रोल नं.
*Roll No.*

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।
*Candidates must write the Q.P. Code on the title page of the answer-book.*

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 23 हैं।

- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 39 प्रश्न हैं।

- **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।**

- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका में कोई उत्तर नहीं लिखेंगे।

- Please check that this question paper contains **23** printed pages.

- Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

- Please check that this question paper contains **39** questions.

- **Please write down the Serial Number of the question in the answer-book before attempting it.**

- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

# विज्ञान (सैद्धान्तिक)
# SCIENCE (Theory)

निर्धारित समय : *3 घण्टे*
*Time allowed : 3 hours*

अधिकतम अंक : *80*
*Maximum Marks : 80*
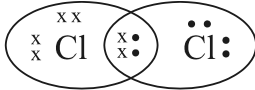
## SECTION – A
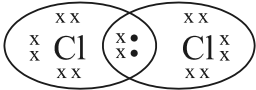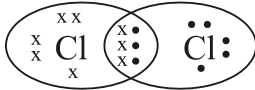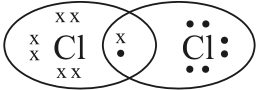## (Multiple Choice Questions)

1. When aqueous solutions of potassium iodide and lead nitrate are mixed, an insoluble substance separates out. The chemical equation for the reaction involved is : **1**

   (a) $KI + PbNO_3 \longrightarrow PbI + KNO_3$

   (b) $2KI + Pb(NO_3)_2 \longrightarrow PbI_2 + 2KNO_3$

   (c) $KI + Pb(NO_3)_2 \longrightarrow PbI + KNO_3$

   (d) $KI + PbNO_3 \longrightarrow PbI_2 + KNO_3$

2. When Sodium bicarbonate reacts with dilute hydrochloric acid, the gas evolved is : **1**
   (a) Hydrogen; it gives pop sound with burning match stick.
   (b) Hydrogen; it turns lime water milky.
   (c) Carbon dioxide; it turns lime water milky.
   (d) Carbon dioxide; it blows off a burning match stick with a pop sound.

3. Acid present in tomato is : **1**
   (a) Methanoic acid          (b) Acetic acid
   (c) Lactic acid             (d) Oxalic acid

4. A metal ribbon 'X' burns in oxygen with a dazzling white flame forming a white ash 'Y'. The correct description of X, Y and the type of reaction is : **1**
   (a) X = Ca ; Y = CaO ;          Type of reaction = Decomposition
   (b) X = Mg ; Y = MgO ;          Type of reaction = Combination
   (c) X = Al ; Y = $Al_2O_3$ ;          Type of reaction = Thermal decomposition
   (d) X = Zn ; Y = ZnO ;          Type of reaction = Endothermic

**5.** The name of the salt used to remove permanent hardness of water is : **1**

    (a) Sodium hydrogen carbonate ($NaHCO_3$)

    (b) Sodium chloride (NaCl)

    (c) Sodium carbonate decahydrate ($Na_2CO_3.10H_2O$)

    (d) Calcium sulphate hemihydrate ($CaSO_4. \frac{1}{2}H_2O$)

**6.** The electron dot structure of chlorine molecule is : **1**

    (a)       (b) 

    (c)       (d) 

**7.** Sodium hydroxide is termed an alkali while Ferric hydroxide is not because : **1**

    (a) Sodium hydroxide is a strong base, while Ferric hydroxide is a weak base.

    (b) Sodium hydroxide is a base which is soluble in water while Ferric hydroxide is also a base but it is not soluble in water.

    (c) Sodium hydroxide is a strong base while Ferric hydroxide is a strong acid.

    (d) Sodium hydroxide and Ferric hydroxide both are strong base but the solubility of Sodium hydroxide in water is comparatively higher than that of Ferric hydroxide.

**8.** Opening and closing of stomata is due to : **1**

    (a) High pressure of gases inside the cells.

    (b) Movement of water in and out of the guard cells.

    (c) Stimulus of light in the guard cells.

    (d) Diffusion of $CO_2$ in and out of the guard cells.

**9.** Water in the root enters due to : **1**

    (a) the function of the root to absorb water.

    (b) difference in the concentration of ions between the root and the soil.

    (c) excess water present in the soil.

    (d) diffusion of water in the roots.

**10.** Which one of the given statements is incorrect : **1**

(a) DNA has the complete information for a particular characteristic.

(b) DNA is the molecule responsible for the inheritance of characters from parents to offsprings.

(c) Change in information will produce a different protein.

(d) Characteristics will remain the same even if protein changes.

**11.** Sensory nerve of a reflex arc carries information from the receptor cells to the : **1**

(a) spinal cord

(b) brain

(c) muscles of the effector organ

(d) bones of the receptor organ

**12.** A cross between pea plant with white flowers (vv) and pea plant with violet flowers (VV) resulted in $F_2$ progeny in which ratio of violet (VV) and white (vv) flowers will be : **1**

(a)  1 : 1          (b)  2 : 1          (c)  3 : 1          (d)  1 : 3

**13.** The correct pattern of magnetic field lines of the field produced by a current carrying circular loop is : **1**
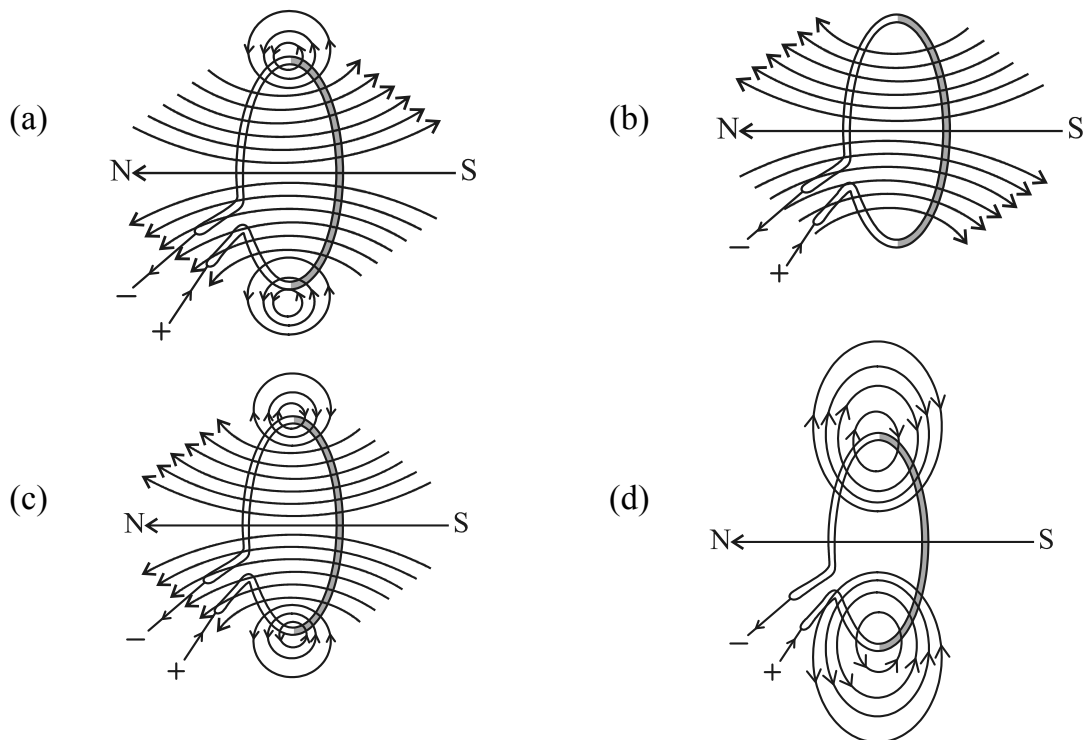
**14.** Two LED bulbs of 12W and 6W are connected in series. If the current through 12W bulb is 0.06A the current through 6W bulb will be :　　**1**

(a)  0.04A　　　(b)  0.06A　　　(c)  0.08A　　　(d)  0.12A

**15.** An alpha particle enters a uniform magnetic field as shown. The direction of motion of the alpha particle is :　　**1**

(a)  towards right

(b)  towards left

(c)  into the page

(d)  out of the page
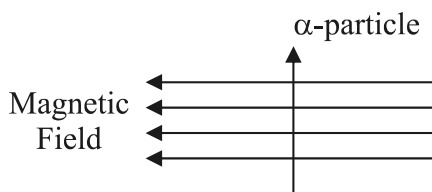
**16.** The resistance of a resistor is reduced to half of its initial value. If other parameters of the electrical circuit remain unaltered, the amount of heat produced in the resistor will become :　　**1**

(a)  four times

(b)  two times

(c)  half

(d)  one fourth

**Q. No. 17 to 20 are Assertion – Reasoning based questions.**

**These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below.**

(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.

**17.  Assertion (A) :** In humans, if gene (B) is responsible for black eyes and gene (b) is responsible for brown eyes, then the colour of eyes of the progeny having gene combination Bb, bb or BB will be black only.

**Reason (R) :** The black colour of the eyes is a dominant trait.　　**1**

**18.  Assertion (A) :** Reaction of Quicklime with water is an exothermic reaction.

**Reason (R) :** Quicklime reacts vigorously with water releasing a large amount of heat.　　**1**

19. **Assertion (A) :** A current carrying straight conductor experiences a force when placed perpendicular to the direction of magnetic field.

**Reason (R) :** The net charge on a current carrying conductor is always zero. **1**

20. **Assertion (A) :** The inner walls of the small intestine have finger like projections called villi which are rich in blood.

**Reason (R) :** These villi have a large surface area to help the small intestine in completing the digestion of food. **1**

## SECTION – B
### (Very Short Answer Questions)

21. Name a plant hormone responsible for bending of a shoot of a plant when it is exposed to unidirectional light. How does it promote phototropism ? **2**

22. **(A)** A student took a small amount of copper oxide in a conical flask and added dilute hydrochloric acid to it with constant stirring. He observed a change in colour of the solution. **2**

   (i) Write the name of the compound formed and its colour.

   (ii) Write a balanced chemical equation for the reaction involved.

### OR

   **(B)** The industrial process used for the manufacture of caustic soda involves electrolysis of an aqueous solution of compound 'X'. In this process, two gases 'Y' and 'Z' are liberated. 'Y' is liberated at cathode and 'Z', which is liberated at anode, on treatment with dry slaked lime forms a compound 'B'. Name X, Y, Z and B. **2**

23. Two green plants are kept separately in oxygen free containers, one in the dark and other in sunlight. It was observed that plant kept in dark could not survive longer. Give reason for this observation. **2**

24. What is the other name of 'tissue fluid' ? Write its two functions. **2**

**25.** "Although gardens are created by man but they are considered to be an ecosystem." Justify this statement. **2**

**26. (A)** Observe the following diagram and answer the questions following it : **2**



Light rays

Retina

Eye lens

Eye ball
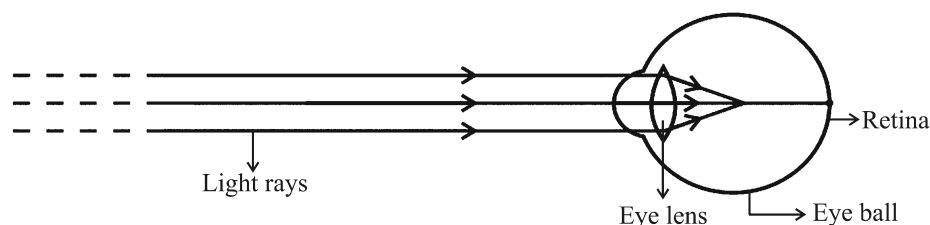
     (i)   Identify the defect of vision shown.
     (ii)  List its two causes.
     (iii) Name the type of lens used for the correction of this defect.

**OR**

**(B)** The colour of clear sky from the earth appears blue but from the space it appears black. Why ? **2**

**SECTION – C**
**(Short Answer Questions)**

**27.** Consider the following salts : **3**

     (i)   YCl            (ii)  $NH_4X$          (iii)  $ZCO_3$

     (a)  What would be the pH of the salt solution if in YCl, Y is sodium ? Give reason for your answer.

     (b)  If in salt $NH_4X$, X is nitrate, then its solution will give what colour with universal indicator ? Why ?

     (c)  What would be the change in colour in blue litmus solution if $ZCO_3$ is added to it and Z is potassium ?

**28.** (i)  While electrolysing water before passing the current some drops of an acid are added. Why ? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode. **3**

     (ii) What is observed when silver chloride is exposed to sunlight ? Give the type of reaction involved.

**29.** The magnification produced when an object is placed at a distance of 20 cm from a spherical mirror is +1/2. Where should the object be placed to reduce the magnification to +1/3.     **3**

**30. (A) (i)** How does Paramecium obtain its food ?     **3**

      **(ii)** List the role of each of the following in our digestive system :

          **(a)** Hydrochloric acid

          **(b)** Trypsin

          **(c)** Muscular walls of stomach

          **(d)** Salivary amylase

**OR**

**(B) (i)** What is double circulation ?     **3**

      **(ii)** Why is the separation of the right side and the left side of the heart useful ? How does it help birds and mammals ?

**31. (A) (i)** Why is an alternating current (A.C.) considered to be advantageous over direct current (D.C.) for the long distance transmission of electric power ?     **3**

      **(ii)** How is the type of current used in household supply different from the one given by a battery of dry cells ?

      **(iii)** How does an electric fuse prevent the electric circuit and the appliances from a possible damage due to short circuiting or overloading.

**OR**

**(B)** For the current carrying solenoid as shown, draw magnetic field lines and give reason to explain that out of the three points A, B and C, at which point the field strength is maximum and at which point it is minimum ?     **3**
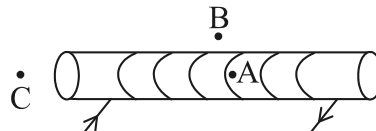
**32.** Write one difference between biodegradable and non-biodegradable wastes. List two impacts of each type of the accumulated waste on environment if not disposed off properly.     **3**

**33.** **(A)** Define the term dispersion of white light. State the colour which bends (i) the most, (ii) the least while passing through a glass prism. Draw a diagram to show the dispersion of white light. **3**

**OR**

**(B)** What is a rainbow ? Draw a labelled diagram to show its formation. **3**

### SECTION – D
### (Long Answer Questions)

**34.** **(i)** Name and explain the two modes of asexual reproduction observed in hydra. **5**

**(ii)** What is vegetative propagation ? List two advantages of using this technique.

**35.** **(i)** How is electric current related to the potential difference across the terminals of a conductor ? **5**
Draw a labelled circuit diagram to verify this relationship.

**(ii)** Why should an ammeter have low resistance ?

**(iii)** Two V - I graphs A and B for series and parallel combinations of two resistors are as shown. Giving reason state which graph shows (a) series, (b) parallel combination of the resistors.
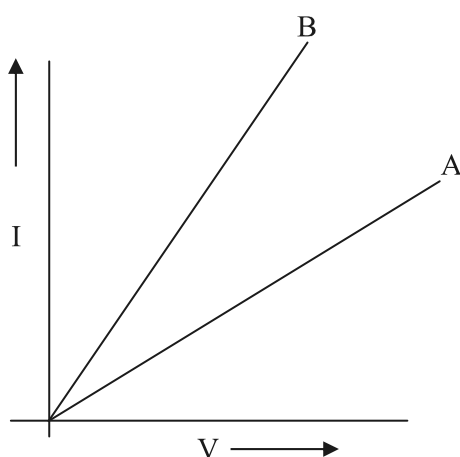
**36. (A)** Write the chemical equation for the following :      **5**

     (i)   Combustion of methane     (ii)  Oxidation of ethanol

     (iii) Hydrogenation of ethene    (iv)  Esterification Reaction

     (v)   Saponification Reaction

<div align="center">

**OR**

</div>

**(B)** (i)   Draw two structural isomers of butane.      **5**

     (ii)  Draw the structures of propanol and propanone.

     (iii) Name the third homologue of :
       (a)  alcohols           (b)  aldehydes

     (iv) Name the following :

       (a)
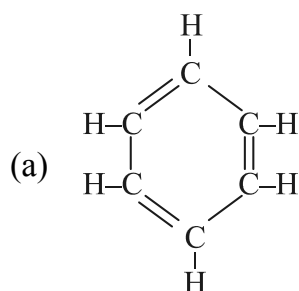


       (b)  $CH_3-CH_2CH = CH_2$

     (v)  Show the covalent bond formation in nitrogen molecule.

<div align="center">

**SECTION – E**
**(Source Based/Case Based Questions)**

</div>

**37.** The most obvious outcome of the reproductive process is the generation of   **4**
individuals of similar design, but in sexual reproduction they may not be
exactly alike. The resemblances as well as differences are marked. The
rules of heredity determine the process by which traits and characteristics
are reliably inherited. Many experiments have been done to study the rules
of inheritance.

     (i)   Why an offspring of human being is not a true copy of his parents in
       sexual reproduction ?      **1**

(ii) While performing experiments on inheritance in plants, what is the difference between $F_1$ and $F_2$ generation ? **1**

(iii) (A) Why do we say that variations are useful for the survival of a species over time ? **2**

**OR**

(iii) (B) Study Mendel's cross between two plants with a pair of contrasting characters. **2**

RRYY       ×       rryy
Round Yellow       Wrinkled Green

He observed 4 types of combinations in $F_2$ generation. Which of these were new combinations ? Why do new features which are not present in the parents, appear in $F_2$ generation ?

**38.** The ability of a medium to refract light is expressed in terms of its optical density. Optical density has a definite connotation. It is not the same as mass density. On comparing two media, the one with the large refractive index is optically denser medium than the other. The other medium with a lower refractive index is optically rarer. Also the speed of light through a given medium is inversely proportional to its optical density. **4**

(i) Determine the speed of light in diamond if the refractive index of diamond with respect to vacuum is 2.42. Speed of light in vacuum is $3×10^8$ m/s. **1**

(ii) Refractive indices of glass, water and carbon disulphide are 1.5, 1.33 and 1.62 respectively. If a ray of light is incident in these media at the same angle (say θ), then write the increasing order of the angle of refraction in these media. **1**

(iii) (A) The speed of light in glass is $2×10^8$ m/s and in water is $2.25×10^8$ m/s. **2**

(a) Which one of the two is optically denser and why ?

(b) A ray of light is incident normally at the water-glass interface when it enters a thick glass container filled with water. What will happen to the path of the ray after entering the glass ? Give reason.

**OR**

(iii) (B) The absolute refractive indices of water and glass are 4/3 and 3/2 respectively. If the speed of light in glass is $2 \times 10^8$ m/s, find the speed of light in (i) vacuum and (ii) water. **2**

**39.** The melting points and boiling points of some ionic compounds are given below : **4**

| Compound | Melting Point (K) | Boiling Point (K) |
|----------|-------------------|-------------------|
| NaCl | 1074 | 1686 |
| LiCl | 887 | 1600 |
| $CaCl_2$ | 1045 | 1900 |
| CaO | 2850 | 3120 |
| $MgCl_2$ | 981 | 1685 |

These compounds are termed ionic because they are formed by the transfer of electrons from a metal to a non-metal. The electron transfer in such compounds is controlled by the electronic configuration of the elements involved. Every element tends to attain a completely filled valence shell of its nearest noble gas or a stable octet.

(i) Show the electron transfer in the formation of magnesium chloride. **1**

(ii) List two properties of ionic compounds other than their high melting and boiling points. **1**

(iii) (A) While forming an ionic compound say sodium chloride how does sodium atom attain its stable configuration ? **2**

**OR**

(iii) (B) **Give reasons :** **2**

(i) Why do ionic compounds in the solid state not conduct electricity ?

(ii) What happens at the cathode when electricity is passed through an aqueous solution of sodium chloride ?

**Secondary School Examination, 2023**
**Marking Scheme – Science  (SUBJECT CODE -086)**
**(PAPER CODE –31/4/3)**

**General Instructions: -**

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.

2. **"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its' leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under various rules of the Board and IPC."**

3. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**

4. The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.

5. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after delibration and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.

6. Evaluators will mark( √ ) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓)while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**

7. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.

8. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

9. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **"Extra Question"**.

10. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
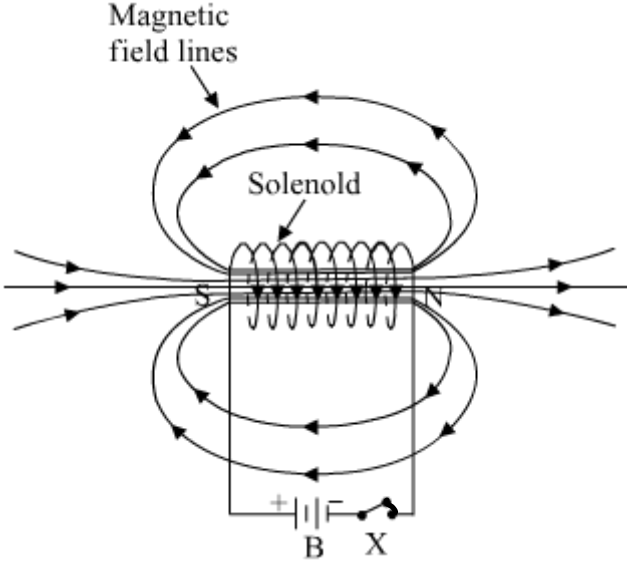
11. A full scale of marks **80** (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

12. Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).This is in view of the reduced syllabus and number of questions in question paper.

13. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    • Leaving answer or part thereof unassessed in an answer book.
    • Giving more marks for an answer than assigned to it.
    • Wrong totaling of marks awarded on a reply.
    • Wrong transfer of marks from the inside pages of the answer book to the title page.
    • Wrong question wise totaling on the title page.
    • Wrong totaling of marks of the two columns on the title page.
    • Wrong grand total.
    • Marks in words and figures not tallying / not same.
    • Wrong transfer of marks from the answer book to online award list.
    • Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    • Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

14. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.

15. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

16. The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation. Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

17. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.

18. The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

**Maximum Marks: 80**

| Q. No. | EXPECTED ANSWER / VALUE POINTS | Marks | Total Marks |
|---|---|---|---|
| | **SECTION A** | | |
| 1. | (b) | 1 | 1 |
| 2. | (c) | 1 | 1 |
| 3. | (d) | 1 | 1 |
| 4. | (b) | 1 | 1 |
| 5. | (c) | 1 | 1 |
| 6. | (c) | 1 | 1 |
| 7. | (b) | 1 | 1 |
| 8. | (b) | 1 | 1 |
| 9. | (b) | 1 | 1 |
| 10. | (d) | 1 | 1 |
| 11. | (a) | 1 | 1 |
| 12. | (a) | 1 | 1 |
| 13. | (c) | 1 | 1 |
| 14. | (b) | 1 | 1 |
| 15. | (d) | 1 | 1 |
| 16. | (b) | 1 | 1 |
| 17. | (d) | 1 | 1 |
| 18. | (a) | 1 | 1 |
| 19. | (b) | 1 | 1 |
| 20. | (c) | 1 | 1 |
| | **SECTION B** | | |
| 21. | • Auxin | 1 | |
| | • Auxins slowly diffuse towards the shady side of the shoot which stimulate cells on the shady side to grow longer, causing the plant to bend towards light. | 1 | 2 |
| 22. | (A) (i) • Copper (II) chloride / Copper chloride / Cupric chloride / $CuCl_2$ | ½ | |
| | • colour- blue-green. | ½ | |
| | (ii) $CuO + 2HCl \rightarrow CuCl_2 + H_2O$ | 1 | |
| | **OR** | | |
| | (B)   X : Sodium Chloride / NaCl | ½ | |
| | Y : Hydrogen /$H_2$ | ½ | |
| | Z : Chlorine / $Cl_2$ | ½ | |
| | B : Bleaching powder / $CaOCl_2$ | ½ | 2 |
| 23. | • The plant kept in dark is unable to carry out photosynthesis and due to absence of oxygen it cannot respire. | 1 | |
| | • But the plant kept in light is able to photosynthesize converting $CO_2$ into oxygen which it can use for respiration. | 1 | 2 |
| 24. | • Lymph | 1 | |

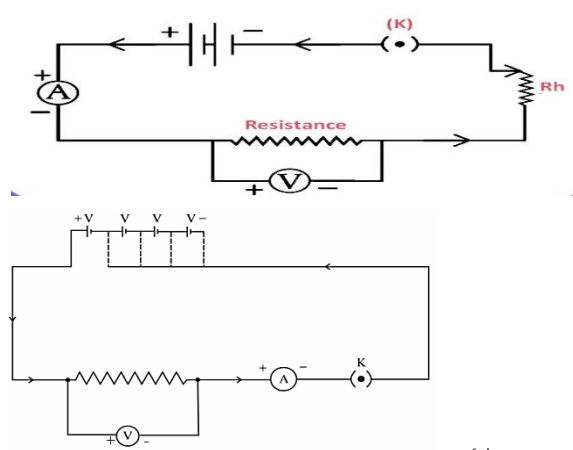| | | | |
|---|---|---|---|
| | • Functions:<br>(i) carries digested and absorbed fat from intestine.<br>(ii) drains excess fluid from extracellular space back into the blood. | ½<br>½ | 2 |
| 25. | Gardens have biotic components like plants, and animals. All these living organisms interact with each other and with abiotic components of ecosystem like water, air and soil. | 2 | 2 |
| 26. | (A) (i) Myopia / Short Sightedness<br>    (ii) • Excessive curvature of eye lens<br>        • Elongation of eye ball<br>    (iii) Concave lens /Diverging Lens<br>**OR**<br>(B)  • Size of particles in the atmosphere is smaller than the wavelength of visible light, so they scatter light of shorter wavelengths i.e. blue.<br>    • In space, there is no scattering of light due to absence of particles. (no atmosphere) | ½<br>½<br>½<br>½<br><br>1<br><br><br>1 | 2 |
| | **SECTION C** | | |
| 27. |    (a) • 7<br>       • salt of strong acid and strong base<br>   (b)  • Pink / orange<br>       • salt of weak base and strong acid<br>   (c)  • No change / remain blue | ½<br>½<br>½<br>½<br>1 | 3 |
| 28. | (i) • To increase the conductivity of water<br>  • Hydrogen – cathode     Oxygen – anode<br>  • Anode : Cathode<br>        1 : 2<br> /Volume of hydrogen liberated at cathode is twice that of oxygen liberated at anode.<br>(ii) • White silver chloride turns grey<br>  • Decomposition reaction / Photolytic Decomposition | ½<br>½, ½<br><br><br>½<br><br>½<br>½ | 3 |
| 29. | Given,<br>Distance of object, u = -20 cm<br>Magnification m = $\dfrac{1}{2}$<br>$\therefore$ m $= \dfrac{-v}{u} \Rightarrow$ v $= -\dfrac{1}{2} \times$ -20 = 10 cm<br>Using mirror formula<br>$\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$<br>$\dfrac{1}{f} = \dfrac{1}{10} - \dfrac{1}{20} = \dfrac{1}{20}$<br>f = 20 cm<br>If m $= \dfrac{1}{3}$ and v' and u' are the corresponding image distance and object distance. $\dfrac{1}{3} = \dfrac{-v'}{u'} \Rightarrow$ $v' = \dfrac{-u'}{3}$<br>$\dfrac{1}{f} = \dfrac{1}{v'} + \dfrac{1}{u'}$<br>$\dfrac{1}{20} = \dfrac{-3}{u'} + \dfrac{1}{u'} \Rightarrow \dfrac{1}{20} = \dfrac{-2}{u'}$ | ½, ½<br><br>½<br><br>½<br><br>½ | |

| | | | | |
|---|---|---|---|---|
| | | u' = – 40 cm. | ½ | 3 |
| 30. | | (A) (i) Food enters through a specific spot with the help of movement of cilia. | 1 | |
| | | (ii) | | |
| | | (a) Creates an acidic medium which facilitates the action of enzyme / kills microorganisms ingested with the food. | ½ | |
| | | (b) Digestion of proteins | ½ | |
| | | (c) Mixing the food thoroughly with digestive juices. / pushes food forward by peristalsis. | ½ | |
| | | (d) Conversion of starch into sugar | ½ | |
| | | **OR** | | |
| | | (B) (i) Blood goes through the heart twice during each cycle. | 1 | |
| | | (ii) • To prevent oxygenated and deoxygenated blood from mixing for efficient supply of oxygen to the body. | 1 | |
| | | • It helps birds and mammals who have high energy needs and constantly use energy to maintain their body temperature. | 1 | 3 |
| 31. | | (A) (i) Alternating current can be transmitted over long distances without much loss of electric energy. | 1 | |
| | | (ii) Household supply – Alternating current (AC) | ½ | |
| | | Battery of Dry cell – Direct current (DC) | ½ | |
| | | (iii) It melts and breaks the circuit when a current of higher value than its rating flows through it. | 1 | |
| | | **OR** | | |
| | | (B) • | | |
| | |  | 1 | |
| | | **[Deduct ½ mark if direction of current or magnetic field is not marked]** | | |
| | | • Maximum at A | ½ | |
| | | Magnetic field lines are crowded. / Magnetic field adds up due to 'n' number of turns of a solenoid. | ½ | |

| | | | |
|---|---|---|---|
| | • Minimum at B<br> Magnetic field lines are far apart. | ½<br>½ | 3 |
| 32. | •<br><table><tr><th>Biodegradable</th><th>Non-biodegradable</th></tr><tr><td>Biodegradable wastes can be broken down by biological processes.</td><td>Non-biodegradable wastes cannot be broken down by biological processes.</td></tr></table> | 1 | |
| | • Impact of accumulated biodegradable wastes:<br>(i) Foul smell<br>(ii) Breeding place for carriers of diseases **(or any other)**<br>• Impact of accumulated non-biodegradable wastes:<br>(i) Biological Magnification<br>(ii) Affect soil fertility. **(or any other)** | ½<br>½<br><br>½<br>½ | 3 |
| 33. | (A)<br>• The splitting up of white light into its constituent/seven different colours while passing through a glass prism is called dispersion of white light.<br>• (i) Violet bends the most<br>• (ii) Red bends the least | 1<br><br>½<br>½ | |
| |  | 1 | |
| | **OR** | | |
| | (B)<br>• A rainbow is a natural spectrum of sunlight appearing in the sky after the rainfall.<br>• | 1 | |
| |  | 2 | |
| | | | 3 |

| | **SECTION D** | | |
|---|---|---|---|
| 34. | (i) The two modes of asexual reproduction observed in hydra are:<br>• Budding: A bud develops as an outgrowth. These buds develop into tiny individuals. When fully matured it detaches from the parent body and become new independent individual.<br>• Regeneration: Hydra can be cut into any number of pieces and each piece grows into a complete organism.<br>(ii)• Definition: When any vegetative part of plants like root, stem or leaf is used to grow new plants.<br>• Advantages: -<br>1. Plants can bear flowers and fruits earlier than those produced from seeds.<br>2. It enables the propagation of plants such as banana, orange, rose and jasmine which have lost the capacity to produce seeds.<br>3. The plants produced are genetically similar enough to the parent plant to have all the characteristics.<br>**(Any two)** | ½ , 1<br><br><br><br>½ , 1<br><br>1<br><br><br><br><br><br>½, ½ | 5 |
| 35. | (i) Current flowing through a conductor is directly proportional to the potential difference.   / $V \alpha I$     / $I \alpha V$<br><br>**(Any one diagram)**<br>(ii)Since ammeter is connected in series, it should not increase the resistance of the circuit. / should allow maximum current to flow through the circuit.<br>(iii) • Series combination - Graph A<br>Less slope and more resistance<br>• Parallel combination - Graph B<br>More slope and less resistance | 1<br><br><br><br><br><br>1<br><br><br>1<br><br>½<br>½<br>½<br>½ | 5 |
| 36. | (A)<br>(i)   $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$<br><br>(ii)<br>$CH_3 - CH_2OH \xrightarrow[\text{Or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} CH_3COOH$<br>Ethanol                              Ethanoic Acid | 1<br><br><br><br>1 | |

(iii)



Ethene ... Ethane

1

(iv)



$C_2H_5OH$ + $CH_3COOH$ $\xrightarrow{\text{Conc. }H_2SO_4}$ $CH_3-\overset{\overset{O}{\|}}{C}-O-C_2H_5$
Ethanol ... Ethanoic acid ... Ethyl ethanoate (ester)

1

(v)



(v)

$CH_3COOC_2H_5$ + NaOH $\longrightarrow$ $CH_3COONa$ + $C_2H_5OH$
Ethyl ethanoate ... Sodium ... Sodium ethanoate ... Ethanol
(Ethyl acetate) ... hydroxide ... (Sodium acetate) ... (Ethyl alcohol)

1

**OR**

(B) (i)



(i) H—C—C—C—C—H

(ii) H—C — C — C—H

½ , ½

(ii)



H—C—C—C—O—H / $CH_3-CH_2OH$

½

H—C—C—C—H / $\underset{H_3C}{\overset{H_3C}{>}}C=O$

½

(iii)
  (a) Propanol
  (b) Propanal

½
½

(iv)
  (a) Benzene
  (b) Butene

½
½

| | (v)  | 1 | |
| --- | --- | --- | --- |
| | | | 5 |
| | **SECTION E** | | |
| 37. | (i) Sexual reproduction involves the fusion of male and female gametes, which combines to the characters of both parents and cause variation. | 1 | |
| | (ii) | | |

| $F_1$ generation | $F_2$ generation |
| --- | --- |
| • In $F_1$ generation only the dominant traits are expressed. | • In $F_2$ generation both dominant and recessive traits are expressed. |
| • It refers to the offspring/ plants resulting immediately from a cross between the first set of parents. | • It refers to the offspring/plants resulting from a cross among the plants of $F_1$ generation. |

**[Any one]**

(iii) (A) Because if a niche of population of organisms is altered, the whole population could be wiped out. However, if variation is present in this population they have some chance of survival.

**[Alternate answer]**
If there is a population of bacteria living in temperate waters and if water temperature were to be increased by global warming, most of the bacteria would die, but a few variants resistant to heat would survive and grow further. Thus, variations are useful for survival of species over time.

**OR**

(iii) (B) • Wrinkled, yellow
Round, green
• If two or more traits are involved, their genes are independently inherited irrespective of the combination present in parents.

| 37. col3 | 1 |
| --- | --- |

(The right-hand mark column values for item 37: 1, 2, ½, ½, 1 and total 4)

| 38. | (i) Refractive index of diamond = $\dfrac{Speed\ of\ light\ in\ vacuum}{Speed\ of\ light\ in\ diamond}$ | ½ | |
| --- | --- | --- | --- |
| | Speed of light in diamond = $\dfrac{3\times10^8\,\text{m/s}}{2\cdot42}$ = $1\cdot23\times10^8$ m/s | ½ | |
| | (ii) $\angle$r in carbon disulphide < $\angle$r in glass < $\angle$r in water | 1 | |
| | (iii) (A)<br>(a) • Glass | ½ | |
| | • The speed of light in water is more than the speed of light in glass. / Refractive index of glass is more than the refractive index of water. | ½ | |

| | | | | |
|---|---|---|---|---|
| | | (b) Light will enter from water to glass without bending (undeviated / straight) because in this case $\angle i = 0$ ; $\angle r = 0$.<br>**OR**<br>(iii) (B)<br><br>$n_{glass} = \frac{3}{2}$<br><br>$n_{water} = \frac{4}{3}$<br><br>$v_{glass} = 2 \times 10^8 m/s$<br><br>$n_{glass} = \frac{speed\ of\ light\ in\ vacuum(c)}{speed\ of\ light\ glass(v_g)}$<br><br>$c = n_{glass} \times v_{glass}$<br>$= \frac{3}{2} \times 2 \times 10^8 m/s$<br>$= 3 \times 10^8 m/s$<br><br>$v_{water} = \frac{c}{n_{water}} = \frac{3 \times 10^8 m/s}{\frac{4}{3}}$<br><br>$= \frac{9}{4} \times 10^8$ m/s **or** $2.25 \times 10^8$ m/s | 1<br><br><br><br><br><br><br><br><br><br><br><br><br><br>1<br><br><br><br><br>1 | 4 |
| 39. | (i) | <br><br>(ii)<br>• They are hard solids<br>• They are soluble in water<br>• They conduct electricity in aqueous solution or molten state<br><div align="right">**[Any other]**</div><div align="right">**[Any two]**</div><br>(iii) (A) • Sodium atom has one electron in its outermost shell<br>    • It attains its nearest noble gas configuration by losing this electron<br>    forming $Na^+$ ion  / **Na** $\rightarrow$ **Na⁺ + e⁻**<br>            2,8,1     2,8<br>                 stable<br>**OR**<br>(iii) (B) (i) Because movement of ions in the solid is not possible due to their rigid structure.<br>    (ii) $H_2$ gas is liberated at cathode. | 1<br><br><br><br><br><br><br><br>½, ½<br><br><br><br>1<br><br>1<br><br><br><br><br>1<br>1 | 4 |