an ideal solution?

(a) $\Delta Hmix = 0$. (b) $\Delta Vmix = 0$
(c) $\Delta Pmix = 0$ (d) $\Delta Smix = 0$

5. Azeotrope mixture are:
(a) mixture of two solids
(b) those will boil at different temperature
(c) those which can be fractionally distilled
(d) constant boiling mixtures

6. If K_f value of H_2O is 1.86. The value of ΔT_f for 0.1 m solution of non-volatile solute is
(a) 18.6 (b) 0.186. (c) 1.86 (d) 0.0186

7. Solute when dissolve in water

(a) increases the vapour pressure of water (b) decreases the boiling point of water
(c) decrease the freezing point of water (d) All of the above

8. The plant cell will shrink when placed in:
(a) water (b) A hypotonic solution (c) a hypertonic solution (d) an siotonic solution

9. The freezing point of 11% aquous solution of calcium nitrate will be:
(a) 0°C (b) above 0°C
(c) 1°C (d) below 0°C

10. The Van't Hoff factor for 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of dissociation is:

(a) 91.3% (b) 87% (c) 100% (d) 74%

11. Which of the following solutions would have the highest osmotic pressure:

(a) M10 NaCl (b) M10 Urea
(c) M10 $BaCl_2$ (d) M10 Glucose

12. 0.5 M aquous solution of Glucose is isotonic with:
(a) 0.5 M KCl solution. (b) 0.5 M $CaCl_2$solution
(c) 0.5 M Urea solution. (d) 1 M solution of sucrose

13. Which of the following is true for Henry's constant
(a) It decreases with temperature

(b) It increases with temperature

(c) Independent on temperature

(d) It do not depend on nature of gases.

14. Which one is the best colligative property for determination of molecular mass of polymer?

(a) osmotic pressure (b) elevation in boiling point

(c) depression in freezing point (d) osmosis

15. Which of the following do not depend on temperature?

(a) % W/V (weight/volume) (b) molality (c) molarity (d) normality

16. Henry's law constant K_H of CO_2 in water at 25°C is 3×10^{-2} mol/L atm–1. Calculation the mass of CO_2 present in 100 L of soft drink bottled with a partial pressure of CO_2 of 4 atm at the same temperatrue.
(a) 5.28 g. (b) 12.0 g
(c) 428 g. (d) 528 g

17. Mixing of HNO_3 and HCl is reaction:
(a) endothermic reaction (b) exothermic reaction

(c) both exothermic and endothermic (d) depend on entropy of reaction

18. The most likely on ideal solution is:
(a) NaCl—H_2O (b) C_2H_5OH—C_6H_6
(c) C_7H_{16}—H_2O (d) C_7H_{16}—C_8H_{18}

19. Van't Hoff factor for a dilute solution of a $K_2[HgI_4]$ is:

(a) 2. (b) 1. (c) 3 (d) zero

20. Benzoic acid dissolved in benzene shows a molecular weight of:
(a) 122. (b) 61. (c) 244 (d) 366

21. 6% (W/V) solution of urea will be isotonic with:

(a) 18% (W/V) solution of glucose (b) 0.5 M solution of NaCl

(c) 1 M solution of CH_3COOH (d) 6% (W/V) solution of sucrose.

22. Solution showing (+) ve deviation from Raoult's law include:

(a) acetone + CS_2. (b) acetone + C_2H_5OH (c) acetone + Benzene. (d) acetone + aniline

Case based questions

1.Read the given passage and answer the questions that follow.

Boiling point or freezing point of liquid solution would be affected by the dissolved solids in the liquid phase. A soluble solid in solution has the effect of raising its boiling point and depressing its freezing point. The addition of non-volatile substances to a solvent decreases the vapour pressure and the added solute particles affect the formation of pure solvent crystals. According to many researches the decrease in freezing point directly correlated to the concentration of solutes dissolved in the solvent. This phenomenon is expressed as freezing point depression and it is useful for several applications such as freeze concentration of liquid food and to find the molar mass of an unknown solute in the solution. Freeze concentration is a high quality liquid food concentration method where water is removed by forming ice crystals. This is done by cooling the liquid food below the freezing point of the solution. The freezing point depression is referred as a colligative property and it is proportional to the molar concentration of the solution (m), along with vapour pressure lowering, boiling point elevation, and osmotic pressure. These are physical characteristics of solutions that depend only on the identity of the solvent and the concentration of the solute. The characters are not depending on the solute's identity.

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) When a non volatile solid is added to pure water it will:

(a) boil above 100°C and freeze above 0°C

(b) boil below 100°C and freeze above 0°C

(c) boil above 100°C and freeze below 0°C

(d) boil below 100°C and freeze below 0°C

(ii) colligative properties are:

(a) dependent only on the concentration of the solute and independent of the solvent's and solute's identity.

(b) dependent only on the identity ot the solute and the concentration ot the solute and independent of the solvent's identity.

(c) dependent on the identity of the solvent and solute and thus on the concentration of the solute.

(d) dependent only on the identity of the solvent and the concentration of the solute and independent of the solute's identity

(iii) Assume three samples of juices A, B and C have glucose as the only sugar present in them. The concentration of sample A, B and C are 0.1 M, 0.5 M and 0.2 M respectively. .Freezing point will be highest for the fruit juice:

(a) A

(c) C

(b) B

(d) All have same freezing point

(iv) Identify which of the following is a colligative property:

(a) freezing point (b) boiling point (c) osmotic pressure (d) all of the above

II. Read the passage given below and answer the following questions;

Scuba apparatus includes a tank of compressed air toted by the diver on his or her back, a hose for carrying air to a mouthpiece, a face mask that covers the eyes and nose, regulators that control air flow, and gauges that indicate depth and how much air remains in the tank.

A diver who stays down too long, swims too deep, or comes up too fast can end up with a condition called "the bends." In this case, bubbles of gas in the blood can cause intense pain, even death.

In these following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(A) Assertion and Reason both are correct statements and reason is correct explanation of Assertion.

(B) Assertion and Reason both are correct statements but Reason is not correct explanation of assertion

(C) Assertion is correct statement but Reason is wrong statement.

(D) Assertion is wrong statement but Reason is correct statement.

Q. 1. **Assertion :** Scuba divers may face a medical condition called 'bends'.

Reason : 'Bends' can be explained with the help of Henry's law as it links the partial pressure of gas to that of its mole fraction.

Q. 2. **Assertion** : Bends is caused due to formation of nitrogen bubbles in the blood of scuba divers which blocks the capillaries.

Reason : Underwater high pressure increases solubility of gases in blood, while as pressure gradually decreases moving towards the surface, gases are released and nitrogen bubbles are formed in blood.

Q. 3. **Assertion**: Soft drinks and soda water bottles are sealed under high pressure.

Reason : high pressure maintains the taste and the texture of the soft drinks

Q4 **Assertion** : Anoxia is a condition experienced by climbers which makes them suddenly agile and unable to think clearly.

Reason : at a height partial pressure of oxygen is less than at ground level.

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COMPUTER SCIENCE --

1. Revise and Practice Class 11 and 12 Python concepts covered.
2. Complete all 11 and 12 programming questions given for practical file. (They are needed in both hardcopy and softcopy)

A. Competency Focused Multiple Choice Questions

1. In a biology quiz, students are asked to identify the correct path of sperms during fertilization. Which of the following images best represents the accurate journey of sperms (indicated by the arrows) through the female reproductive system to the point where it may meet the egg cell (indicated by the point) ?

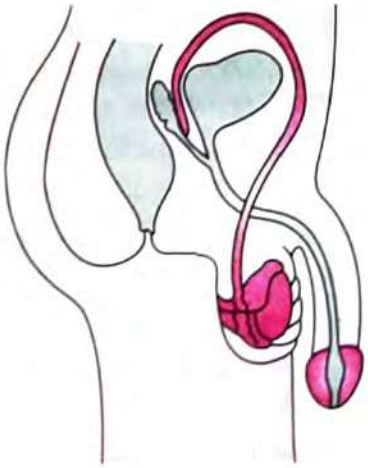
(*a*)

(*b*)

(*c*)

(*d*)

2. Shown here is a representation of the male reproductive system. One of its important parts is missing. What aspect to the semen was primarily affected ?



(*a*) The concentration of sperm
(*b*) The fluidity and pH of the semen
(*c*) The number of sperms produced
(*d*) The level of testosterone in the blood

3. A 30-year-old pregnant woman is undergoing a prenatal check-up. The doctor explains the transport of substances like oxygen, nutrients, carbon dioxide and urea between maternal blood and foetus through the placenta.

Concentration of which of the following substances will decrease in maternal blood as they flow through the umbilical cord ?

(*i*) Oxygen (*ii*) Amino Acids

(*iii*) Carbon dioxide (*iv*) Urea

Options :

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iv*)

(*c*) (*iii*) and (*iv*) (*d*) (*i*) and (*iv*)

4. During a consultation, Dr. Riya explains her patient, Anjali, "As the fertilized egg moves through the isthmus on its way to the uterus, it undergoes a process called cleavage." What do you think is the significance of this cleavage ?

(*a*) It decreases the size of the embryo.

(*b*) It decreases the number of cells in the embryo.

(*c*) It leads to the formation of a multicellular structure.

(*d*) It changes the genetic composition of the cells.

5. During a fertility consultation, a doctor explains to a patient the timing of hormone surges in her menstrual cycle to track ovulation. Which sequence of hormone increases is the correct order from menstrual to the luteal phase ?

(*a*) LH, Progesterone, Estrogen

(*b*) FSH, Estrogen, Progesterone

(*c*) Progesterone, LH, Estrogen

(*d*) Estrogen, Progesterone, FSH

6. John is studying the male reproductive system in his biology class. His teacher assigns him a task to trace the pathway that sperm cells take from the site of production to the point of release from the body. Can you help him figure out the correct pathway ?

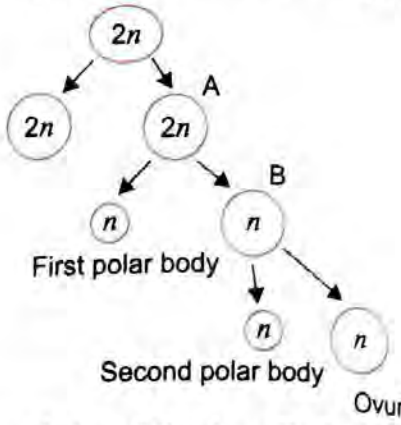
(*a*) Testis → Epididymis → Vasa efferentia → Rete testis → Urethra → Ejaculatory duct

(*b*) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus

(*c*) Seminiferous tubules → Vasa efferentia → Epididymis → Urethra → Vas deferens → Urethral meatus

(*d*) Testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus

7. If a chemical is experimentally introduced to prevent the progression from "A" to "B", which of the following processes would be directly inhibited ?



(*a*) Completion of Prophase II of meiosis

(*b*) Completion of Cytokinesis after meiosis II

(*c*) Completion of Prophase I of meiosis

(*d*) Completion of Anaphase II of meiosis

8. Which of the following statements describes the difference between placenta and umbilical cord ?

(*a*) The placenta secretes hormones whereas the umbilical cord does not.

(*b*) The placenta persists after pregnancy while the umbilical cord is expelled.

(*c*) The placenta is lined with veins and arteries while the umbilical cord is not.

(*d*) The placenta interlocks with foetal tissues whereas the umbilical cord interlocks with the uterine tissue.

9. Given below are some statements about spermatogenesis.

P. Spermatogenesis starts at the age of puberty.

Q. GnRH stimulates the anterior pituitary to release LH and FSH.

R. LH acts on Leydig cells to stimulate androgen synthesis, which in turn stimulates spermatogenesis.

S. FSH acts on Leydig cells to stimulate spermiogenesis.

Based on the statements, pick the correct option :

(*a*) P and S are true, and S is the reason for P

(*b*) P and Q are true, and Q is the reason for P

(*c*) P and R are true, and R is the reason for P

(*d*) S and Q are true, and Q is the reason for S

10. Organisms possessing identical sex chromosomes are referred to as the homogametic sex. Organisms with different sex chromosomes are known as the heterogametic sex.

Which of the following is CORRECT about humans ?

(*a*) Both males and females are homogametic

(*b*) Both males and females are heterogametic.

(*c*) Males are homogametic while females are heterogametic.

(*d*) Males are heterogametic while females are homogametic.

11. Which of these cells of the human male reproductive system is haploid ?

(*a*) Spermatid

(*b*) Sertoli cell

(*c*) Leydig cell

(*d*) Spermatogonium

12. Globozoospermia is a condition where sperms have a characteristic round head lacking the acrosome.

Which of the following functions will a sperm NOT be able to do because of the above condition ?

(*a*) Enter the cervix

(*b*) Penetrate the ovum

(*c*) Leave the ejaculatory duct

(*d*) Swim to the Fallopian tube

13. Some events of pregnancy in humans are written below in a sequence.

(*i*) complete development of foetus

(*ii*) uterine contraction

(*iii*) dilation of cervix

(*iv*) delivery of the baby

(*v*) lactation

Between which of the following events does the shedding of the placenta happen ?

(*a*) (*i*) and (*ii*)

(*b*) (*ii*) and (*iii*)

(*c*) (*iii*) and (*iv*)

(*d*) (*iv*) and (*v*)

14. Which of these statements about the female reproductive system is FALSE ?

(*a*) Menarche marks the initiation of oogenesis..

(*b*) The germ layers start forming after implantation.

(*c*) The oocyte completes meiosis after the entry of sperm.

(*d*) Ovulation and menstruation stop permanently after menopause.

15. Which of these hormones would be detected in both a pregnant female and a female who is not pregnant ?

(*a*) Relaxin

(*b*) Prolactin

(*c*) Progesterone

(*d*) Human chorionic gonadotropin

16. If a male testis fails to slip into scrotal sacs may have infertility. Choose the possible reason behind the condition.

(*a*) Scrotal sacs have higher temperature than abdominal cavity

(*b*) Scrotal sacs have temperature 2 – 2.5°C lesser than normal body temperature

(*c*) In scrotal sacs enough space is present for high number of sperm production

(*d*) Wall of scrotal sacs secrete hormones necessary for sperm production

17. The function of germinal and Sertoli cells present in testis is

(*a*) to produce sperms and to nourish developing sperms respectively

(*b*) to secrete hormones and to nourish developing sperms respectively

(*c*) both types of cells secrete different hormones

(*d*) to nourish sperms by secreting 60% and 30% seminal fluid respectively

18. Which statements/s is/are incorrect ?

(*i*) Urethra in human males acts as a urogenital canal.

(*ii*) In human males, testis are extra abdominal

(*iii*) The region outside seminiferous tubules is called interstitial space and contains Leydig cells

(*iv*) In human males testis slips down into the scrotal sacs during certain breeding seasons only.

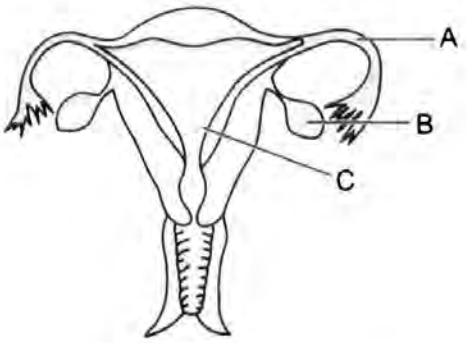
(*a*) (*i*), (*ii*) and (*iii*)

(*b*) (*iv*) only

(*c*) (*ii*), (*iii*) and (*iv*)

(*d*) (*i*), (*ii*), (*iii*) and (*iv*)

19. Which out of the following is the site of fertilisation in the human female reproductive system ?



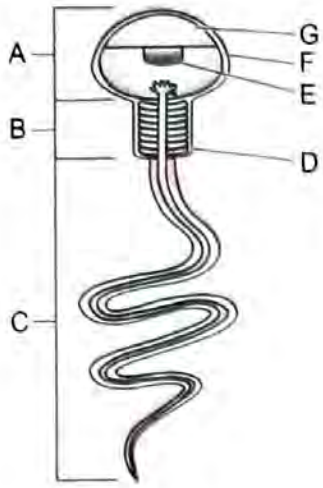
(*a*) A

(*b*) B

(*c*) C

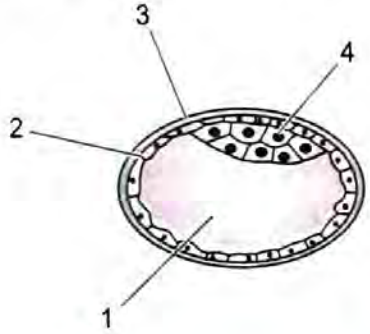
(*d*) None of above

20. Which part of sperm provides energy for movement ?



(*a*) A (*b*) B
(*c*) C (*d*) E

21. In the figure given below the correct name and ultimate fate of part 4 mentioned is



(*a*) inner cell mass, forms embryo
(*b*) inner cell mass forms placenta
(*c*) trophoblast forms umbilical cord
(*d*) trophoblast forms embryo

22. Due to high levels of ..... during 13th to 14th day of menstrual cycle ovulation occurs
(*a*) estrogen (*b*) progesterone
(*c*) LH (*d*) FSH

23. In human females at which stage of oogenesis, ovulation occurs ?
(*a*) Primary oocyte (*b*) Ovum
(*c*) Secondary oocyte (*d*) Oogonium

24. Signals for parturition in human female originate from
(*a*) fully developed foetus only
(*b*) both placenta and fully developed foetus
(*c*) placenta only
(*d*) oxytocin released from maternal pituitary
(CBSE Sample Paper 2024-25)

25. Which one of the following hormones is secreted by the human placenta that helps in the maintenance of pregnancy ?
(*a*) Relaxin
(*b*) Human Chorionic Gonadotropin
(*c*) Oxytocin
(*d*) Human Placental Lactogen (CBSE 2024)

B. Competency Focused Assertion-Reason Type Questions

Two statements are given – one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to the following questions from the codes (*a*), (*b*), (*c*) and (*d*) as given below :

(*a*) Both A and R are true and R is the correct explanation of the assertion.
(*b*) Both A and R are true but R is not the correct explanation of the assertion.
(*c*) A is true but R is false.
(*d*) A is false but R is true.

1. **Assertion.** The blastocyst consists of an outer layer trophoblast and an inner cell mass.
Reason. The trophoblast is involved in the embryo formation, and the inner cell mass gets attached to the endometrium.

2. **Assertion.** Penetration of a sperm into an ovum is a biochemical process.
Reason. Acrosome of a sperm secretes enzymes which dissolves the zona pellucida of ovum.

3. **Assertion.** The scrotum maintains the temperature of the testes 2 – 2.5°C lower than the normal body temperature.
Reason. Lower temperature of testes is crucial for spermatogenesis.

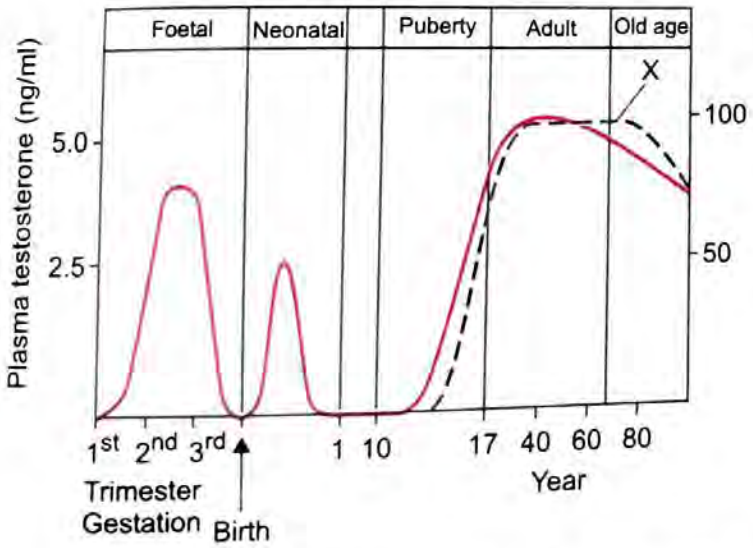
4. **Assertion.** Semen plays a vital role in supporting and facilitating the survival and motility of spermatogonia within the female reproductive tract.
Reason. Semen contains various components, including fructose, calcium and certain enzymes, which provide nourishment, energy, and protection to spermatozoa.

5. **Assertion.** The concentration of estrogen increases while the concentration of progesterone decreases significantly in the maternal blood during pregnancy.
Reason. Estrogen and progesterone are crucial for supporting foetal development.

6. **Assertion.** Only one sperm can fertilise an ovum.
Reason. During fertilisation, a sperm comes in contact with zona pellucida layer of the ovum.

Case-Based Very Short/Short Answer Questions

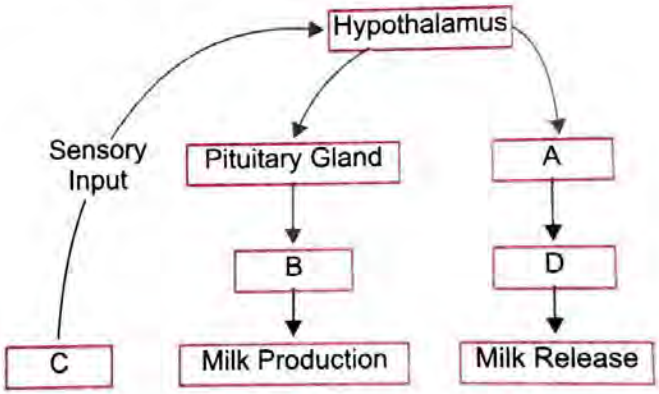
CASE 1. The given graph represents plasma testosterone levels at different stages of life. Analyse the graph given below :



Based on your understanding of the above graph and related studied concepts, answer questions 1 to 4 :

1. Presence of which chromosome would be the cause of moderate levels of testosterone ?
2. During childhood, testosterone levels are almost nil until pubertal age as given in the graph. The testosterone levels increase rapidly afterwards due to stimulus provided by a hormone.
   (*a*) Name this hormone.
   (*b*) Mention its function and source of production.
3. By observing the given graph, what do you think X represents here ?
4. Describe the role of hormone identified in (*ii*) (*a*) in female menstrual cycle.

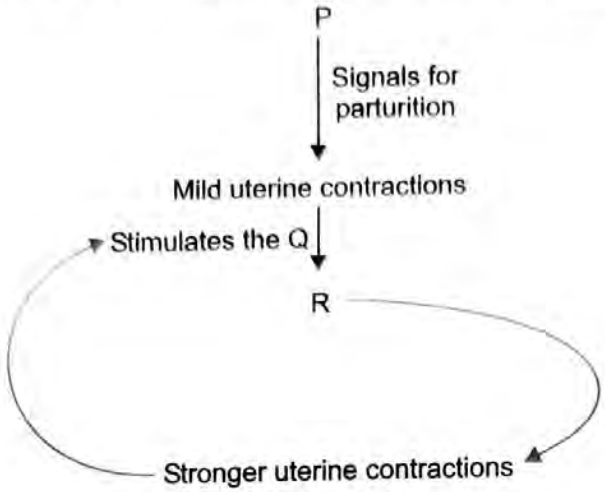
CASE 2. Given below is the control of lactation in human females. The pathway of milk production and release is regulated by various hormones.



Based on your understanding of the above information and related studied concepts, answer questions 5 to 8 :

5. Hormone D is involved in milk ejection. Apart from this, what other role does it perform ?
6. Provide a flowchart of path followed by milk inside the mammary gland.
7. What would happen to the milk production process if B levels were insufficient ? Provide a brief explanation.
8. Describe the feedback mechanism involved in lactation. Is this feedback mechanism considered a positive or negative feedback loop ?

CASE 3. Parturition, also known as childbirth, is a complex process involving the coordinated actions of various hormones and physiological signals. It begins with mild uterine contractions, which gradually increase in intensity to facilitate the delivery of the baby. The flowchart below illustrates the hormonal regulation of parturition.

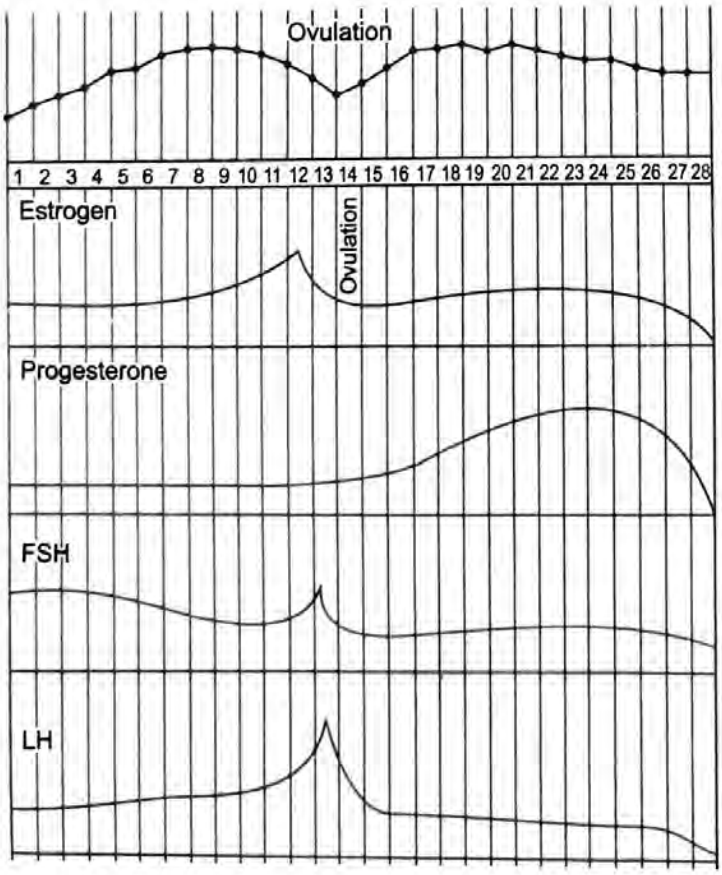


Based on your understanding of the above information and related studied concepts, answer questions 9 to 12 :

9. Identify P, Q and R.
10. A pregnant woman does not deliver a baby after her due date. As a biology student, which remedy would you prefer by considering the flowchart above and your knowledge ? Support your answer with the reason.
11. Mention another role and target tissue/organ of R. Is it associated with the infant by any means ? If yes, mention it.
12. From which gland is hormone R released ? Mention other hormone along with its function that is released from the same gland.

Case-Based Very Short Answer and Multiple Choice Questions

CASE 4. A group of medical students carried out a detailed study on the impact of various factors on the different hormones during the menstrual cycle in a human female. They collected the data with different factors. Given below is the graph plotted from the data collected showing the morning temperature and concentration of hormones FSH, LH, estrogen and progesterone during normal menstrual cycle in a woman.



Based on your understanding of the above graph and related studies concepts, answer the questions 13 to 16 :

13. In which phase of menstrual cycle, the increase in the level of progesterone is maximum under the influence of LH ?
14. Which hormone/hormones is/are showing rapid surge leading to changes in Graafian follicle just before ovulation ?
15. In which period of the menstrual cycle is the chance of fertilisation very high in human female ?
    (*a*) day 1 to 5
    (*b*) day 13 to 17
    (*c*) day 6 to 10
    (*d*) day 22 to 26
16. Which of the following secretes progesterone hormone ?
    (*a*) Endometrium of uterus
    (*b*) Myometrium of uterus
    (*c*) Growing follicle
    (*d*) Corpus luteum

CASE 5. Fusion of a haploid male gamete (spermatozoon) and a haploid female gamete (ovum) to form diploid zygote, is called fertilization. The process of fatilization occurs only within 24 hours of ovulation, in the specific region of the female reproductive tract. Chemical and physical events of fertilization involve five processes, namely, acrosome reaction, cortical reaction, sperm entry, karyogamy and activation of egg.

Based on your understanding of the above paragraph and studied related concepts, answer question numbers 17 to 20.

17. In which part of female reproductive tract does fertilization occur in humans ?

18. Name any two sperm lysins released by the acrosome of sperm.

19. Capacitation of sperms occurs in

(*a*) epididymis (*b*) rete testis

(*c*) vas deferens

(*d*) female reproductive tract

20. During fertilization in humans, what happens after many sperms reach close to the ovum ?

(*a*) cells of corona radiata allow only one sperm to reach upto zona pellucida

(*b*) sperm lysins released from acrosome help one sperm enter the zona pellucida to reach the plasma membrane of the egg

(*c*) all sperms except the nearest one to the egg lose their motility

(*d*) more than one sperm enter through zona pellucida

Answers

A. Multiple Choice Questions

1. Androgens are secreted by

(*a*) Sertoli cells (*b*) Leydig cells

(*c*) Seminal vesicles (*d*) Bulbourethal gland

(CBSE Sample Paper 2019)

2. Which of the following statements are correct with respect to hormones secreted by placenta ?

(*i*) Placenta secretes relaxin during later stage of pregnancy.

(*ii*) Placenta secretes high amount of FSH during pregnancy.

(*iii*) Placenta secretes relaxin during initial stage of pregnancy.

(*iv*) Placenta secretes hCG and hPL during pregnancy.

(*a*) (*i*) and (*iv*) (*b*) (*i*), (*ii*) and (*iv*)

(*c*) (*iii*) and (*iv*) (*d*) (*ii*), (*iii*) and (*iv*)

(CBSE 2022)

3. Penetration of the sperm in the ovum is followed by

(*a*) formation of first polar body

(*b*) completion of meiosis II

(*c*) first meiosis

(*d*) dissolution of zona pellucida (CBSE 2022)

4. The correct sequence of hormone secretion from beginning of menstruation is

(*a*) FSH, progesterone, estrogen

(*b*) estrogen, FSH, progesterone

(*c*) FSH, estrogen, progesterone

(*d*) estrogen, progesterone, FSH (CBSE 2022)

5. During parturition, a pregnant woman is having prolonged labour pains and child birth has to be fastened. It is advisable to administer a hormone that can

(*a*) increase the metabolic rate

(*b*) release glucose in the blood

(*c*) stimulate the ovary

(*d*) activate smooth muscles (CBSE 2022)

6. Figure A shows the front view of the human female reproductive system and Figure B shows the development of a fertilized human egg cell

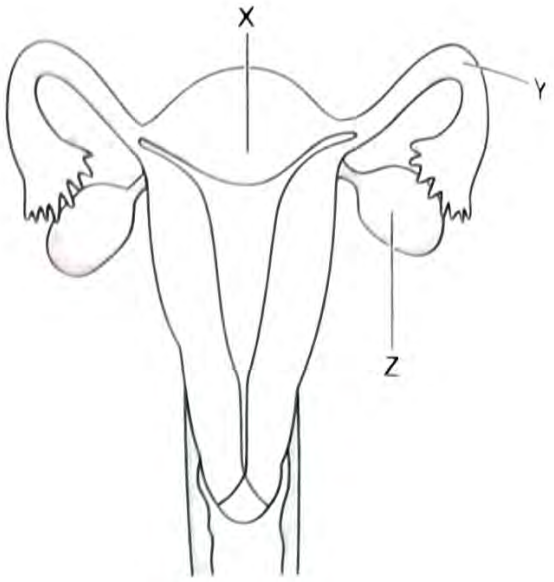


FIGURE A

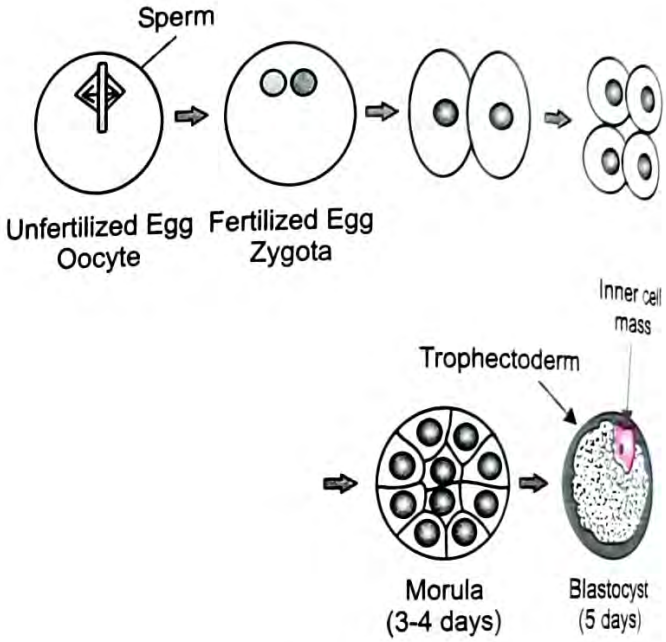


FIGURE B

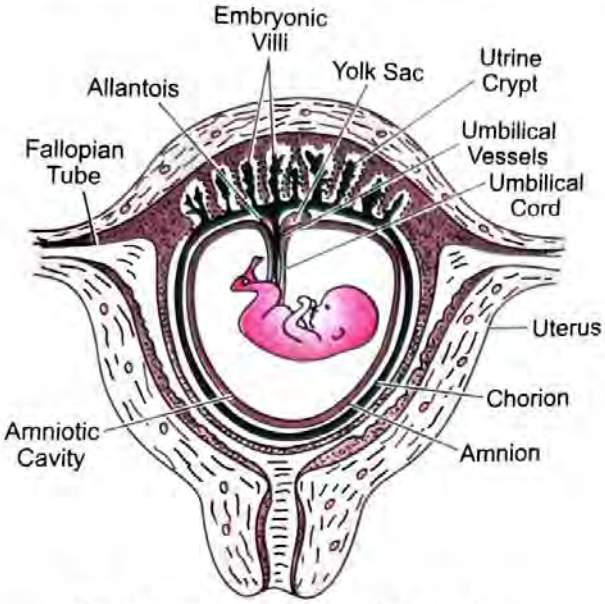
Identify the correct stage of development of human embryo (Figure B) that takes place at the site X, Y and Z respectively in the human female reproductive system (Figure A).

Choose the correct option from the table below :

	X	Y	Z
(*a*)	Morula	Fertilized egg	Blastocyst
(*b*)	Unfertilized egg	Fertilized egg	Morula
(*c*)	Blastocyst	Fertilized egg	Unfertilized egg
(*d*)	Fertilized egg	Morula	Blastocyst

(CBSE 2022)

7. Concentration of which of the following substances will decrease in the maternal blood as it flows from embryo to placenta through the umbilical cord ?



The Human foetus within the uterus

(*i*) Oxygen
(*ii*) Amino Acids
(*iii*) Carbon dioxide
(*iv*) Urea

(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iv*)
(*c*) (*iii*) and (*iv*) (*d*) (*i*) and (*iv*)

(CBSE 2022)

8. Choose the correct option wherein, the correct stages of the development of human embryo takes place.

	Ovary	Fallopian Tube	Uterus
(*a*)	Morula	Fertilized egg	Blastocyst
(*b*)	Unfertilized egg	Fertilized egg	Morula
(*c*)	Unfertilized egg	Fertilized egg	Blastocyst
(*d*)	Fertilized egg	Morula	Blastocyst

(CBSE 2022)

9. Which of the following is not a function of placenta ?
(*a*) secretes relaxin
(*b*) facilitates removed of CO_2 and waste products
(*c*) secretes oxytocin
(*d*) supplies oxygen and nutrients (CBSE 2022)

10. Select the correct option for Human Chorionic Gonadotropin (HCG) released during embryonic development in humans.
(*i*) Helps in maintenance of pregnancy.
(*ii*) Leads to rupture of Graafian follicle.
(*iii*) Cause strong uterine contraction during childbirth.
(*iv*) Brings metabolic changes in the mother.

(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iv*)
(*c*) (*ii*) and (*iii*) (*d*) (*ii*) and (*iv*)

(CBSE 2022)

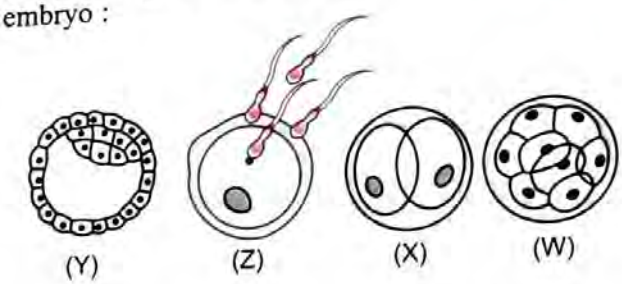
11. The source of gonadotropin LH and its corresponding function is
(*a*) Anterior pituitary, ovulation
(*b*) Anterior pituitary, Graaffian follicle formation
(*c*) Hypothalamus, Ovulation
(*d*) Hypothalamus, Graaffian follicle formation

(CBSE 2022)

12. Breast-feeding the baby acts as a natural contraceptive for the mother because it prevents :
(*i*) Ovulation (*ii*) Menstruation
(*iii*) Insemination (*iv*) Fertilisation
Choose the correct option :
(*a*) (*ii*) and (*iv*) (*b*) (*i*) and (*iii*)
(*c*) (*i*) and (*iv*) (*d*) (*i*) and (*ii*)

(CBSE 2022)

13. The given figure shows the different stages of human embryo :



Identify the correct labellings for W, X, Y and Z and choose the correct option from the table below :

	W	X	Y	Z
(*a*)	Cleavage	Blastocyst	Morula	Fertilisation
(*b*)	Blastocyst	Morula	Cleavage	Fertilisation
(*c*)	Morula	Cleavage	Blastocyst	Fertilisation
(*d*)	Morula	Blastocyst	Cleavage	Fertilisation

(CBSE 2022)

14. During human embryonic development, the external genital organs are well developed in the foetus by the end of –
(*a*) 6 weeks of pregnancy
(*b*) 12 weeks of pregnancy
(*c*) 18 weeks of pregnancy
(*d*) 24 weeks of pregnancy (CBSE 2022)

15. The accessory ducts in the human male reproductive system consists of –
(*a*) Epididymis, Prostrate, Rete testis
(*b*) Rete testis, Vas efferentia, Seminal vesicles
(*c*) Vas efferentia, Bulbourethral, Epididymis
(*d*) Rete testis, epididymis, Vas efferentia

(CBSE 2022)

A. Competency Focused Multiple Choice Questions

1. During the pollen grain formation, the generative cell divides to give rise to the two male gametes.

What is the ploidy of the generative cell ?

(*a*) n (*b*) $2n$

(*c*) $3n$ (*d*) $4n$

2. Kiwi is a dioecious species. Which of the following methods can be definitely **ruled out** as a possible mode of pollination in its case ?

(P) cleistogamous autogamy

(Q) chasmogamous autogamy

(R) geitonogamy

(S) xenogamy

(*a*) Only (P) and (R) (*b*) Only (P) and (Q)

(*c*) Only (Q) and (S) (*d*) Only (P), (Q) and (R)

3. During apomictic seed formation, there is no reduction division and the gametes (both egg cell and the pollen/sperm cells) are diploid.

What is the ploidy of the endosperm formed through apomixis ?

(*a*) $2n$ (*b*) $3n$

(*c*) $4n$ (*d*) $6n$

4. "Cells of the tapetum of a microsporangium are usually multinucleate."

Which of the following can be a reason for the tapetal cells to become multinucleate ?

(*a*) They fuse with the polar cells of the mega-sporangium

(*b*) They do not undergo karyokinesis

(*c*) They do not undergo cytokinesis

(*d*) They do not undergo mitosis

5. Consider three plants with the following modes of pollination :

Plant P : autogamy

Plant Q : xenogamy

Plant R : geitonogamy

Which of the above case(s)/is/are most likely **not** to show genetic variation in the offspring ?

(*a*) Only P (*b*) Only Q

(*c*) Only P and R (*d*) Only Q and R

6. Riya observes the development of female gametophytes in angiosperms. If a plant produces 40 fully developed embryo sacs, how many meiotic and mitotic divisions occurred in total ?

(*a*) 40 meiotic divisions and 120 mitotic divisions

(*b*) 10 meiotic divisions and 30 mitotic divisions

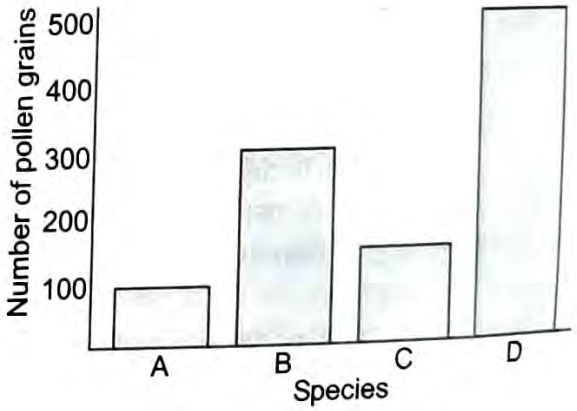
(*c*) 80 meiotic divisions and 240 mitotic divisions

(*d*) 40 meiotic divisions and 80 mitotic divisions

7. Ravi is classifying seeds into dicotyledonous, monocotyledonous, and endospermic groups using a Venn diagram. Select the correct examples for P, Q and R.

	P	Q	R
(*a*)	Castor	Onion	Wheat
(*b*)	Bean	Castor	Maize
(*c*)	Pea	Gram	Barley
(*d*)	Coconut	Rubber	Groundnut

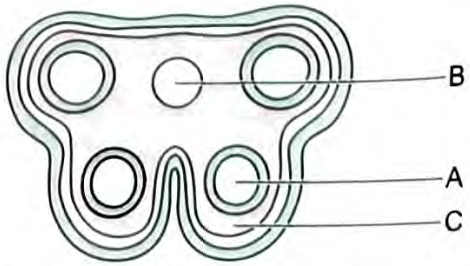
8. The graph below represents the number of pollen grains released by different species. Based on the graph, which species is most likely to use wind as its primary pollinator ?



(*a*) Species A (*b*) Species B

(*c*) Species C (*d*) Species D

9. Which of the following structures contains PMC ?



(*a*) Only A (*b*) Only B

(*c*) Both A and C (*d*) Only C

10. Neha observes a skipped meiotic and mitotic divisions during megasporogenesis and megagametogenesis, respectively. What is the likely outcome for embryo sac structure, ploidy, and fertilization ?

1. The embryo sac may have fewer nuclei
2. The egg cell and the central cell will both be diploid, disrupting the process of double fertilization
3. Only one megaspore will develop, and its nucleus will remain diploid, impacting embryo and endosperm formation
4. The antipodal cells will fail to form, and the embryo sac will contain abnormal nuclei numbers with higher ploidy

Which of the above statements are correct ?

(*a*) 1 and 3 only (*b*) 2 and 4 only
(*c*) 1, 2 and 4 only (*d*) 1, 3 and 4 only

11. The image below is that of an extinct angiosperm species *Archaefructus*.

In a science fiction movie, scientists find fossilised pollen grains of *Archaefructus* and use them to fertilise a modern genus of *Archaefructus*. Nitya thinks that these pollen grains can be found under polar ice sheets where the temperature is around – 40°C.

Is she correct and why ?

(*a*) Yes, because – 40°C is enough to keep pollen grains viable
(*b*) No, because the pollen grains will get wet and won't function
(*c*) Yes, because pollen grains are viable at any temperature for several years
(*d*) No, because pollen grains need to be stored at much lower temperature to be viable

12. Which statement/s is/are correct for wind pollinated flowers ?

(*i*) In these flowers petals are not brightly coloured.
(*ii*) These flowers have large sticky pollen.
(*iii*) These flowers have a hairy, thick style and stigma.
(*iv*) In these flowers fragrance is absent.

(*a*) (*i*), (*ii*) and (*iii*) (*b*) (*i*), (*iii*) and (*iv*)
(*c*) (*ii*), (*iii*) and (*iv*) (*d*) (*i*), (*ii*), (*iii*) and (*iv*)

13. Which out of the following statements is correct about perisperm ?

(*a*) It is a degenerated secondary nucleus
(*b*) It is peripheral part of endosperm
(*c*) It is degenerated synergid
(*d*) It is remnant of nucellus

14. If an endosperm mother cell has 18 chromosomes, then what will be the number of chromosomes in a megaspore mother cell ?

(*a*) 12 (*b*) 18
(*c*) 24 (*d*) 32

15. If a plant is unable to produce normal pollen grains, then which layer of microsporangium is malfunctional ?

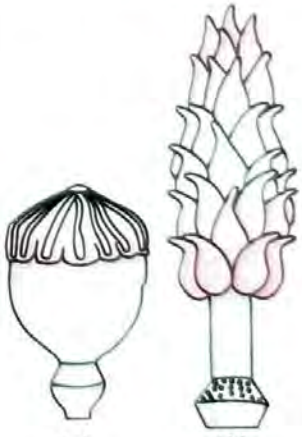
(*a*) Epidermis (*b*) Endothecium
(*c*) Tapetum (*d*) Middle layer

16. Choose the correct statement

(*i*) Pollen grains can be well preserved as fossils.
(*ii*) Pollens can germinate on stigma of flower of any plant
(*iii*) Pollens have articulated exine as per need of pollination
(*iv*) Pollen grains represent male gametophyte as embryo sac represents female gametophyte.

(*a*) (*i*), (*ii*), (*iii*) (*b*) (*i*), (*iii*), (*iv*)
(*c*) (*ii*), (*iii*), (*iv*) (*d*) (*i*) only

17. Which terms are correct about following figures showing gynoecium of (*a*) Papaver and (*b*) Michelia ?

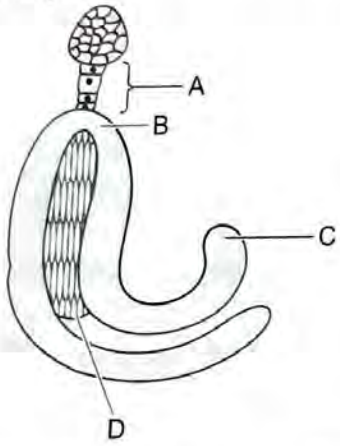


(*a*) Multicarpellary, syncarpous and multicarpellary, apocarpous
(*b*) Monocarpellary, syncarpous and multicarpellary, apocarpous
(*c*) Multicarpellary, syncarpous and monocarpellary, apocarpous
(*d*) Monocarpellary, syncarpous and monocarpellary, apocarpous

18. Products of triple fusion and syngamy respectively in double fertilisation are
(a) Zygote (n), PEN ($2n$)
(b) PEN ($2n$), Zygote ($2n$)
(c) PEN ($3n$), syngamy ($2n$)
(d) Zygote ($3n$), PEN ($3n$)

19. Which out of the following is correct for an artificial hybridisation program ?
(a) Emasculation is done in unisexual flowers
(b) Bagging is done before emasculation
(c) Emasculation is done to prevent unwanted self-pollination and contamination
(d) Rebagging is done just after emasculation

20. Select options A, B, C and D in the given figure of the dicot embryo.



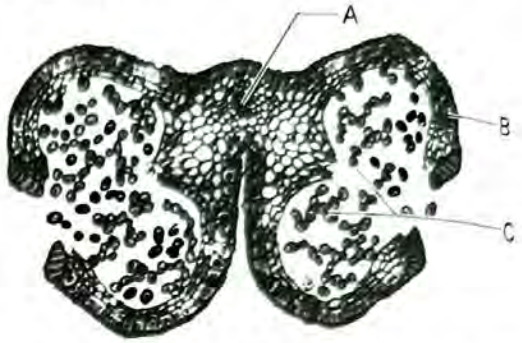
(a) A – Plumule ($2n$), B – Suspensor (n), C – Cotyledon ($2n$), D – Radicle ($2n$)
(b) A – Suspensor ($2n$), B – Radicle ($2n$), C – Cotyledon ($2n$), D – Plumule ($2n$)
(c) A – Cotyledon ($2n$), B – Radicle (n), C – Plumule (n), D – Suspensor (n)
(d) A – Plumule ($2n$), B – Suspensor ($2n$), C – Radicle ($2n$), D – Cotyledon ($2n$)

21. Milky water of tender coconut is
(a) liquid gametes
(b) liquid nucellus
(c) liquid female gametophyte
(d) free nuclear endosperm

22. Microsporangium is generally surrounded by four wall layers. Choose the correct names and sequence of layers from outside to inside.
(a) Endothecium, Epidermis, Tapetum and Middle layer
(b) Epidermis, Middle layer, Endothecium and Tapetum
(c) Epidermis, Endothecium, Tapetum and Middle layer
(d) Epidermis, Endothecium, Middle layer and Tapetum

23. A 7 celled, 8 nucleated embryo sac has
(a) 2 antipodals, 3 synergids, 1 central cell and 1 egg cell
(b) 3 antipodals, 3 synergids and 1 egg cell
(c) 1 antipodal, 3 synergids, 2 central cell and 1 egg cell
(d) 3 antipodals, 2 synergids, 1 central cell and 1 egg cell

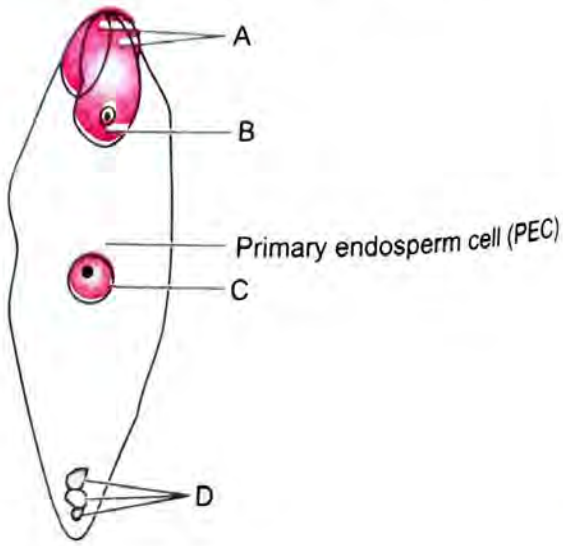
24. Study the following diagram of Transverse Section of a young anther of an angiosperm :



Select the option where parts 'A', 'B' and 'C' are correctly identified.
(a) A – Connective, B – Endothecium, C – Pollen grain
(b) A – Endothecium, B – Connective, C – Pollen grain
(c) A – Pollen grain, B – Connective, C – Endothecium
(d) A – Endothecium, B – Pollen grain, C – Connective (CBSE 2024)

25. A phenomenon where a male insect mistakenly identified the patterns of a orchid flower as the female insect partner, and tries to copulate and thereby pollinates the flower is said to be :
(a) Pseudocopulation
(b) Pseudopollination
(c) Pseudoparthenocarpy
(d) Pseudofertilization (CBSE 2024)

26. Identify the correct labellings in the figure of a fertilised embryo sac of an angiosperm given below :



(a) A – zygote, B – degenerating synergids, C – degenerating antipodals, D – PEN

(b) A – degenerating synergids, B – zygote, C – PEN, D – degenerating antipodals

(c) A – degenerating antipodals, B – PEN, C – degenerating synergids, D – zygote

(d) A – degenerating synergids, B – zygote, C – degenerating antipodals, D – PEN

(CBSE 2024)

B. Competency Focused Assertion-Reason Type Questions

Two statements are given – one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to the following questions from the codes (a), (b), (c) and (d) as given below :

(a) Both A and R are true and R is the correct explanation of the assertion.

(b) Both A and R are true but R is not the correct explanation of the assertion.

(c) A is true but R is false.

(d) A is false but R is true.

1. **Assertion.** The presence of a scutellum can be seen in monocotyledonous seeds.

   Reason. The portion of the embryonal axis above the level of attachment of scutellum is the epicotyl.

2. **Assertion.** Cleistogamous flowers ensure seed production even in the absence of pollinators.

   Reason. Cleistogamous flowers remain closed, preventing any form of cross-pollination.

3. **Assertion.** Pollen tube germinates through the germ pores on the pollen grains.

   Reason. Pollen-pistil compatibility chemicals help to dissolve sporopollenin for the pollen tube to germinate.

4. **Assertion.** Flowers of maize can prevent both autogamy and geitonogamy.

   Reason. Maize has both male and female flowers on the same plant.

5. **Assertion.** Double fertilization results in the formation of a diploid zygote and a triploid endosperm.

   Reason. In double fertilization, one male gamete fuses with the egg cell, and the other male gamete fuses with one of the two polar nuclei.

6. **Assertion.** Endosperm is completely consumed during the development of embryo in ex-albuminous seeds.

   Reason. Castor, pea and beans are all examples of ex-albuminous seeds.

7. **Assertion.** Endosperm is the food laden tissue formed during the development of angiospermous seed.

   Reason. It provides essential nutrients to the growing embryo and also the young seedling at the time of seed germination.

8. **Assertion.** In apomixis, the new individuals are genetically dissimilar to the parent producing them.

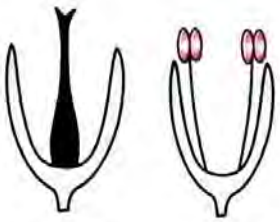
   Reason. Apomixis is the formation of new individuals by asexual methods which mimic sexual reproduction including seed formation but do not involve fusion of gametes.

9. **Assertion.** The zygote gives rise to heart-shaped embryo and subsequently proembryo in most angiosperms.

   Reason. The zygote is present at the micropylar end of the embryo sac and develops into an embryo.

Case-Based Very Short/Short Answer Questions

CASE 1. Consider the flowers of two plants species as described below :

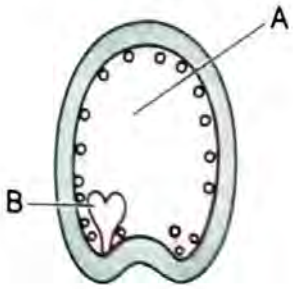
Species P	 Androecium (grey) and gynoecium (black) matures at the same time
Species Q	 Androecium (grey) matures later than the gynoecium (black)

Based on your knowledge of the above information and related studied concepts, answer questions 1 to 4 :

1. What kind of pollination is likely to be seen in species P and Q ? Give a reason for your answer in each case.
2. If a plant cultiver wants more fit varieties of offspring, which species should he choose to cultivate and why ?
3. Explain how the presence of unisexual flowers in species Q affects the type of pollination, considering whether the species is monoecious of dioecious.
4. In which species, P or Q, is inbreeding depression more likely to occur, and why ?

CASE 2. In a research lab, scientists are analyzing the seed development in *Arabidopsis*, a member of the Brassicaceae family.

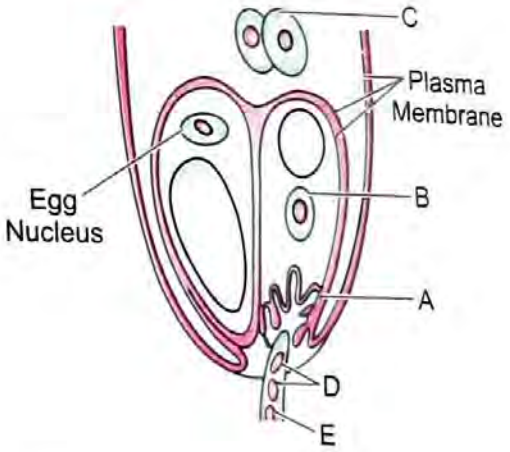
They came across the figure as given below :



Based on your knowledge of the above information and related studied concepts, answer questions 5 to 8 :

5. Derive a simple formula to calculate the number of chromosomes of B.
6. Suppose the genotype of a female plant is bb and male is BB. Both these plants are associated with the formation of seeds given in the figure. Based on this information, calculate the genotype of the A.
7. If A is completely consumed by B. the resultant seed will be called ? Give two examples of such seeds.
8. Explain the functions of part A and B.

CASE 3. Study the following figure carefully.



Based on your knowledge of the given figure and related studied concepts, answer questions 9 to 12 :

9. The structure labelled 'A' assists in the guidance of which structure ?
10. If the structure labelled as 'B' is non-functional how might this impact fertilization ?
11. Explain how the structures labelled 'C' and 'D' are crucial for the process of double fertilization.
12. Describe the function of the structure labelled 'E' during fertilization.

Case-Based Very Short Answer and Multiple Choice Questions

CASE 4. In angiosperms, stamens are modified leaves (or microsporophylls) concerned with the production of pollen grains (microspores). In majority of angiosperms, each stamen has a filament and a broad, terminal bilobed anther. Each lobe of anther has two pollen sacs in which pollen grains are formed. On the other hand, carpel is a modified leaf bearing ovules along the margins. A typical carpel has ovary, style and stigma. Ovary bears ovules.

Based on your understanding of the above paragraph and related studied concepts, answer questions 13 to 16 :

13. Which part of carpel gets transformed into fruit ?

14. Name the part of stamen which connects the anther with the filament ?

15. A dithecus anther, in majority of angiosperms, has how many vascular bundles in the connective ?

(*a*) Four (*b*) Two

(*c*) One (*d*) None

16. How many ovules are there in a single ovary in mango plant ?

(*a*) One

(*b*) Few

(*c*) Thousands

(*d*) Hundreds

CASE 5. Flower is a modified condensed shoot specialized to carry out sexual reproduction in higher plants. The fertile leaves become microsporophylls and megasporophylls which bear anthers and ovules respectively. The anthers produce pollen grains and the ovules possess eggs. The flowers of most angiosperms are variously shaped to help diverse modes of pollination.

Based on your understanding of the above paragraph and studied related concepts, answer question numbers 17 to 20.

17. How would you explain the term 'perianth' ?

18. Name the condition which is used for the sepals when they are coloured ?

19. The term 'tepal' refers to

(*a*) each member of the outermost whorl of floral leaves.

(*b*) an individual, not clearly differentiated, member of perianth.

(*c*) each member of the second whorl of floral leaves inner to outermost whorl.

(*d*) each member of reproductive whorls of the floral appendages.

20. Four whorls of floral appendages are attached on the

(*a*) bract (*b*) pedicel

(*c*) receptacle (*d*) calyx

A. Multiple Choice Questions [NCERT Based]

1. During megasporogenesis, potential megaspore mother cell undergoes following cell divisions to form gametophyte female
   (*a*) two meiotic divisions and three mitotic divisions
   (*b*) one meiotic and one mitotic division
   (*c*) one meiotic and three mitotic divisions
   (*d*) one meiotic and two mitotic divisions
2. Cleistogamous flowers are self pollinated because :
   (*a*) They are bisexual flowers which do not open at all
   (*b*) They are bisexual and open flowers
   (*c*) They are unisexual
   (*d*) Their stigma matures before the anthers dehisce

(CBSE 2020)

3. Which one of the following is not found in a female gametophyte of an angiosperm ?
   (*a*) Germ pore (*b*) Synergids
   (*c*) Filiform apparatus (*d*) Central cell

(CBSE 2020)

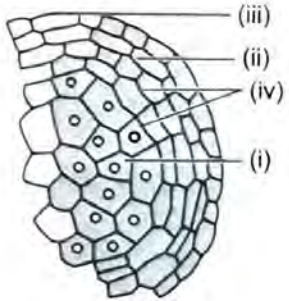
4. A genetic mechanism which prevents inbreeding depression in majority of angiospermic plants is
   (*a*) Parthenogenesis (*b*) Parthenocarpy
   (*c*) Mutation (*d*) Self-incompatability

(CBSE 2022)

5. Residual persistent nucellus in black pepper is known as
   (*a*) Perisperm (*b*) Pericarp
   (*c*) Pulvinus (*d*) Perianth

(CBSE 2022)

6. In the given diagram of a transverse section of a young anther, choose the labellings showing the correct placement of the wall layers from the table given below :



	(i)	(ii)	(iii)	(iv)
(a)	Epidermis	Middle layers	Tapetum	Endothecium
(b)	Tapetum	Endothecium	Epidermis	Middle layers
(c)	Endothecium	Tapetum	Middle layers	Epidermis
(d)	Middle layers	Epidermis	Endothecium	Tapetum

(CBSE 2022)

7. An undifferentiated sheath covering the root cap of a monocotyledonous embryo is

(a) Scutellum (b) Coleorhiza

(c) Coleoptile (d) Epiblast (CBSE 2022)

8. Select the correct statements with respect to the development of an endosperm in a typical angiosperm plant.

(i) Embryo development precedes endosperm development.

(ii) Endosperm cells divide repeatedly to form a triploid endosperm.

(iii) Endosperm tissue has scanty reserves of food materials.

(iv) PEN undergoes successive division to form free-nuclear endosperm.

Choose the correct option :

(a) (i) and (iii) (b) (ii) and (iii)

(c) (i) and (iv) (d) (ii) and (iv)

(CBSE 2022)

9. In which of the following combination of seeds/grains of different plants, residual endosperm will be present at maturity ?

(a) Groundnut, Barley, Beans

(b) Castor, Groundnut, Maize

(c) Wheat, Maize, Barley

(d) Pea, Groundnut, Beans (CBSE 2022)

10. Which of the given statements are correct with respect to pollination in *Vallisneria* ?

(i) Pollen grains are light and non-sticky.

(ii) Female flowers reach the surface of water by long stalks.

(iii) Pollen grains are carried passively by water currents.

(iv) Female flowers remain submerged in water.

Chose the correct option :

(a) (i) and (iv) (b) (ii) and (iv)

(c) (i) and (ii) (d) (ii) and (iii)

(CBSE 2022)

11. The floral part that develops into a fruit in strawberry is :

(a) Pedicel (b) Calyx

(c) Thalamus (d) Bracts

(CBSE 2022)

12. Seeds of an orange when taken out and squeezed, show many embryos of different sizes and shapes. The reason for this is as many embryos have developed from :

(a) Egg cells fusing with different male gametes forming embryos.

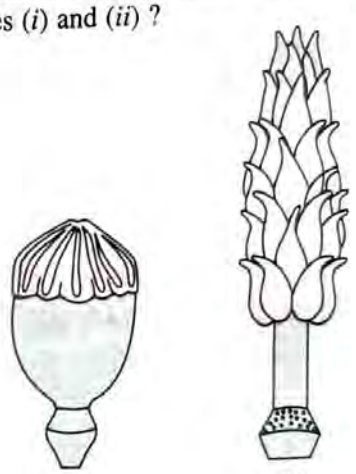
(b) PEN fusing with different male gametes forming embryos.

(c) Nucellar cells dividing and developing into embryos.

(d) Synergids dividing and developing into embryos.

(CBSE 2022)

13. Which condition of gynoecium (pistil) is shown in the figures (i) and (ii) ?



(i) (ii)

(a) (i) multicarpellary apocarpous, (ii) multicarpellary syncarpous

(b) (i) multicarpellary syncarpous, (ii) multicarpellary apocarpous

(c) (i) bicarpellary apocarpous, (ii) bicarpellary syncarpous

(d) (i) bicarpellary syncarpous, (ii) bicarpellary apocarpous (CBSE 2022)

14. Researchers the world over are trying to transfer apomictic genes to hybrid varieties as hybrid characters in the progeny :

(a) do not segregate

(b) segregate

(c) develop genetic variations

(d) will remain unexpressed (CBSE 2022)

15. The aquatic plant having long and ribbon like pollen grains is :

(a) *Vallisneria* (b) *Hydrilla*

(c) *Eicchornia* (d) *Zostera* (CBSE 2022)

16. In a typical dicotyledonous embryo, the portion of embryonal axis above the level of cotyledons is :

(a) Plumule (b) Coleoptile

(c) Epicotyle (d) Hypocotyle

(CBSE 2022)

17. Pollen grains retain viability for months in plants belonging to different families given below :

(i) Solanaceae (ii) Leguminosae

(iii) Gramineae (iv) Rosaceae

(v) Liliaceae

The correct option is :

(a) (i), (ii) and (v) (b) (i), (ii) and (iv)

(c) (ii), (iv) and (v) (d) (i), (iii) and (v)

(CBSE 2022)

18. Which of the following outbreeding devices are used by majority of flowering plants to prevent inbreeding depression ?

(i) Pollen release and stigma receptivity are not synchronised.

(ii) Different positions of anther and stigma.

(iii) Production of different types of pollen grains.

(iv) Formation of unisexual flowers along with bisexual flowers.

(v) Preventing self-pollen from fertilising the ovules by inhibiting pollen germination.

(a) (i), (ii) and (v) (b) (ii), (iii) and (v)

(c) (i), (iii) and (v) (d) (iii), (iv) and (v)

(CBSE 2022)

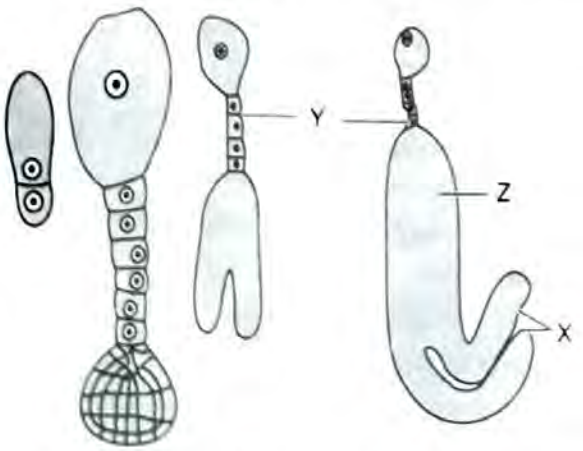
19. Floral reward/s provided by insect pollinated flowers to sustain animal visit is/are :

(a) nectar and fragrance (b) nectar and pollen grains

(c) pollen grains and fragrance

(d) fragrance and bright colour (CBSE 2022)

20. Choose the correct labellings for the parts X, Y and Z in the given figure of the stages in embryo development in a dicot :



(a) X is suspensor, Y is radicle and Z is cotyledon

(b) X is radicle, Y is cotyledon and Z is suspensor

(c) X is cotyledon, Y is suspensor and Z is radicle

(d) X is zygote, Y is radicle and Z is cotyledon

(CBSE 2022)

21. During the pollen grain formation, the generative cell divides to give rise to the two male gametes. What is the ploidy of the generative cell ?

(a) n (b) $2n$

(c) $3n$ (d) $4n$

22. Kiwi is a dioecious species. Which of the following methods can be definitely RULED OUT as a possible mode of pollination in its case ?

(P) cleistogamous autogamy

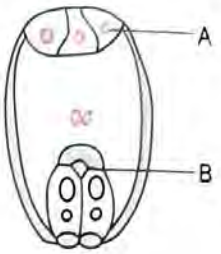
(Q) chasmogamous autogamy

(R) geitonogamy (S) xenogamy

(a) only P and R (b) only P and Q

(c) only Q and S (d) only P, Q and R

23. Study the given diagram and choose the correct option against 'A' and 'B'



(a) A-Egg apparatus; B-Polar body

(b) A-Antipodals; B-Egg apparatus

(c) A-Synergids; B-Egg apparatus

(d) A-Central cell; B-Antipodals

24. Remnants of nucellus are persistent during seed development in :

(a) pea (b) groundnut

(c) wheat (d) black pepper

(CBSE Sample Paper 2023-24)

25. The wall layer of microsporangium which nourishes the pollen grain is :

(a) epidermis (b) endothecium

(c) middle layers (d) tapetum

(CBSE Sample Paper 2023-24)

26. Choose the option that gives the correct number of pollen grains that will be formed after 325 microspore mother cells undergo microsporogenesis.

(a) 325 (b) 650

(c) 1300 (d) 975 (CBSE 2023)

27. Which of the following seeds have remained alive for the longest period ?

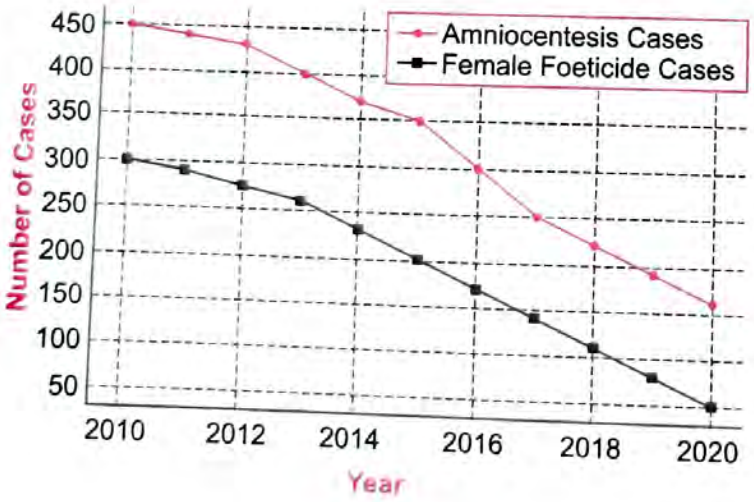
(a) *Phoenix dactylifera* (b) *Striga asiatica*

(c) *Mangifera indica* (d) *Yucca gigantea*

(CBSE 2023)

A. Competency Focused Multiple Choice Questions

1. The hypothetical data on amniocentesis and female foeticide cases are presented in the graph below.



Considering other possible reasons for these changes, assess how effective the law banning amniocentesis for sex determination has been in reducing cases of female foeticide ?

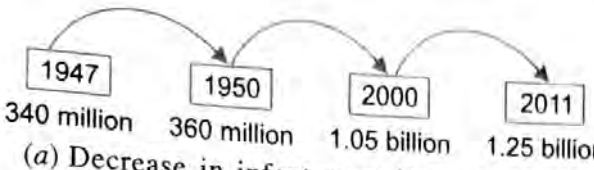
(*a*) The decline in amniocentesis cases is primarily due to improved prenatal diagnostic technologies, not the statutory ban.

(*b*) Although both trends decline, the reduction in female foeticide cases could also been influenced by increased public awareness and societal changes.

(*c*) The direct correlation between the ban and the decrease in female foeticide cases alone confirms the effectiveness of the ban.

(*d*) The reduction in female foeticide cases is mainly due to external healthcare polices unrelated to the ban on amniocentesis.

2. The Indian government introduced several initiatives for improving public health. An illustration showing India's population growth from 1947 to 2011 is given below. What was a significant factor contributing to this trend ?



(*a*) Decrease in infant mortality rate (IMR) and maternal mortality rate (MMR)

(*b*) Increase in death rates

(*c*) Decline in fertility rates

(*d*) Increase in the number of old-aged people

3. A 35-year-old male, Ayaan, is considering a vasectomy after having three children. He is informed about the procedure, recovery, and long-term effects by his healthcare provider. However, he expresses concern about the reversibility of the procedure.

Evaluate how well the following responses from his healthcare provider address Ayaan concerns :

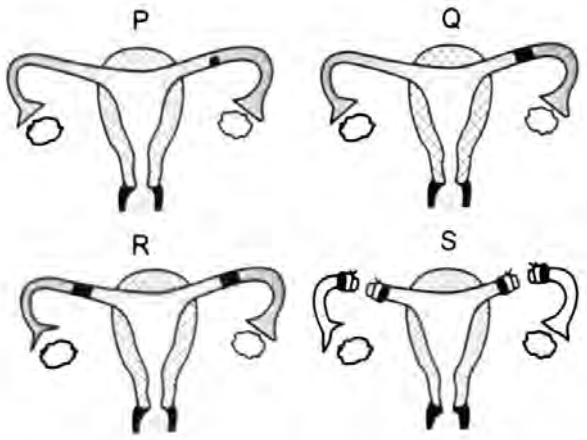
(*a*) Vasectomies are completely reversible, and you can regain fertility at any time.

(*b*) While reversals are possible, they are not guaranted to restore fertility completely.

(*c*) Reversal of vasectomies increase the risk of prostate cancer, so you should consider other options.

(*d*) Success rate of reversing a vasectomy increases with the time after the procedure.

4. The accompanying diagram shows the uterine tubes of four women (P, Q, R and S). In which of two women fertilization is impossible at present ?



(*a*) P and Q (*b*) Q and R

(*c*) R and S (*d*) S and P

5. A community health survey revealed a high incidence of Hepatitis B and HIV among young adults. Which integrated strategy should be prioritized to address this issue effectively ?

1. Increasing the distribution of condoms and promoting their use through targeted campaigns.

2. Focusing solely on treatment facilities for those already infected.

3. Implementing comprehensive sex education programs in schools and communities.

4. Isolating the infected individuals.

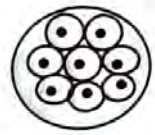
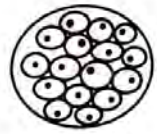
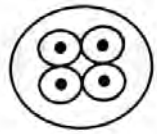
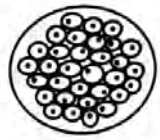
(*a*) Strategies 1 and 3

(*b*) Strategy 4 only

(*c*) Strategies 2 and 3 only

(*d*) Strategies 1, 2, 3 and 4

6. Dr. Mehta is conducting an IVF procedure and has four embryos at different stages of development, as shown in the table below. Dr. Mehta is considering transferring embryos for further development.

Embryo No.	Microscopic Illustration
Embryo 1	
Embryo 2	
Embryo 3	
Embryo 4	

Which of the following combinations of embryos should Dr. Mehta transfer using ZIFT and IUT, respectively ?

(*a*) Embryos 1 and 3 using ZIFT; Embryos 2 and 4 using IUT

(*b*) Embryos 2 and 4 using ZIFT; Embryos 1 and 3 using IUT

(*c*) All embryos using ZIFT only

(*d*) All embryos using IUT only

7. A couple with a history of genetic disorders is interested in ART. They wish to minimise the risk of passing on genetic disorders to their offspring. Which ART process should they prioritize ?

(*a*) Use of donor gametes followed by ZIFT

(*b*) Surrogacy with a genetically screened surrogate

Case-Based Very Short/Short Answer Questions

CASE 1. Amey and Tia are expecting their first child, with Tia being in her second month of pregnancy with no known complications. Amey's family has a history of cystic fibrosis while Tia's family has a history of Down's syndrome, leading to a concern that the baby may have one of these conditions.

Based on your understanding of the above paragraph and related studied concepts, answer questions 1 to 4 :

1. Suggest and explain a way of testing if their baby is at risk for any genetic disorders.
2. In case of the presence of one or both of the abnormalities and posing a risk to the mother's health, mention one possible option for them to consider.
3. Is the process mentioned in (*ii*) safe for Tia at the current gestational age ? Justify.
4. Under what conditions is the process mentioned in (*ii*) illegal ?

CASE 2. A nurse counsels a new mother who is interested in using breastfeeding as a natural method of contraception, based on the lactational amenorrhea method. Lactational amenorrhea is one of the natural methods of contraceptives. It is based on the fact that suckling causes release of prolactin, which has an inhibitory effect on GnRH, FSH, resulting in amenorrhea.

Based on your understanding of the above paragraph and related studied concepts, answer questions 5 to 8 :

5. Apply the principles of lactational amenorrhea to explain to the mother how breastfeeding impacts fertility.
6. Suggest the effective period for this contraceptive method. Mention one strategy to minimize the risk of conception.
7. Advise the mother on how to optimize breastfeeding practices during this period to maximize contraceptive effectiveness.
8. Plot a hypothetical graph based on the relationship between prolactin and effectiveness of lactational amenorrhea.

CASE 3. A person undergoes a medical procedure that results in the complete absence of sperms in his semen. Despite an attempted reversal of the procedure, the couple is unable to conceive naturally. They seek infertility treatment at a specialized clinic, where various options are presented to help them conceive.

Based on your understanding of the above paragraph and related studied concepts, answer questions 9 to 12 :

9. Draw a labelled diagram of a procedure that might result in the absence of sperms in the semen.
10. Interpret why the reversal of the medical procedure might not restore fertility in this case ?
11. As a biology student, suggest two infertility treatments that could help the couple conceive, and discuss the advantages of each option.
12. Evaluate the potential challenges and ethical implications of using assisted reproductive technologies (ART) in such cases.

Case-Based Very Short Answer and Multiple Choice Questions

CASE 4. A variety of methods are known for birth control. These methods deliberately prevent fertilization and are referred to as contraceptive methods. Contraceptive methods or an ideal contraceptive should be user-friendly, easily available, effective and with least side effects. It also should not interfere with the sexual drive, desire and/ or the sexual act of the user. Contra- ceptive methods act by preventing any one or more of the three major steps in reproductive processes : (*i*) preventing sperm motility, (*ii*) preventing ovulation, and (*iii*) preventing implantation of early embryo in the uterus.

Based on your understanding of the above paragraph and related studied concepts, answer questions 13 to 16.

13. How does Cu-T act as an effective contraceptive for human females ?

14. Why do some women take 'Saheli' pills ?

15. 'Test Tube Baby' programme is run for those couples where

(*a*) woman has blocked oviducts

(*b*) husband has a low sperm count in semen or is unable to produce sperms

(*c*) woman can not produce ova

(*d*) all of these

16. Assisted Reproduction Technologies have hurdles in our country due to

(*a*) non-availability of experts

(*b*) religious and social factors

(*c*) not funded by central government

(*d*) affected couples do not support the pogramme.

CASE 5. Millions of adolescents contract sexually transmitted diseases. Some STDs are completely curable if detected early and treated properly. However, infected persons avoid going to doctors due to social stigma. Government has launched RCH (Reproduction and Child Health) programme to create awareness about consequences of uncontrolled population growth and social evils (sex abuses, sex-related crimes, use of drugs, alcohol, tobacco etc.) among young people, in particular. Also, maternity and child health, massive child immunization, ban on female foeticide etc. are other such steps undertaken by the government.

Based on your understanding of the above paragraph and related studied concepts, answer questions 17 to 20.

17. Name the most recent and improved programmes in operation in India in reproduction related areas.

18. Who is a surrogate mother ?

19. Why has the government banned amniocentesis ?

(*a*) It is very costly affair.

(*b*) It is being misused and leads to killing of normal female foetuses.

(*c*) It is very dangerous to the growing foetus and the mother.

(*d*) Unqualified people have set up this technique to mint money.

20. Which of the following are sexually transmitted diseases (STDs) ?

(*a*) Hepatitis B (*b*) Gonorrhoea

(*c*) Genital Worts (*d*) All of these

Answers

Subject Hindi

1-सिल्वर वेडिंग कहानी के माध्यम से पुरानी पीढ़ी एवं नई पीढ़ी के अंतराल को समझाइए तथा यह भी बताइए कि इस अंतराल में सामंजस्य कैसे बैठाया जा सकता है।(कॉपी में)

2-हरिवंश राय बच्चन द्वारा लिखित मधुशाला की किन्ही 10, 12 पंक्तियों को लिखिए जो आपको बहुत प्रभावित करती हो। (फाइल पेज में)

3-किन्ही दो दैनिक हिंदी समाचार पत्र के संपादकीय पृष्ठ मे आए फीचर लेखन, संपादकीय ,आलेख ,स्तंभ लेखन ,प्रेरक प्रसंग, संपादक के नाम पत्र, और लेख आदि को काटकर और उनके बारे में भी लिखकर परियोजना कार्य तैयार करें। -जैसे फीचर लेखन किसे कहते हैं यह कैसे लिखा जाता है इसी प्रकार अन्य के बारे में भी लिखें(फाइल में)

नोट-प्रश्न 2 और 3 के रचनात्मक क्रियाकलाप के लिए एक फाइल बनाएं। जिसमें रंगीन पेपर पर विषय की अभिव्यक्ति चित्रात्मक रूप से करें ।चित्रों को पृष्ठ के बाएं ओर (left side) स्वच्छता के साथ चिपकाएं।

Relations and Functions

1. Let the function 'f' : $N \to N$ be defined by $f(x) = 2x + 3$, $\forall\, x \in N$. Then 'f' is **(1 mark)**
   (*a*) not onto
   (*b*) bijective function
   (*c*) many-one, into function
   (*d*) None of these

2. A relation defined in a non-empty set A, having n elements, has **(1 mark)**
   (*a*) n relations (*b*) 2 relations
   (*c*) n^2 relations (*d*) 2^{n^2} relations

3. A relation R in human beings defined as $R = \{(a, b) : a, b \in$ human beings ; a loves $b\}$ is **(1 mark)**
   (*a*) reflexive
   (*b*) symmetric and transitive
   (*c*) equivalence
   (*d*) neither of these

4. A function $f : R \to R$ is defined as $f(x) = x^3 + 1$. Then the function has **[CBSE 2021] (1 mark)**
   (*a*) no minimum value
   (*b*) no maximum value
   (*c*) both maximum and minimum values
   (*d*) neither maximum value nor minimum value

5. Let $A = \{a, b, c\}$ and the relation R be defined on A, as follows: $R = \{(a, a), (b, c), (a, b)\}$. Then, write minimum number of ordered pairs to be added in R to make R reflexive and transitive. **[NCERT Exemplar] (2 marks)**

6. Given set $A = \{a, b, c\}$. Is relation $R = \{(a, c)\}$ transitive? **(2 marks)**

7. Prove that the Greatest Integer Function $f : R \to R$, given by $f(x) = [x]$ is neither one-one nor onto. Where $[x]$ denotes the greatest integer less than or equal to x. **[NCERT] (2 marks)**

8. Let $A = \{1, 2, 3\}$, $B = \{4, 5, 6, 7\}$ and let $f = \{(1, 4), (2, 5), (3, 6)\}$ be a function from A to B. Show that f is one-one. **[NCERT] (2 marks)**

9. Let $f : N \to N$ be defined by $f(x) = 3x$. Show that f is not onto function. **[HOTS] (2 marks)**

10. Let the function $f : R \to R$ be defined by $f(x) = \cos x$ $\forall\, x \in R$. Show that f is neither one-one nor onto. **[NCERT Exemplar] (2 marks)**

11. Determine whether the relation R defined on the set R of all real numbers as $R = \{(a, b) : a, b \in R$ and $a - b + \sqrt{3} \in S$, where S is the set of all irrational numbers$\}$, is reflexive, symmetric and transitive. **[Ajmer 2015] (3 marks)**

12. Given a non empty set X, consider $P(X)$ which is the set of all subsets of X. Define the relation R in $P(X)$ as follows: For subsets A, B in $P(X)$, ARB if and only if $A \subset B$. Is R an equivalence relation on $P(X)$? Justify your answer. **[NCERT] (3 marks)**

13. Let A and B be sets. Show that $f : A \times B \to B \times A$ such that $f(a, b) = (b, a)$ is bijective function. **[NCERT] (3 marks)**

14. Let L be the set of all lines in XY plane and R be the relation in L defined as $R = \{(L_1, L_2) : L_1$ is parallel to $L_2\}$. Show that R is an equivalence relation. Find the set of all lines related to the line $y = 2x + 4$. **[NCERT] (5 marks)**

15. Let $A = \{x \in Z : 0 \le x \le 12\}$. Show that $R = \{(a, b) : a, b \in A,\ |a - b|$ is divisible by 4$\}$ is an equivalence relation. Find the set of all elements related to 1. Also, write the equivalence class [2]. **[CBSE 2018] (5 marks)**

16. Let N denote the set of all natural numbers and R be the relation on $N \times N$ defined by $(a, b)\ R\ (c, d)$ if $ad\,(b + c) = bc\,(a + d)$. Show that R is an equivalence relation. **[DoE; Delhi 2015] (5 marks)**

17. Let $f : N \to N$ be defined by

$$f(n) = \begin{cases} \dfrac{n+1}{2}, & \text{if } n \text{ is odd} \\ \dfrac{n}{2}, & \text{if } n \text{ is even} \end{cases} \quad \text{for all } n \in N.$$

State whether the function f is bijective. Justify your answer. **[NCERT] (5 marks)**

18. Show that the function $f : R \to \{x \in R : -1 < x < 1\}$ defined by $f(x) = \dfrac{x}{1 + |x|}, x \in R$ is one-one and onto function. **[NCERT] (5 marks)**

Relations and Functions

In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

1. **Assertion (A):** In set $A = \{1, 2, 3\}$ a relation R defined as $R = \{(1, 1), (2, 2)\}$ is reflexive.

   Reason (R): A relation R is reflexive in set A if $(a, a) \in R$ for all $a \in A$.

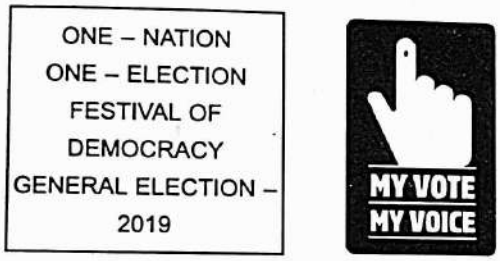
2. **Assertion (A):** In set $A = \{a, b, c\}$ relation R in set A, given as $R = \{(a, c)\}$ is transitive.

   Reason (R): A singleton relation is transitive.

3. **Assertion (A):** Given set $A = \{1, 2, 3, \ldots 9\}$ and relation R in set $A \times A$ defined by $(a, b)\ R\ (c, d)$ if $a + d = b + c$, be an equivalence relation. The ordered pair $(1, 3)$ belongs to equivalence class related to $[(5, 3)]$

   Reason (R): Any ordered pair of $A \times A$ belongs to equivalence class $[(5, 3)]$ if $(x, y)R\ (5, 3)\ \forall\ (x, y) \in A \times A$.

1. A general election of Lok Sabha is a gigantic exercise. About 911 million people were eligible to vote and voter turnout was about 67%, the highest ever



Let I be the set of all citizens of India who were eligible to exercise their voting right in general election held in 2019. A relation 'R' is defined on I as follows:

$\{R = \{(V_1, V_2): V_1, V_2 \in I$ and both use their voting right in general election – 2019$\}$

(*i*) Two neighbours X and $Y \in I$. X exercised his voting right while Y did not cast her vote in general election-2019. Check whether X is related to Y or not.

(*ii*) Mr. 'X' and his wife 'W' both exercised their voting right in general election-2019. Show that $(X, W) \in R$ and $(W, X) \in R$.

(*iii*) Three friends F_1, F_2 and F_3 exercised their voting right in general election-2019. Show that $(F_1, F_2) \in R$, $(F_2, F_3) \in R$ and $(F_1, F_3) \in R$.

OR

Show that the relation R defined on set I is an equivalence relation.

2. Sherlin and Danju are playing Ludo at home during Covid-19. While rolling the dice, Sherlin's sister Raji observed and noted that possible outcomes of the throw every time belongs to set $\{1, 2, 3, 4, 5, 6\}$. Let A be the set of players while B be the set of all possible outcomes.

$A = \{S, D\}$, $B = \{1, 2, 3, 4, 5, 6\}$

(*i*) Let $R : B \to B$ be defined by $R = \{(x, y) : y$ is divisible by $x\}$. Show that relation R is reflexive and transitive but not symmetric.

(*ii*) Let R be a relation on B defined by $R = \{(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)\}$. Then check whether R is an equivalence relation.

(*iii*) Raji wants to know the number of functions from A to B. How many number of functions are possible?

OR

Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible?

Inverse trigonometric functions

1. Principal value of the expression $\cos^{-1}[\cos(-680°)]$ is

   (a) $\frac{2\pi}{9}$ (b) $-\frac{2\pi}{9}$

   (c) $\frac{34\pi}{9}$ (d) $\frac{\pi}{9}$

2. If $\tan^{-1} x = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$, then x is equal to

   (a) $\frac{5\pi}{4}$ (b) 1

   (c) $\frac{3\pi}{4}$ (d) $\frac{\pi}{4}$

3. Find the principal value of $\cos^{-1}\left(\cos\frac{7\pi}{5}\right)$.

Write the principal value of each of the following (Exercises 4 to 9):

4. $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ [NCERT Exemplar; DoE]

5. $\sec^{-1}(-2)$ [DoE]

6. $\cos^{-1}\left(\frac{1}{2}\right) - 2\sin^{-1}\left(-\frac{1}{2}\right)$. [Delhi 2012]

7. $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$.

8. $\sec^{-1}\left(\frac{2}{\sqrt{3}}\right)$.

9. $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ [NCERT]

10. Find the value of $\tan^{-1}\left[2\cos\left(2\sin^{-1}\frac{1}{2}\right)\right]$ [NCERT]

11. Find the value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ [NCERT]

---

1. The principal value of $\sin^{-1}\left(\sin\frac{2\pi}{3}\right)$ is **(1 Mark)**

   (a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{3}$

   (c) $-\frac{\pi}{6}$ (d) $\frac{\pi}{6}$

2. The value of $\cos^{-1}\left(\frac{1}{2}\right) + 3\sin^{-1}\left(\frac{1}{2}\right)$ is equal to **(1 Mark)**

   (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$

   (c) $\frac{2\pi}{3}$ (d) $\frac{5\pi}{6}$

3. The greatest and least values of $(\sin^{-1} x)^2 + (\cos^{-1} x)^2$ are respectively **(1 Mark)**

   (a) $\frac{\pi^2}{8}, \frac{5\pi^2}{4}$ (b) $\frac{\pi^2}{4}, \frac{5\pi^2}{8}$

   (c) $\frac{5\pi^2}{4}, \frac{\pi^2}{8}$ (d) $\frac{5\pi^2}{8}, \frac{\pi^2}{4}$

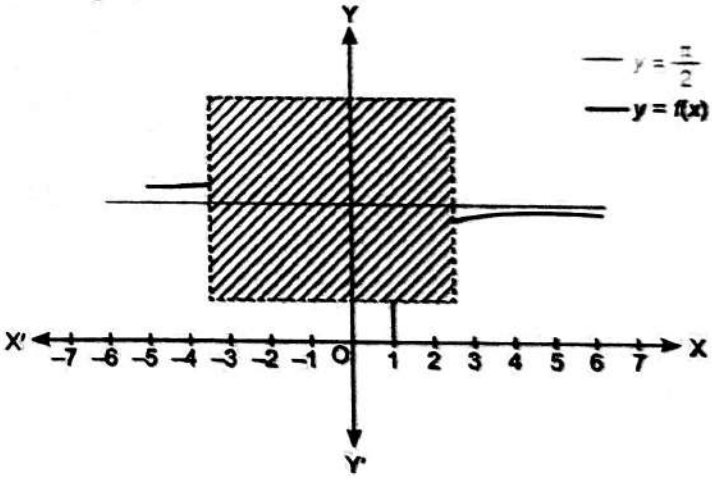
4. The value of $\sin\frac{3\pi}{2} - \sin(\sec^{-1} t + \operatorname{cosec}^{-1} t)$, when $|t| \geq 1$.

   [CBSE Learning Framework] **(1 Mark)**

   (a) 0 (b) –1

   (c) 1 (d) –2

5. Shown below is graph of function 'f' whose domain is $R - (-1, 1)$ some portion of graph is hidden behind square.



   Which of the following is '$f(x)$'? **(1 Mark)**

   (a) $\tan^{-1}x$ (b) $\cot^{-1}x$

   (c) $\sec^{-1}x$ (d) $\operatorname{cosec}^{-1}x$

6. $\cot^{-1}x = \cos^{-1}(-1) - \operatorname{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$

   Based on above find $\tan^{-1}\left(\frac{1}{x}\right)$ using the principal value of inverse trigonometric function. Show your work. **(2 Marks)**

Inverse trigonometric functions

7. Find the domain of the function:
$$f(x) = \frac{1}{2}\sec^{-1}(5x - 3)$$ **(2 Marks)**

8. Find the range of principal value branch of the function:
$$f(x) = 3\cos^{-1}\left(\frac{1}{2x-1}\right) - 2.$$ Show your work. **(2 Marks)**

9. Find the principal value of $\text{cosec}^{-1}(2)$. **[NCERT] (2 Marks)**

10. Evaluate $\tan^{-1}\left\{\sin\left(-\frac{\pi}{2}\right)\right\}$. **[NCERT Exemplar] (2 Marks)**

11. Write the value of $\cos^{-1}\left(-\frac{1}{2}\right) + 2\sin^{-1}\left(\frac{1}{2}\right)$.
[Foreign 2014] (2 Marks)

12. Write one branch of $\sin^{-1}x$ other than the principal branch. **(2 Marks)**

13. Find the principal value of $\tan^{-1}(-1)$ **[NCERT] (2 Marks)**

14. Find the principal value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$.
[NCERT; HOTS] (2 Marks)

15. Find the value of $\sin\left(2\sin^{-1}\frac{3}{5}\right)$. **[Foreign 2013] (2 Marks)**

16. Find the value of $\tan^{-1}\left(\tan\frac{9\pi}{8}\right)$.
[NCERT Exemplar; Foreign 2013] (2 Marks)

17. Write the principal value of $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$.
[NCERT; HOTS] (2 Marks)

18. Find the value of $\sin^{-1}\left[\sin\left(-\frac{17\pi}{8}\right)\right]$.
[CBSE 2020] (2 Marks)

19. Find the principal value of $\tan^{-1}\left(\tan\frac{5\pi}{6}\right)$. **[DoE] (2 Marks)**

ASSERTION AND REASON QUESTIONS

In the following questions, a statement of assertion (*A*) is followed by a statement of reason (*R*). Choose the correct answer out of the following choices.

(*a*) Both *A* and *R* are true and *R* is the correct explanation of *A*.

(*b*) Both *A* and *R* are true but *R* is not the correct explanation of *A*.

(*c*) *A* is true but *R* is false.

(*d*) *A* is false but *R* is true.

1. **Assertion (*A*):** Inverse of sine function exists in interval $[0, \pi]$

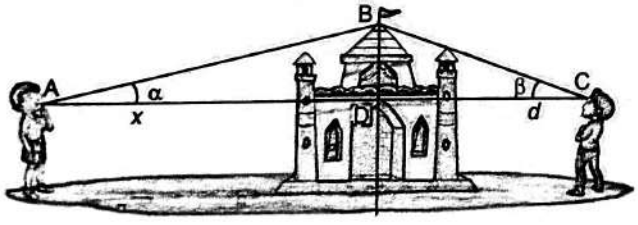
   Reason (*R*): $\sin^{-1}$ function becomes bijective if we restrict its domain to $[-1, 1]$.

2. **Assertion (*A*):** Principal value of $\tan^{-1}(-1)$ is $\frac{\pi}{4}$.

   Reason (*R*): The range of principal value branch of $\tan^{-1}$ is $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$ and $\tan(-x) = -\tan x$.

CASE-BASED QUESTIONS

1.



Two men on either side of a temple of 30 metres high from the level of eye observe its top at the angles of elevation α and β respectively. (as shown in the figure above). The distance between the two men is $40\sqrt{3}$ metres and the distance between the first person A and the temple is $30\sqrt{3}$ metres. Based on the above information answer the following:

(*i*) Find $\angle CAB$ and $\angle ACB$ (*ii*) Find $\angle ABC$

(*iii*) Find the principal value of $\sin^{-1}\left\{\sin\left(\alpha + \frac{2\pi}{3}\right)\right\}$

OR

Find the principal value of $\cos^{-1}\left\{\cos\left(\beta + \frac{\pi}{3}\right)\right\}$

2. Let $f: A \to B$ be a bijective function then $f^{-1}: B \to A$ is a function such that $f[f^{-1}(x)] = x \ \forall\ x \in B$ and $f^{-1}[f(x)] = x \ \forall\ x \in A$. For ensuring bijectivity, domain of trigonometric function are restricted.

Based on the above information, answer the following questions:

(*i*) Find the value of $\sin^{-1}(\sin 10)$.

(*ii*) Find the value of $\tan^{-1}\left(\sqrt{\frac{1-\cos x}{1+\cos x}}\right)$ if $x \in (-\pi, \pi)$.

(*iii*) Find the value of function $\sin(\tan^{-1} x)$.

OR

Find the value of function $\cos[\text{cosec}^{-1}(x)]$.

Inverse trigonometric functions

1. Solution of $\tan^{-1}x - \cot^{-1}x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ is

   (a) $-\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$

   (c) $\sqrt{3}$ (d) $-\frac{1}{\sqrt{3}}$

2. If $\alpha \le 2\sin^{-1}x + \cos^{-1}x \le \beta$, then α and β are

   (a) $\alpha = 0, \beta = \pi$ (b) $\alpha = \pi, \beta = 0$

   (c) $\alpha = -\frac{\pi}{2}, \beta = \frac{\pi}{2}$ (d) $\alpha = \frac{\pi}{2}, \beta = -\frac{\pi}{2}$

3. If $\tan^{-1}x = \frac{\pi}{10}$ for some $x \in R$, then the value of $\cot^{-1}x$ is

   (a) $\frac{\pi}{5}$ (b) $\frac{2\pi}{5}$ (c) $\frac{3\pi}{5}$ (d) $\frac{4\pi}{5}$

4. The principal value of $\tan^{-1}\left(\tan\frac{9\pi}{8}\right)$ is

   (a) $\frac{\pi}{8}$ (b) $\frac{3\pi}{8}$ (c) $-\frac{\pi}{8}$ (d) $-\frac{3\pi}{8}$

   [CBSE 2021]

5. The principal value of $\cos^{-1}\left(\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ is

   (a) $\frac{\pi}{12}$ (b) π (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{6}$

   [CBSE 2021]

6. Show that $\sin^{-1}\left(\sqrt{\frac{a-x}{2a}}\right) = \frac{1}{2}\cos^{-1}\frac{x}{a}$.

Write the principal values in Exercises 7 to 10:

7. $\operatorname{cosec}^{-1}(2)$ 8. $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

9. $\tan^{-1}(-\sqrt{3})$ 10. $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$

Write the value in Exercises 11 to 13:

11. $\operatorname{cosec}^{-1}(\sqrt{2}) + \sec^{-1}(\sqrt{2})$

12. $\cos^{-1}\left(\cos\frac{2\pi}{3}\right) + \sin^{-1}\left(\cos\frac{2\pi}{3}\right)$

13. $\tan^{-1}(\sqrt{3}) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right)$

14. What is the domain of the function $\operatorname{cosec}^{-1}x$?

15. Write one branch of $\tan^{-1}x$ other than the principal branch.

Evaluate in Exercises 16 to 27:

16. $\sin^{-1}\left\{\cos\left(\sin^{-1}\frac{3}{2}\right)\right\}$ 17. $\operatorname{cosec}^{-1}\left\{\operatorname{cosec}\left(-\frac{\pi}{4}\right)\right\}$

18. $\cos\left\{\frac{\pi}{3} - \cos^{-1}\left(\frac{1}{2}\right)\right\}$ 19. $\sec^2(\tan^{-1}2)$

20. $\cos^{-1}\left(\cos\frac{5\pi}{3}\right)$

21. $\tan^{-1}\{\cos\pi\}$

22. Find the value of $\sin\left\{2\cot^{-1}\left(-\frac{5}{12}\right)\right\}$.

In the following questions, a statement of assertion (*A*) is followed by a statement of reason (*R*). Choose the correct answer out of the following choices.

(a) Both *A* and *R* are true and R is the correct explanation of *A*.

(b) Both *A* and *R* are true but *R* is not the correct explanation of *A*.

(c) *A* is true but *R* is false.

(d) *A* is false but *R* is true.

23. **Assertion (*A*):** The domain of the function $f(x) = \cos^{-1}(3x + 1)$ is $\left[\frac{-2}{3}, 0\right]$

    Reason (*R*): Domain of $\cos^{-1}$ is $[-1, 1]$

24. **Assertion (*A*):** $\sin^{-1}(-1.0001)$ is defined.

    Reason (*R*): Domain of $\sin^{-1}x$ is $[-1, 1]$.

25. **Assertion (*A*):** Principal value of $\sin^{-1}\left(\sin\frac{17\pi}{18}\right)$ is $\frac{\pi}{18}$.

    Reason (*R*): Domain of principal value branch of $\sin^{-1}$ is $[-1, 1]$.

26. **Assertion (*A*):** The range of principal value branch of $\operatorname{cosec}^{-1}x$ is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$.

    Reason (*R*): Domain of principal value branch of $\operatorname{cosec}^{-1}x$ is $[-1, 1] - \{0\}$

27. A teacher gives a table of the domain and range of inverse trigonometric functions to the students and told them that when we dealing with the inverse trigonometric functions, we need to careful about their range, which is defined from restricted domain of trigonometric functions.

Matrix

1. If $A = \begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ and $A = A'$ then

   (a) $x = 0, y = 5$ (b) $x = y$

   (c) $x + y = 5$ (d) $x - y = 5$

2. If a matrix A is both symmetric and skew symmetric then matrix A is

   (a) a scalar matrix

   (b) a diagonal matrix

   (c) a zero matrix of order $n \times n$

   (d) a rectangular matrix.

3. If A is a skew symmetric matrix then A^2 is a

   (a) square matrix

   (b) diagonal matrix

   (c) symmetric matrix

   (d) skew symmetric matrix

4. If A and B are two matrices such that their multiplication is defined, then $(AB)'$

   (a) $A'B'$ (b) AB

   (c) AB' (d) $B'A'$

5. For the matrix $X = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, $(X^2 - X)$ is [CBSE 2021]

   (a) $2I$ (b) $3I$ (c) I (d) $5I$

6. For two matrices $P = \begin{bmatrix} 3 & 4 \\ -1 & 2 \\ 0 & 1 \end{bmatrix}$ and $Q^T = \begin{bmatrix} -1 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, $P - Q$ is [CBSE 2021]

   (a) $\begin{bmatrix} 2 & 3 \\ -3 & 0 \\ 0 & -3 \end{bmatrix}$ (b) $\begin{bmatrix} 4 & 3 \\ -3 & 0 \\ -1 & -2 \end{bmatrix}$

   (c) $\begin{bmatrix} 4 & 3 \\ 0 & -3 \\ -1 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & 3 \\ 0 & -3 \\ 0 & -3 \end{bmatrix}$

7. If $A' = \begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$, then find $(A + 2B)'$. [NCERT]

8. Is matrix $A = \begin{bmatrix} 0 & -1 & 2 \\ 1 & 0 & -3 \\ -2 & 3 & 0 \end{bmatrix}$ symmetric or skew symmetric? Give a reason.

9. If $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, prove that $A - A^T$ is a skew symmetric matrix, where A^T denotes the transpose of A.

10. If $A = \begin{bmatrix} 4 & 1 \\ 5 & 8 \end{bmatrix}$, show that $A + A^T$ is a symmetric matrix, where A^T denotes the transpose of matrix A.

11. For the matrix A, show that $A + A^T$ is a symmetric matrix. [HOTS]

12. Matrix $A = \begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is given to be symmetric, find values of a and b. [Delhi 2016]

13. If $A = \begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$, $B = [-2 \ -1 \ -4]$, verify that $(AB)' = B'A'$.

14. If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, verify that $AA' = I$

---

1. If $F(x) = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$, then $F(x)\,F(y)$ is equal to **(1 Mark)**

   (a) $F(x)$ (b) $F(xy)$

   (c) $F(x + y)$ (d) $F(x - y)$

2. The matrix A satisfies the equation $\begin{bmatrix} 0 & 2 \\ -1 & 1 \end{bmatrix} A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then matrix A is **(1 Mark)**

   (a) $\begin{bmatrix} 2 & 0 \\ 1 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -2 \\ 1 & 0 \end{bmatrix}$

   (c) $\begin{bmatrix} \frac{1}{2} & -1 \\ \frac{1}{2} & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 2 \\ -1 & 0 \end{bmatrix}$

3. If $A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, then A^6 is equal to **(1 Mark)**

   (a) zero matrix (b) A

   (c) I (d) None of these

4. If $A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$, then $A^2-5A-7I$ is **(1 Mark)**

(a) a zero matrix (b) an identity matrix

(c) diagonal matrix (d) None of these

5. If a matrix has 28 elements, what are the possible orders it can have? What if it has 13 elements?

[NCERT Exemplar] (2 Marks)

6. Construct $a_{2\times 2}$ matrix where, $a_{ij}=|-2i+3j|$.

[NCERT Exemplar] (2 Marks)

7. If $A=[a_{ij}]=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ and $B=[b_{ij}]=[-3\ 2]$, then find $\frac{a_{11}\cdot b_{12}}{a_{21}\cdot a_{12}}+b_{11}$. **(2 Marks)**

8. If $\begin{bmatrix}9 & -1 & 4\\ -2 & 1 & 3\end{bmatrix}=A+\begin{bmatrix}1 & 2 & -1\\ 0 & 4 & 9\end{bmatrix}$, then find the matrix A. **[Delhi 2013] (2 Marks)**

9. Find the value of $x+y$ from the following equation:

$$2\begin{bmatrix}x & 5\\ 7 & y-3\end{bmatrix}+\begin{bmatrix}3 & -4\\ 1 & 2\end{bmatrix}=\begin{bmatrix}7 & 6\\ 15 & 14\end{bmatrix}$$

[NCERT; Bhubaneshwar 2015; AI 2012] (2 Marks)

10. If $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$, then write the value of $(x+y)$. **[Delhi 2013(C)] (2 Marks)**

11. Simplify

$$\tan\theta\begin{bmatrix}\sec\theta & \tan\theta\\ \tan\theta & -\sec\theta\end{bmatrix}+\sec\theta\begin{bmatrix}-\tan\theta & -\sec\theta\\ -\sec\theta & \tan\theta\end{bmatrix}.$$

(2 Marks)

12. Solve the following matrix equation for x,

$$[x\ \ 1]\begin{bmatrix}1 & 0\\ -2 & 0\end{bmatrix}=O.$$ **[Delhi 2014] (2 Marks)**

13. If $A=\begin{bmatrix}2 & 4\\ 3 & 2\end{bmatrix}$ and $B=\begin{bmatrix}-2 & 5\\ 3 & 4\end{bmatrix}$, then find $(3A-B)$. **[Guwahati 2015] (2 Marks)**

14. Write the element a_{12} of the matrix $A=[a_{ij}]_{2\times 2}$, whose elements a_{ij} are given by $a_{ij}=e^{2ix}\sin jx$. **[Punchkula 2015] (2 Marks)**

15. Write a 3×3 skew symmetric matrix. **[Chennai 2015] (2 Marks)**

16. If $A=\begin{bmatrix}1 & 3 & 5\\ -2 & 5 & 7\end{bmatrix}$ and $2A-3B=\begin{bmatrix}4 & 5 & -9\\ 1 & 2 & 3\end{bmatrix}$, find B. **(2 Marks)**

17. Find x, if $[x\ \ 1]\begin{bmatrix}1 & 0\\ -2 & -3\end{bmatrix}\begin{bmatrix}x\\ 3\end{bmatrix}=O$. [HOTS] **(2 Marks)**

18. If $A=\begin{bmatrix}2 & 0 & 1\\ 2 & 1 & 3\\ 1 & -1 & 0\end{bmatrix}$, find $A^2-5A+16I$. [Patna 2015] **(3 Marks)**

19. If $f(x)=x^2-4x+1$, find $f(A)$, when $A=\begin{bmatrix}2 & 3\\ 1 & 2\end{bmatrix}$. **(3 Marks)**

20. Find the matrix X such that,

$$\begin{bmatrix}2 & -1\\ 0 & 1\\ -2 & 4\end{bmatrix}X=\begin{bmatrix}-1 & -8 & -10\\ 3 & 4 & 0\\ 10 & 20 & 10\end{bmatrix}.$$ [HOTS] **(3 Marks)**

21. If A is a square matrix such that $A^2=A$, show that $(I+A)^3=7A+I$. [NCERT Exemplar; AI 2014] **(3 Marks)**

22. Find x, if $[x\ -5\ -1]\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}\begin{bmatrix}x\\ 4\\ 1\end{bmatrix}=O$.

[NCERT] **(3 Marks)**

23. If $A=\begin{bmatrix}0 & -\tan\frac{\alpha}{2}\\ \tan\frac{\alpha}{2} & 0\end{bmatrix}$ and I is the identity matrix of order 2, show that

$$I+A=(I-A)\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$$

[NCERT] **(5 Marks)**

24. If $A=\begin{bmatrix}2 & 0 & 1\\ 2 & 1 & 3\\ 1 & -1 & 0\end{bmatrix}$, find $A^2-5A+4I$ and hence find a matrix X such that $A^2-5A+4I+X=O$.

[Delhi 2015] **(5 Marks)**

25. For the matrix $A=\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$, show that $A^2-5A+4I=O$. Hence find A^{-1}.

[Guwahati 2015] (5 Marks)

Determinants

1. A and B are invertible matrices of the same order such that $|(AB)^{-1}| = 8$, If $|A| = 2$, then $|B|$ is

   (a) 16 (b) 4 (c) 6 (d) $\frac{1}{16}$.

2. If $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, then adj A is

   (a) $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ (b) $\begin{bmatrix} -\sin\theta & \cos\theta \\ \cos\theta & \sin\theta \end{bmatrix}$

   (c) $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ (d) $\begin{bmatrix} \sin\theta & \cos\theta \\ \cos\theta & -\sin\theta \end{bmatrix}$

3. The matrix $\begin{bmatrix} 4+3k & 3 \\ 1+2k & 2 \end{bmatrix}$ is singular matrix, for k equal to

   (a) 0 (b) -1

   (c) 1 (d) no value of k

4. If the value of a third order determinant is 7, then the value of a determinant formed by replacing each element by its cofactor will be

   (a) 7 (b) -7

   (c) 49 (d) 14

5. The values of 'x' for which $\begin{vmatrix} 6 & -2 \\ 2 & 4 \end{vmatrix} = x^2 - 12x$ are

   (a) $-2, 14$ (b) $2, -14$

   (c) $-2, -14$ (d) None of these

6. For what value of x, the matrix $\begin{bmatrix} 5-x & x+1 \\ 2 & 4 \end{bmatrix}$ is singular?

7. Determinant of a non-singular matrix P of order 2 is 12. Find the determinant of P^{-1}.

8. If $A^2 - 3A + I = O$ and A is a non-singular matrix, then write A^{-1} in terms of I and A.

9. If the value of third order determinant is 12, then find the value of the determinant formed by its cofactors.

10. If $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$, find the value of x.

11. For $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ write A^{-1}. [CBSE 2020]

12. Find A^{-1}, if $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ and show that $A^{-1} = \frac{A^2 - 3I}{2}$.

    [NCERT Exemplar]

13. Find the adjoint of matrix $\begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 5 \\ -2 & 0 & 1 \end{bmatrix}$ and verify that

    $A(\text{adj } A) = (\text{adj } A)A = |A|I$. [NCERT]

14. Find the inverse of matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\alpha & \sin\alpha \\ 0 & \sin\alpha & -\cos\alpha \end{bmatrix}$. [NCERT]

Determinants

1. Use product $\begin{bmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & -2 & 4\end{bmatrix}\begin{bmatrix}-2 & 0 & 1\\ 9 & 2 & -3\\ 6 & 1 & -2\end{bmatrix}$ to solve the system of equations $x - y + 2z = 1$; $2y - 3z = 1$; $3x - 2y + 4z = 2$

2. Using matrix method solve the following system of linear equations: $x - y + 2z = 7$; $3x + 4y - 5z = -5$, $2x - y + 3z = 12$ **[NCERT; Delhi 2012]**

3. The cost of 4 kg onion, 3 kg wheat and 2 kg rice is ₹ 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is ₹ 90. The cost of 6 kg onion, 2 kg wheat and 3 kg rice is ₹ 70. Find cost of each item per kg by matrix method. **[NCERT]**

4. If $A = \begin{bmatrix}2 & -3 & 5\\ 3 & 2 & -4\\ 1 & 1 & -2\end{bmatrix}$, find A^{-1}. Hence using A^{-1} solve the system of equations $2x - 3y + 5z = 11$; $3x + 2y - 4z = -5$; $x + y - 2z = -3$. **[CBSE 2020; AI 2017]**

5. If $A = \begin{bmatrix}1 & 2 & 5\\ 1 & -1 & -1\\ 2 & 3 & -1\end{bmatrix}$ find A^{-1} and hence solve the system of equations $x + 2y + 5z = 10$; $x - y - z = -2$; and $2x + 3y - z = -11$. **[Foreign 2017]**

6. If $A = \begin{bmatrix}1 & -2 & 0\\ 2 & 1 & 3\\ 0 & -2 & 1\end{bmatrix}$, find A^{-1} and hence solve the system of equations $x - 2y = 10$; $2x + y + 3z = 8$; and $-2y + z = 7$. **[Foreign 2017]**

☆ Do Holiday HW in a separate notebook.

1. Maximum value of $\Delta = \begin{vmatrix}1 & 1 & 1+\cos\theta\\ 1 & 1+\sin\theta & 1\\ 1 & 1 & 1\end{vmatrix}$, θ is a real number is **(1 Mark)**

   (a) $-\frac{1}{2}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) $-\frac{3}{4}$

2. If A and B are invertible matrices then which of the following is not correct **(1 Mark)**

   (a) $AdjA = |A|.A^{-1}$ (b) $\det(A^{-1}) = (\det A)^{-1}$

   (c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A + B)^{-1} = A^{-1} + B^{-1}$

3. Let A be a non-angular square matrix of order 3×3, then $|A \cdot \text{adj } A|$ is equal to **(1 Mark)**

   (a) $|A|^3$ (b) $|A|^2$ (c) $|A|$ (d) $3|A|$

4. Let A be a square matrix of order 3×3 and k a scalar, then $|kA|$ is equal to **(1 Mark)**

   (a) $k|A|$ (b) $|k||A|$

   (c) $k^3|A|$ (d) None of these

5. If C_{ij} denotes the cofactor of element p_{ij} of the matrix $P = \begin{bmatrix}1 & -1 & 2\\ 0 & 2 & -3\\ 3 & 2 & 4\end{bmatrix}$, then the value of $C_{31} \cdot C_{23}$ is **(1 Mark)**

   (a) 5 (b) 24 (c) –24 (d) –5

6. If for the matrix $A = \begin{bmatrix}\alpha & -2\\ -2 & \alpha\end{bmatrix}$, $|A^3| = 125$, then the value of α is **(1 Mark)**

   (a) ± 3 (b) –3 (c) ± 1 (d) 1

7. If A is a square matrix of order 3 and $|A| = -5$, then $|adj\ A|$ is **(1 Mark)**

   (a) 125 (b) –25 (c) 25 (d) ±25

8. Let matrix $X = [x_{ij}]$ is given by $X = \begin{bmatrix}1 & -1 & 2\\ 3 & 4 & -5\\ 2 & -1 & 3\end{bmatrix}$. Then the matrix $Y = [m_{ij}]$, where m_{ij} = Minor of x_{ij}, is **(1 Mark)**

   (a) $\begin{bmatrix}7 & -5 & -3\\ 19 & 1 & -11\\ -11 & 1 & 7\end{bmatrix}$ (b) $\begin{bmatrix}7 & -19 & -11\\ 5 & -1 & -1\\ 3 & 11 & 7\end{bmatrix}$

   (c) $\begin{bmatrix}7 & 19 & -11\\ -3 & 11 & 7\\ -5 & -1 & -1\end{bmatrix}$ (d) $\begin{bmatrix}7 & 19 & -11\\ -1 & -1 & 1\\ -3 & -11 & 7\end{bmatrix}$

9. If $x = -4$ is a root of $\begin{vmatrix}x & 2 & 3\\ 1 & x & 1\\ 3 & 2 & x\end{vmatrix} = 0$, then the sum of the other two roots is **(1 Mark)**

   (a) 4 (b) –3 (c) 2 (d) 5

10. If points (2, 0), (0, 5) and (x, y) are collinear, then show that $\frac{x}{2} + \frac{y}{5} = 1$. **(2 Marks)**

11. If A is a square matrix of order 3 and $|3A| = k|A|$, then write the value of k. **(2 Marks)**

12. A is a non-singular matrix of order 3 and $|A| = -4$. Find $|\text{adj } A|$. **[HOTS] (2 Marks)**