DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

24-0002-AB TEST BOOKLET

Time Allowed: 3.00 hours

PAPER – II

Maximum Marks: 200

INSTRUCTIONS TO CANDIDATES

Read the instructions carefully before answering the questions: -

1. This Test Booklet consists of 16 **(sixteen) pages.**
2. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
3. **Please note that it is the candidate's responsibility to fill in the Roll Number and other required details carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet and Answer Booklet. Any omission/discrepancy will render the OMR Answer Sheet and Answer Booklet liable for rejection.**
4. Do not write anything else on the OMR Answer Sheet and Answer Booklet except the required information. Before you proceed to mark in the OMR Answer Sheet, please ensure that you have filled in the required particulars as per given instructions.
5. Use **only Black Ball Point Pen** to fill the OMR Answer Sheet.
6. This Test Booklet is divided into 3 (three) parts – **Part – I, Part – II and Part – III.**
7. All three parts are **Compulsory.**
8. **Part-I consist of Multiple Choice-based Questions.** The answers to these questions have to be marked in the **OMR Answer Sheet** provided to you. **Part II and III are conventional questions** which have to be answered in the separate answer booklet(s) provided to you.
9. In Part-I each item (question) **comprises of 04 (four) responses (answers).** You are required to select the response which you want to mark on the OMR Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
10. After you have completed filling in all your responses on the OMR Answer Sheet and the Answer Booklet(s) and the examination has concluded, you should hand over to the Invigilator ***only the OMR Answer Sheet and the Answer Booklet(s)***. You are permitted to take the Test Booklet with you.
11. **Penalty for wrong answers in Multiple Choice-based Questions:**
    THERE WIL BE **PENALTY** FOR WRONG ANSWERS MARKED BY A CANDIDATE.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to the question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to the question.
    (iii) If a question is left blank. i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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PART-I

(Multiple Choice Questions)

Choose the correct answer for the following questions: **(3x32 = 96)**

MATH

1. The decimal expansion of the rational number $\frac{93}{2^6 \times 5^3}$ will terminate after:

   (a) 3 decimal places

   (b) 4 decimal places

   (c) 5 decimal places

   (d) 6 decimal places

2. On dividing the polynomial $x^3 - 2x^2 + x - 3$ by a polynomial g(x), the quotient and the remainder are $x^2 - 3x + 4$ and -7 respectively. The polynomial g(x) is:

   (a) $x - 1$

   (b) $x + 1$

   (c) $x - 3$

   (d) $x + 3$

3. The values of a and b for which the following pair of linear equations will have infinitely many solutions are respectively:

   (a) $\frac{17}{5}$ and $\frac{11}{4}$ (b) $\frac{17}{4}$ and $\frac{11}{5}$ (c) $\frac{-17}{4}$ and $\frac{11}{5}$ (d) $\frac{17}{5}$ and $\frac{-11}{4}$

4. Sum of areas of two squares is 468 m^2. If the difference of their perimeters is 24m, then the sides of the two squares are:

   (a) 20 m, 14 m (b) 16 m, 10 m (c) 22 m, 16 m (d) 18 m, 12 m

5. The sum of first six terms of an A.P. is zero and its fourth term is 2. The sum of its 30 terms is:

   (a) 1440 (b) 1445 (c) 2040 (d) 2070

6. A solid right circular cone of diameter 14 cm and height 8 cm is melted to form a hollow sphere, with its external diameter 10 cm. The internal diameter of the sphere is:

(a) 6 cm (b) $6\sqrt{2}$ cm (c) 9 cm (d) $9\sqrt{2}$ cm

7. Two circles touch each other externally at the point P. AB is the direct tangent touching the circles at the points A and B. $\angle APB$ is:

(a) 60° (b) 75° (c) 90° (d) 105°

8. The ratio in which the line $3x + y - 9 = 0$ divides the line segment joining the points (1, 3) and (2, 7) internally, is:

(a) 2: 5 (b) 3: 4 (c) 4: 1 (d) 2: 7

PHYSICS

9. The ratio of electrostatic force between one electron & one positron and one electron & one proton separated at a distance of 0.1 decimeter and 1.414 centimeter respectively is-

(a) 2: 1 (b) 1:2 (c) 1:4 (d) 4:1

10. Two resistances (30 Ω and R Ω) are connected in parallel and this combination is in series with a resistance of 48 Ω and a battery of 2V. When resistance of R Ω is removed an additional resistance of 72 Ω must be introduced in series with the battery in order to keep current in 30Ω resistance unaltered. Hence R is-

(a) 10Ω (b) 15Ω (c) 20Ω (d) 25Ω

11. At magnetic poles, the angle of dip is-

(a) 45^0
(b) 30^0
(c) 0^0
(d) 90^0

12. Current in a circuit is watt-less if-

(a) inductance in the circuit is zero
(b) resistance in the circuit is zero
(c) current is alternating
(d) resistance and inductance both are zero

13. An electromagnetic wave propagating along north has its electric field vector upwards. Its magnetic field vector points -

(a) Downwards
(b) Towards North
(c) Towards East
(d) Towards West

14. An underwater swimmer cannot see very clearly even in the absolutely clear water because of -

(a) Absorption of light in water
(b) Scattering of light in water
(c) Reduction of speed of light in water
(d) Change in the focal length of eye lens

15. When a wave undergoes reflection at a denser medium, what will be the phase change?

(a) 2π radian
(b) 0 radian
(c) π radian
(d) 3π radian

16. An electron and a photon have the same wavelength. If p is the momentum of the electron and E is the energy of the photon, the magnitude of p/E in SI unit is -

(a) 6.64×10^{-34}
(b) 9.11×10^{-31}
(c) 3.33×10^{-9}
(d) 6.64×10^{4}

BIOLOGY

17. Bacteriophages are -

(a) Fungi
(b) Bacteria
(c) Viruses
(d) Algae

18. The word 'species' was first given by -

(a) Charaka
(b) John Ray
(c) Bentham and Hooker
(d) Carolus Linnaeus

19. Nitrosomonas converts -

(a) ammonia to nitrite
(b) Nitrogen to ammonia
(c) nitrite to nitrate
(d) ammonia to nitrogen

20. Name the enzyme which converts starch into maltose.

(a) amylase
(b) maltase
(c) lipase
(d) protease

21. The smallest measuring unit of cytology is -

(a) nanometer
(b) angstrom
(c) micrometer
(d) millimeter

22. Which of the following is a sexually transmitted disease?

(a) Hepatitis
(b) Meningitis
(c) Syphilis
(d) Tuberculosis

23. A population interaction where one species is harmed whereas the other is unaffected is called-

(a) mutualism
(b) competition
(c) predation
(d) amensalism

24. Aleurone layer of maize seed stores _____ and is _____ in ploidy.

(a) proteins, n
(b) cellulose, 2n
(c) proteins, 3n
(d) fat, 3n

CHEMISTRY

25. Which one of the following is in the correct increasing order in terms of acidic strength?

(a) Water < Acetic acid < Hydrochloric acid
(b) Water < Hydrochloric acid < Acetic acid
(c) Acetic acid < Water < Hydrochloric acid
(d) Hydrochloric acid < Water < Acetic acid

26. C3H8 belongs to the homologous series of -

(a) Alkynes
(b) Alkenes
(c) Alkanes
(d) Cyclo alkanes

27. On complete oxidation, ethanol gives which of the following?

(a) acetic acid/ethanoic acid
(b) CO_2 and water
(c) ethanal
(d) acetone/ethenone

28. An atom of an element has the electronic configuration 2,8,2. To which group does it belong?

(a) 4th group
(b) 6th group
(c) 3rd group
(d) 2nd group

29. Select the oxidizing agent for the following reaction: $H_2S + I_2 > 2HI + S$

(a) I_2
(b) H_2S
(C) HI
(d) S

30. Where would you locate the element with electronic configuration 2, 8 in the Modern Periodic Table?

(a) Group 8
(b) Group 2
(c) Group 18
(d) Group 10

31. The most reactive element of group 17 is-

(a) Oxygen
(b) Sodium
(c) Fluorine
(d) Magnesium

32. _____ is not a Lewis acid.

(a) Aluminum chloride
(b) Sodium ion
(c) Sulphur tetra fluoride
(d) Hydroxide ion

PART – II

Answer any 3 (three) questions from the following: **(2x3=6)**

1. If the product of zeros of the polynomial $ax^2 - 6x - 6$ is 4, find the sum of zeros of the polynomial.

2. For what value of k, will the following pair of linear equations have no solution?
   $2x + 3y = 9$; $6x + (k - 2)\, y = 3k - k$.

3. Which term of the A.P. 8, 14, 20, 26,... will be 72 more than its 41^{st} term?

4. Solve the equation for θ :
   $$\frac{\sin^2\theta}{\tan^2\theta - \sin^2\theta} = 3$$

5. Two dices are rolled once. Find the probability of getting numbers on the faces of dice, whose product is a perfect square.

PART-III

Answer any 5 (five) questions from the following: **(4x5=20)**

6. If one zero of the quadratic polynomial $f(x) = 3x^2 - 8kx + 16x - 9$ is negative of the other, then find the zeros of the polynomial $ax^2 - 4kx + 6$.

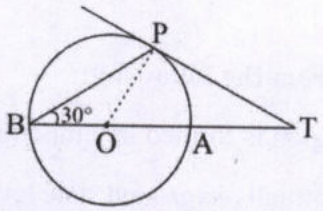
7. A two-digit number is 4 times the sum of its digits. The number formed by reversing its digits is greater than the original number by 27. Find the original number.

8. Find the ratio in which the point P (–1, k) lying on the line segment joining the points A (–3, 10) and B (6, –8) divides it. Also find the value of k.

9. ABC is a right triangle, right angled at B. If the points D and E trisect the side BC, then prove that $3AC^2 + 5AD^2 = 8\ AE^2$.

10. A hemispherical bowl of internal diameter 40 cm contains liquid. This liquid is filled into 80 cylindrical bottles of diameter 6 cm and of similar height. Find the height of the bottle, if 10% of liquid is wasted in this transfer.

11. In the following figure, TP is the tangent to the circle from the external point T. If O is the centre of the circle the line TAB passes through O such that $\angle PBT = 30°$, then prove that BA: AT = 2: 1.



12. The median of the following frequency distribution is 35. Find the value of variate x.

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	2	3	x	6	5	3	2

13. Two fair dice are thrown simultaneously. Find the probability that the number 5 may not come on either dice.

PHYSICS

PART – II

Answer any 3 (three) questions from the following: **(2x3=6)**

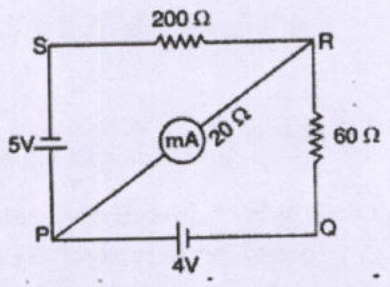
1. Explain how a depletion region is formed in a junction diode.
2. A hydrogen atom which is initially in ground state level absorbs a photon which excited it to the n= 5 level. Determine the frequency of the photon.
3. A coil of 'N' turns and radius 'R' carries a current 'I'. It is unwound and rewound to make a square coil of side 'a' having the same number of turns (N). Keeping the current 'I' same, find the ratio of magnetic moment of the square coil and circular coil.
4. A capacitor of capacitance C is charged to a potential V. What is the total electric flux of the electric field through a closed surface around the capacitor?
5. A jet plane is travelling towards west at a speed of 900 km/h. What is the voltage difference developed between the ends of the wing having a span of 75 m, if the Earth's magnetic field at the location has a magnitude of 5×10^{-4} T and the dip angle is 30^0.

PART – III

Answer any 5 (five) questions from the following: **(4x5=20)**

6. State the Gauss theorem for electric field. Derive the expression of the potential at a point along the axial line of a short electric dipole.

7. (a)The network PQRS, shown in the circuit diagram, has the batteries of 4 V and 5 V and negligible internal resistance. A milliammeter of 20 Ω resistance is connected between P and R. Calculate the reading in the milliammeter.



(b) Explain the term 'drift velocity' of electrons in a conductor.

8. (a) A uniform conducting wire of length 36 A and resistance 5R is wound as a current-carrying coil in the shape of (i) an equilateral triangle of side A (ii) a square of sides A, and (iii) a regular hexagon of sides A. The coil is connected to a voltage source 30V. Find the ratio of magnetic moment of the coils.

   (b) Give one example of para magnetic, dia magnetic and ferro magnetic material.

9. Explain with the help of a labeled diagram, principal and working of a transformer. Deduce the expression for its working formula.

10. (a) A radio can tune in to any station in the 7.5 MHz to 12 MHz band. What is the corresponding wavelength band?

    (b) Name the radiations which are next to these radiations in em Spectrum having: -

    i. Shorter wavelength
    ii. Longer wavelength

11. (a) The threshold frequency for a certain metal is 4.1×10^{14} Hz. If the light of frequency 9.7×10^{11} KHz is incident on the metal, predict the cut-off voltage for the photoelectric emission.

    (b) What do you understand by coherent sources.

12. Draw a plot of the binding energy per nucleon as a function of mass number for a large number of nuclei, $2 \leq A \leq 240$. How do you explain the constancy of binding energy per nucleon in the range $30 < A < 170$ using the property that nuclear force is short-ranged? Using this curve state clearly how the release of energy in the processes of nuclear fission and nuclear fusion can be explained.

13. Explain how p and n type of extrinsic semiconductors are made. Explain the working of rectifier using suitable diagram.

BIOLOGY

PART -II

Answer any 3 (three) questions from the following: **(2x3=6)**

1. Name the pathogens that cause typhoid and tetanus.

2. Why are C4 plants more efficient than C3 plants?

3. Describe the main functions of medulla oblongata and hypothalamus?

4. Explain the role of plasmids in genetic engineering?

5. Name any two fungal species which are used in the production of antibiotics.

PART – III

Answer any 5 (five) questions from the following: **(4x5=20)**

6. List out the differences between Mitosis and Meiosis.

7. Write a note on feedback inhibition giving a suitable example.

8. Explain the function of the organ of Corti?

9. Discuss gene expression and regulation using the lac operon model.

10. Suggest and explain the methods that can assist infertile couples to have children.

11. What do you understand by Biopiracy and patents?

12. What are transgenic animals? Discuss giving an example.

13. What are sacred groves? Highlight their role in conservation.

CHEMISTRY

PART – II

Answer any 3 (three) questions from the following: **(2x3=6)**

1. A solution is prepared by adding 2 gm of a substance A to 18gm of water. Calculate the mass percent of the solute.

2. An atom of an element contains 29 electrons and 35 neutrons. Write the electronic configuration of that element with its symbol. Write the full name and symbol of elements in IUPAC system having atomic number 2.

3. Predict in which of the following, entropy increases/ decreases. Justify your answer.
   (a) A liquid crystallizes into a solid.
   (b) Temperature of a crystalline solid is raised from 0 K to 115k.
   (c) $2\ NaH\ CO_3\ (s) \rightarrow Na2CO_3\ (s) + CO_2\ (g) + H_2O\ (g)$
   (d) $H_2(g) \rightarrow 2H\ (g)$

4. Assign oxidation number of underlined elements in each of the following species.
   (a) $NaH_2\underline{P}O_4$
   (b) $K_2\ \underline{Mn}\ O_4$
   (c) $H_2\underline{S}_2O_7$
   (d) $K_2\underline{Cr}_2O_7$

5. Write the structural formulae and IAPAC names of all possible isomess C_4H_8.

PART – III

Answer any 5 (five) questions from the following: **(4x5=20)**

6. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 gm. What are its empirical and molecular formula?

7. What is meant by the term bond order? Calculate the bond order of N_2, O_2, O_2^+ and O_2^-

8. If water vapour is assumed to be a perfect gas, molar enthalpy changes for vapourization of 1 mol of water at 1 bar and 100^0 C is 41 kJ mol^{-1}. Calculate the internal energy change, when 1 mol of water is vapourized at 1 bar pressure and 100^0C.

9. On the equilibrium of the reaction $2H_2(g)+CO\ (g) \rightleftharpoons CH_3OH\ (g)$
Describe the effect of-

(a) addition of H_2

(b) addition of CH_3OH

(c) removal of CO

(d) removal CH_3OH

10. Balance the following redox reactions by ion – electron method:
$Cr_2O_{7(aq)}^{-2} + SO_2\ (g) \rightarrow Cr^{+3}\ (aq) + SO_{4(aq)}^{-2}$ (in acidic medium)

$Mn\ O4^{-}\ (aq) + I_{(aq)}^{-} \rightarrow MnO_2\ (s) + I_2(s)$ (in basic medium.)

11. What will be the products obtained by ozonolysis of the following compounds?

(a) pent-2-ene

(b) 3- 4 dimethylhept – 3 - ene

(c) 2 ethylbut – 1 - ene

12. Give the reaction and write the mechanism of Fridel Craft alkylation and acylation reactions.

13. A) What are electrophiles and nucleophiles? Explain with examples.
B) Write the chemical equations for combustion of following hydrocarbon-
(i) Butane (ii) Hexyne
