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12th Science  
Board Papers - July 2022

**1. Physics**

**2. Chemistry**

**3. Biology**

**4. Maths**

# BOARD QUESTION PAPER: JULY 2022

## PHYSICS

Time: 3 Hrs.

Max. Marks: 70

**General Instructions:**

The question paper is divided into **four** sections:

- (1) **Section A:** Q. No. 1 contains **Ten multiple choice** type of questions carrying **One mark** each.  
Q. No. 2 contains **Eight very short answer** type of questions carrying **One mark** each.
- (2) **Section B:** Q. No. 3 to Q. No. 14 contain **Twelve short answer** type of questions carrying **Two marks** each. (Attempt **any Eight**).
- (3) **Section C:** Q. No. 15 to Q. No. 26 contain **Twelve short answer** type of questions carrying **Three marks** each. (Attempt **any Eight**).
- (4) **Section D:** Q. No. 27 to Q. No. 31 contain **Five long answer** type of questions carrying **Four marks** each. (Attempt **any Three**).
- (5) Use of the log table is allowed. Use of calculator is **not** allowed.
- (6) Figures to the right indicate full marks.
- (7) For each multiple choice type of question, it is mandatory to write the correct answer along with its alphabet. e.g., (a)...../(b)...../(c)...../(d)..... No marks(s) shall be given, if **ONLY** the correct answer or the alphabet of the correct answer is written. Only the first attempt will be considered for evaluation.
- (8) **Physical Constants:**
  - (i)  $\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}$
  - (ii)  $\sigma = 5.7 \times 10^{-8} \text{ J/m}^2\text{s K}^4$
  - (iii)  $g = 9.8 \text{ m/s}^2$
  - (iv)  $\pi = 3.142$

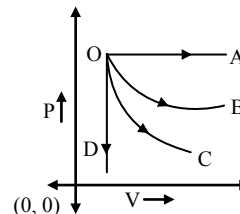
## SECTION – A

**Q.1. Select and write the correct answers for the following multiple choice type of questions:** [10]

- (i) Raindrops are spherical in shape because of \_\_\_\_\_.
 

(a) surface tension	(b) capillarity
(c) downward motion	(d) acceleration due to gravity
- (ii) The average K.E. of a gas is \_\_\_\_\_.
  - (a) directly proportional to absolute temperature of gas
  - (b) directly proportional to square of absolute temperature of gas
  - (c) directly proportional to square root of absolute temperature of gas
  - (d) inversely proportional to absolute temperature of gas
- (iii) A graph of pressure versus volume for an ideal gas for different processes is as shown. In the graph curve OA represents \_\_\_\_\_.
 

(a) isochoric process	(b) isothermal process
(c) isobaric process	(d) adiabatic process
- (iv) Standing waves are produced on a string fixed at both ends. In this case \_\_\_\_\_.
  - (a) all particles vibrate in phase
  - (b) all antinodes vibrate in phase
  - (c) all alternate antinodes vibrate in phase
  - (d) all particles between two consecutive antinodes vibrate in phase



- (v) What changes are observed in a diffraction pattern if the whole apparatus is immersed in water?
- the wavelength of light increases
  - width of central maximum increases
  - width of central maximum decreases
  - frequency of light decreases
- (vi) The magnitude of the magnetic field at the centre of a circular current carrying coil varies \_\_\_\_\_.
- inversely with the square of the radius of the coil
  - directly with the radius of the coil
  - inversely with the radius of the coil
  - directly with the square of the radius of the coil
- (vii) Balmer series is obtained when all transitions of electron terminate on \_\_\_\_\_.
- 2nd orbit
  - 1st orbit
  - 3rd orbit
  - 4th orbit
- (viii) A simple harmonic oscillator has amplitude 16 cm and period 4 seconds. The interval of time required by it to travel from  $x = 16$  cm to  $x = 8$  cm is \_\_\_\_\_.
- $\frac{1}{2}$  second
  - $\frac{2}{3}$  second
  - $\frac{5}{6}$  second
  - $\frac{4}{3}$  second
- (ix) In potentiometer experiment, the cell balances at a length of 240 cm. When the cell is shunted by a resistance of  $2 \Omega$ , the balancing length becomes 120 cm. The internal resistance of the cell is \_\_\_\_\_.
- $4 \Omega$
  - $2 \Omega$
  - $1 \Omega$
  - $0.5 \Omega$
- (x) A small piece of metal wire is dragged across the gap between the pole pieces of magnet in 0.5 second. The magnetic flux between the pole pieces is  $8 \times 10^{-4}$  weber. The emf induced in the wire is \_\_\_\_\_.
- 1.6 millivolt
  - 16 millivolt
  - 1.6 volt
  - 16 volt

**Q.2. Answer the following questions:**

[8]

- In which thermodynamic process the total internal energy of system remains constant?
- State the law of conservation of angular momentum.
- What is shunt?
- What happens to the fringe width in diffraction pattern if the diameter of wire is increased?
- What is perfectly black body?
- State the formula for electric field intensity at a point outside an infinitely long charged cylindrical conductor.
- The half-life of a nuclear species is 1.386 years. Calculate its decay constant per year.
- An automobile engine develops 62.84 kW while rotating at a speed of 1200 rpm. What torque does it deliver?

SECTION – B

Attempt any EIGHT questions of the following:

[16]

- Q.3. What is capillarity? State any two uses of capillarity.
- Q.4. Define: (i) Emissive power  
(ii) Co-efficient of emission
- Q.5. State any two characteristics of progressive waves.
- Q.6. Draw neat, labelled diagram of a parallel plate capacitor with a dielectric slab between the plates.
- Q.7. State the formula for magnetic potential energy of a dipole and hence obtain the minimum and maximum magnetic potential energy.
- Q.8. What is gyromagnetic ratio? Write the necessary expression.
- Q.9. How does the wave theory of light fail to explain the observations from experiment on photoelectric effect.  
[Give any two points]
- Q.10. A system releases 125 kJ of heat while 104 kJ of work is done on the system. Calculate the change in internal energy of the gas.
- Q.11. A plane wavefront of light of wavelength  $4000 \text{ \AA}$  is incident on two slits on a screen perpendicular to the direction of light ray. If the total separation of 10 bright fringes on a screen 2 m away is 2 cm, find the distance between the slits.
- Q.12. An emf of 96.0 mV is induced in the windings of a coil when the current in a nearby coil is increasing at the rate of 1.20 A/s. What is the mutual inductance (M) of the coils?
- Q.13. An aircraft of wing span of 50 m flies horizontally in earth's magnetic field of  $6 \times 10^{-5} \text{ T}$ . Calculate the velocity required to generate an e.m.f. of 1.2 V between the tips of the wings of the aircraft.
- Q.14. The surface density of a uniform disc of radius 10 cm is  $2 \text{ kg/m}^2$ . Find its MI about an axis passing through its centre and perpendicular to its plane.

SECTION – C

Attempt any EIGHT questions of the following:

[24]

- Q.15. State zeroth law of thermodynamics. What are the limitations of first law of thermodynamics?
- Q.16. What is de-Broglie hypothesis? Obtain the relation for de-Broglie wavelength.
- Q.17. Derive an expression for kinetic energy of a rotating body.
- Q.18. Derive the laws of reflection of light using Huygens' theory.
- Q.19. Derive an expression for orbital magnetic moment of an electron revolving around the nucleus in an atom. State the formula for the Bohr magneton.
- Q.20. Explain the terms:  
(a) Capacitive reactance  
(b) Inductive reactance  
(c) Impedance
- Q.21. Define  $\alpha_{dc}$  and  $\beta_{dc}$ . Obtain the relation between them.
- Q.22. A pipe at both the ends has a fundamental frequency of 600 Hz. The first overtone of a pipe closed at one end has the same frequency as the first overtone of the open pipe. How long are the two pipes?  
[Velocity of sound in air = 330 m/s]

- Q.23.** A small particle carrying a negative charge of  $1.6 \times 10^{-19}$  C is suspended in equilibrium between two horizontal metal plates 10 cm apart, having a potential difference of 4000 volts across them. Find the mass of the particle.
- Q.24.** A 1000 mH inductor, 36  $\mu$ F capacitor and 12  $\Omega$  resistor are connected in series to 120 V, 50 Hz AC source. Calculate:
- impedance of the circuit at resonance
  - current at resonance
  - resonant frequency
- Q.25.** A current of equal magnitude flows through two long parallel wires separated by 2 cm. If force per unit length of  $4 \times 10^{-2}$  N/m acts on both the wires respectively, calculate the current through each wire.
- Q.26.** Calculate the energy radiated in half a minute by a black body of surface area 200 cm<sup>2</sup> at 127° C.

**SECTION – D**

**Attempt any THREE questions of the following:**

**[12]**

- Q.27.** Discuss analytically the composition of two linear SHMs having same period and along the same path. Obtain the expression for resultant amplitude. Find the resultant amplitude when the phase difference is
- zero radians
  - $\frac{\pi}{2}$  radians.
- Q.28.** What is a transformer? With the help of a suitable diagram describe working of transformer.
- Q.29.** Define angle of contact. State any two properties of angle of contact. Find the difference of pressure between inside and outside of a spherical water drop of radius 2 mm, if surface tension of water is  $73 \times 10^{-3}$  N/m.
- Q.30.** State Kirchhoff's laws of electrical network. When two cells of emfs  $E_1$  and  $E_2$  are connected in series so as to assist each other, their balancing length on potentiometer wire is found to be 3.2 m. When two cells are connected in series so as to oppose each other, the balancing length is found to be 0.7 m. Compare the emfs of two cells.
- Q.31.** State the first and second postulate of Bohr's atomic model. Compute the ratio of longest wavelengths of Lyman and Balmer series in hydrogen atom.

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# BOARD QUESTION PAPER: JULY 2022

## CHEMISTRY

Time: 3 Hrs.

Max. Marks: 70

**General Instructions:**

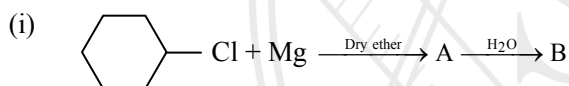
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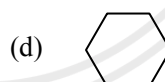
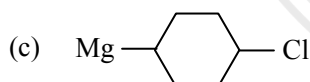
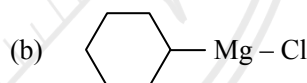
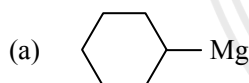
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**SECTION – A**

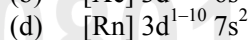
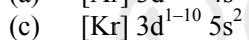
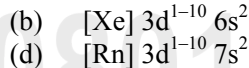
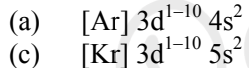
**Q.1. Select and write the correct answer for the following multiple choice type of questions: [10]**



the product 'B' is \_\_\_\_\_.



(ii) General electronic configuration of 3d series of 'd' block elements is \_\_\_\_\_.



(iii) Correct IUPAC name of tert-butyl alcohol is \_\_\_\_\_.

(a) 2-Methyl butan-1-ol

(b) 2-Methyl butan-2-ol

(c) 2-Methyl propan-2-ol

(d) 2-Methyl propan-1-ol

(iv) The standard emf of the following cell at 298K is \_\_\_\_\_.



$$E_{\text{Zn}}^{\circ} = -0.76\text{V}, E_{\text{Cr}}^{\circ} = -0.74\text{V}$$

(a)  $-0.02\text{V}$

(b)  $+0.02\text{V}$

(c)  $-0.2\text{V}$

(d)  $+0.2\text{V}$

(v) In the following oxyacid, chlorine has +7 oxidation state:

(a) HOCl

(b) HClO<sub>2</sub>

(c) HClO<sub>3</sub>

(d) HClO<sub>4</sub>

(vi) The work done during isothermal irreversible expansion of 2 moles of helium from 2dm<sup>3</sup> to 4 dm<sup>3</sup> at 1 bar pressure and at 298K is \_\_\_\_\_.

(a) 2.0 kJ

(b)  $-2.0\text{ kJ}$

(c) 0.2 kJ

(d)  $-0.2\text{ kJ}$

(vii) The correct relation between edge length and radius of an atom in simple cubic lattice is

- (a)  $2a = r$  (b)  $\sqrt{3}a = 4r$   
 (c)  $a = 2r$  (d)  $\sqrt{2}a = 4r$

(viii) Lactose on hydrolysis gives \_\_\_\_\_.

- (a) galactose + glucose (b) 2 molecules of glucose  
 (c) fructose + glucose (d) fructose + galactose

(ix) ZWT in green chemistry stands for:

- (a) zero waiting time (b) zero waste technology  
 (c) zubl water technology (d) zhen wu tang

(x) The most basic amine amongst the following is \_\_\_\_\_.

- (a)  $\text{CH}_3 - \text{NH}_2$  (b)  $(\text{CH}_3)_2 \text{NH}$   
 (c)  $(\text{CH}_3)_3 \text{N}$  (d)  $\text{C}_2\text{H}_5 - \text{NH}_2$

**Q.2. Answer the following questions:**

[8]

- (i) Write relation between molar conductivity and conductivity of solution.  
 (ii) Calculate effective atomic number of  $\text{Co}^{+3}$  in  $[\text{Co}(\text{NH}_3)_6]^{3+}$  complex.  
 (iii) Write the name of reaction during conversion of phenol to salicylic acid.  
 (iv) Write the IUPAC name of  $\alpha$ -methylpropionic acid.  
 (v) Write the formula of Hinsberg's reagent.  
 (vi) Write the name of monomer used for preparation of Nylon 6.  
 (vii) Write cell representation of standard hydrogen electrode.  
 (viii) Write chemical composition of Ziegler-Natta catalyst.

**SECTION – B**

**Attempt any EIGHT of the following questions:**

[16]

**Q.3.** Define:

- (i) Osmotic pressure  
 (ii) Ebullioscopic constant

**Q.4.** The pH of solution is 3.12. Calculate the concentration of  $\text{H}_3\text{O}^+$  ion.

**Q.5.** State Kohlrausch Law of independent migration of ions. Write one application of Kohlrausch Law of independent migration of ions.

**Q.6.** Distinguish between Schottky and Frenkel defect.

**Q.7.** Derive the relationship between  $\Delta H$  and  $\Delta U$  for gas phase reactions.

**Q.8.** What is the action of chlorine on the following:

- (i)  $\text{NH}_3$  (excess)  
 (ii) phosphorous?

**Q.9.** Write the molecular formula of the following minerals:

- (i) chalcopyrite  
 (ii) calamine

**Q.10.** Show that time required for 99.9% completion of a first order reaction is three times the time required for 90% completion.

**Q.11.** Convert ethyl bromide to:

- (i) ethyl iodide  
 (ii) ethyl fluoride

**Q.12.** Explain linkage isomerism in complexes with one example.

**Q.13.** What is the action of the following on carboxylic acid:

- (i)  $\text{SOCl}_2$
- (ii)  $\text{P}_2\text{O}_5$ ?

**Q.14.** Write balanced chemical reactions of the following reagents on carbolic acid:

- (i)  $\text{Br}_2$  water
- (ii) Concentrated  $\text{HNO}_3$

### SECTION – C

**Attempt any EIGHT of the following questions:**

[24]

**Q.15.** Write a note on ‘aldol’ condensation.

**Q.16.** What is a Lanthanoid contraction? Write similarities between lanthanoids and actinoids.

**Q.17.** Calculate the standard enthalpy of formation of  $\text{CH}_3 - \text{OH}$ , if standard heat of combustion of methyl alcohol are  $-726 \text{ kJ mol}^{-1}$ .

Given data:

- (i)  $\text{CH}_3\text{OH}_{(l)} + \frac{3}{2}\text{O}_{2(g)} \rightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)} \quad \Delta H^\circ = -726 \text{ kJ mol}^{-1}$
- (ii)  $\text{C}_{(\text{graphite})} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)} \quad \Delta_c H^\circ = -393 \text{ kJ mol}^{-1}$
- (iii)  $\text{H}_{2(g)} + \frac{1}{2}\text{O}_{2(g)} \rightarrow \text{H}_2\text{O}_{(l)} \quad \Delta_f H^\circ = -286 \text{ kJ mol}^{-1}$

**Q.18.** What happens when:

- (i) Ethene reacts with iodine monochloride.
- (ii) Sulphur dioxide is oxidised in presence of  $\text{V}_2\text{O}_5$ .
- (iii) Cu heated with concentrated  $\text{H}_2\text{SO}_4$

**Q.19.** Calculate the number of atoms and unit cell present in 0.5 g of Niobium if it forms body centred cubic structure. The density of Niobium is  $8.55 \text{ g cm}^{-3}$  and edge length of unit cell is 330.6 pm. Write preparation of glucose from sucrose.

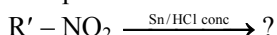
**Q.20.** Define: Nanochemistry.

What happens when vapours of  $1^\circ$  and  $2^\circ$  alcohols are passed over hot Cu metal?

**Q.21.** 5% aqueous solution of cane sugar has freezing point of 271 K. Calculate freezing point of 5% glucose solution.

[Molar mass of cane sugar =  $342 \text{ g mol}^{-1}$ ]

Complete the reaction



**Q.22.** What is denaturation of protein? Derive an expression of Ostwald’s dilution law for weak acid.

**Q.23.** Define: Nanotechnology.

Write any two applications of electrochemical series.

**Q.24.** A chemical reaction occurs in the following steps:

- (i)  $\text{NO}_{2(g)} + \text{F}_{2(g)} \rightarrow \text{NO}_2\text{F}_{(g)} + \text{F}_{(g)}$  (slow)
- (ii)  $\text{F}_{(g)} + \text{NO}_{2(g)} \rightarrow \text{NO}_2\text{F}_{(g)}$  (fast)
  - (a) Write the equation of overall reaction.
  - (b) Write down rate law.
  - (c) Identify the reaction intermediate.

Write chemical reaction for preparation of teflon.

**Q.25.** Define: Elastomer.

Write two postulates of Werner theory of coordinate complexes.

**Q.26.** Write four salient features of  $\text{S}_\text{N}1$  mechanism.

Write chemical reaction for carbylamine test.



SECTION – D

Attempt any THREE of the following questions:

[12]

**Q.27.** The normal boiling point of ethyl acetate is  $77.06^{\circ}\text{C}$ . A solution of 50 g of non-volatile solute in 150 g of ethyl acetate boils at  $84.27^{\circ}\text{C}$ . Evaluate the molar mass of solute if  $K_b$  for ethyl acetate is  $2.77 \text{ K kg mol}^{-1}$ .

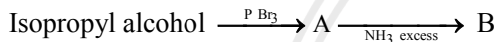
Explain pseudo first order reaction with suitable example.

**Q.28.** Why does aq.  $\text{CuSO}_4$  solution turn blue litmus red?  
Why are compounds of transition metal ions coloured?

**Q.29.** State and explain Hess's law of constant heat summation.  
What are interhalogen compounds?  
Write two uses of neon.

**Q.30.** Explain homoleptic and heteroleptic complexes with examples.  
Convert carboxylic acids to:  
(i) ester  
(ii) acid amide

**Q.31.** Define: Green chemistry.  
Complete the following reaction and identify A and B.



What is the action of hot HI on glucose?

  
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# BOARD QUESTION PAPER: JULY 2022

## MATHEMATICS AND STATISTICS

Time: 3 Hrs.

Max. Marks: 80

**General instructions:**

The question paper is divided into **FOUR** sections.

- (1) **Section A:** Q.1 contains **Eight** multiple choice type of questions, each carrying **Two** marks.  
Q.2 contains **Four** very short answer type questions, each carrying **One** mark.
- (2) **Section B:** Q.3 to Q. 14 contains **Twelve** short answer type questions, each carrying **Two** marks. (Attempt any **Eight**)
- (3) **Section C:** Q.15 to Q. 26 contain **Twelve** short answer type questions, each carrying **Three** marks. (Attempt any **Eight**)
- (4) **Section D:** Q.27 to Q. 34 contain **Eight** long answer type questions, each carrying **Four** marks. (Attempt any **Five**)
- (5) Use of log table is allowed. Use of calculator is not allowed.
- (6) Figures to the right indicate full marks.
- (7) Use of graph paper is not necessary. Only rough sketch of graph is expected.
- (8) For each multiple choice type of question, it is mandatory to write the correct answer along with its alphabet, e.g. (a)..... / (b)..... / (c)..... / (d)....., etc.  
No marks shall be given, if **ONLY** the correct answer or the alphabet of correct answer is written. Only the first attempt will be considered for evaluation.
- (9) Start answer to each section on a new page.

**SECTION – A**

**Q.1. Select and write the correct answer for the following multiple choice type of questions:** **[16]**

- (i) The negation of  $(p \vee \sim q) \wedge r$  is \_\_\_\_\_.  
 (a)  $(\sim p \wedge q) \wedge r$  (b)  $(\sim p \wedge q) \vee r$   
 (c)  $(\sim p \wedge q) \vee \sim r$  (d)  $(\sim p \vee q) \wedge \sim r$  (2)
- (ii)  $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) =$  \_\_\_\_\_.  
 (a)  $\frac{\pi}{6}$  (b)  $\frac{\pi}{3}$  (c)  $\frac{\pi}{2}$  (d)  $\frac{\pi}{4}$  (2)
- (iii) If  $|\vec{a}|=3$  and  $|\vec{b}|=4$ , then value of  $\lambda$  for which  $\vec{a} + \lambda\vec{b}$  is perpendicular to  $\vec{a} - \lambda\vec{b}$  is \_\_\_\_\_.  
 (a)  $\pm \frac{9}{16}$  (b)  $\pm \frac{3}{4}$  (c)  $\pm \frac{16}{9}$  (d)  $\pm \frac{4}{3}$  (2)
- (iv) The equation of plane passing through  $(2, -1, 3)$  and making equal intercepts on the co-ordinate axes is \_\_\_\_\_.  
 (a)  $x + y + z = 1$  (b)  $x + y + z = 2$   
 (c)  $x + y + z = 3$  (d)  $x + y + z = 4$  (2)
- (v) The equation of tangent to the curve  $y = 1 - e^{\frac{x}{2}}$  at the point of intersection with Y-axis is \_\_\_\_\_.  
 (a)  $x + 2y = 0$  (b)  $2x + y = 0$   
 (c)  $x - y = 2$  (d)  $x + y = 2$  (2)
- (vi) The area of the region bounded by the curve  $y = \sin x$ , X-axis and lines  $x = 0, x = \frac{\pi}{2}$  is \_\_\_\_\_ sq. units.  
 (a) 2 (b) 3 (c) 4 (d) 1 (2)

(vii) The differential equation of  $y = c^2 + \frac{c}{x}$  is \_\_\_\_\_.

(a)  $x^4 \left( \frac{dy}{dx} \right)^2 - x \frac{dy}{dx} = y$

(b)  $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$

(c)  $x^3 \left( \frac{dy}{dx} \right)^2 + x \frac{dy}{dx} = y$

(d)  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - y = 0$  (2)

(viii) If the mean and variance of a Binomial distribution are 18 and 12 respectively then value of n is \_\_\_\_\_.

- (a) 36 (b) 54 (c) 18 (d) 27 (2)

**Q.2. Answer the following questions:**

[4]

(i) If the statement p, q are true statements and r, s are false then determine the truth value of  $(p \rightarrow q) \vee (r \rightarrow s)$ . (1)

(ii) Find the direction cosines of the vector  $\hat{i} + 2\hat{j} - 2\hat{k}$ . (1)

(iii) Evaluate:  $\int \frac{1}{x \log x} dx$ . (1)

(iv) Write the degree of the differential equation

$\frac{dy}{dx} + \frac{3xy}{\frac{dy}{dx}} = \cos x$  (1)

**SECTION - B**

**Attempt any EIGHT of the following questions:**

[16]

**Q.3.** Without using truth table prove that:

$\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$  (2)

**Q.4.** Find the inverse of the matrix  $A = \begin{bmatrix} 1 & 3 \\ 2 & 7 \end{bmatrix}$  (2)

**Q.5.** Find the principal solutions of  $\sin \theta = \frac{1}{2}$ . (2)

**Q.6.** Find k if one of the lines given by  $6x^2 + kxy + y^2 = 0$  is  $2x + y = 0$  (2)

**Q.7.** Show that the points A(4, 5, 2), B(3, 2, 4) and C(5, 8, 0) are collinear. (2)

**Q.8.** Find the cartesian equation of the line passing through the point A(2, 1, -3) and perpendicular to the vectors  $\vec{b} = \hat{i} + \hat{j} + \hat{k}$  and  $\vec{c} = \hat{i} + 2\hat{j} - \hat{k}$ . (2)

**Q.9.** If  $y = \tan^{-1} \left( \frac{8x}{1-15x^2} \right)$  then find  $\frac{dy}{dx}$ . (2)

**Q.10.** Evaluate:  $\int \frac{1}{25-9x^2} dx$  (2)

**Q.11.** Evaluate:  $\int_{-3}^3 \frac{x^3}{9-x^2} dx$  (2)

**Q.12.** Find the area of the region bounded by the curve  $y = x^2$  and the line  $y = 9$ . (2)

**Q.13.** A particle is moving along the X-axis. Its acceleration at time t is proportional to its velocity at that time. Find the differential equation of the motion of the particle. (2)

**Q.14.** In a meeting 70% of the members favour and 30% oppose a certain proposal. A member is selected at random and we take  $X = 0$  if he opposes, and  $X = 1$  if he is in favour. Find  $E(X)$  and  $Var(X)$ . (2)

## SECTION – C

Attempt any EIGHT of the following questions:

[24]

Q.15. Examine whether the statement pattern  $(p \rightarrow q) \leftrightarrow (\sim p \vee q)$  is a tautology, contradiction or contingency. (3)

Q.16. In  $\Delta ABC$ , with usual notations prove that  $a^2 = b^2 + c^2 - 2bc \cos A$ . (3)

Q.17. In  $\Delta ABC$ ,  $A = 45^\circ$ ,  $B = 60^\circ$ , then find the ratio of its sides. (3)

Q.18. Find the volume of the tetrahedron whose vertices are  $A(-1, 2, 3)$ ,  $B(3, -2, 1)$ ,  $C(2, 1, 3)$  and  $D(-1, -2, 4)$ . (3)

Q.19. Find the angle between two lines:

$$\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + 2\hat{j} + \hat{k}) \quad \text{and} \quad \vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda'(\hat{i} + 2\hat{j} + 2\hat{k}) \quad (3)$$

Q.20. Find the vector equation of the plane passing through the points  $A(-2, 7, 5)$  and parallel to the vectors  $4\hat{i} - \hat{j} + 3\hat{k}$  and  $\hat{i} + \hat{j} + \hat{k}$ . (3)

Q.21. Find the derivative of  $\cos^{-1}x$  w.r.t.  $\sqrt{1-x^2}$ . (3)

Q.22. If  $f(x) = 3x + \frac{1}{3x}$  find the values of  $x$  for which function  $f(x)$  is decreasing. (3)

Q.23. Evaluate:  $\int e^{\sin^{-1}x} \left( \frac{x + \sqrt{1-x^2}}{\sqrt{1-x^2}} \right) dx$  (3)

Q.24. Solve the differential equation  $(x + 1) \frac{dy}{dx} - 1 = 2e^{-y}$ . Also find particular solution when  $y = 0, x = 1$ . (3)

Q.25. Find expected value and variance of  $X$ , where  $X$  is number obtained on the uppermost face when a fair die is thrown. (3)

Q.26. It is known that 10% of certain articles manufactured are defective. What is the probability that in a random sample of 12 such articles 9 articles are defective? (3)

## SECTION – D

Attempt any FIVE of the following questions:

[20]

Q.27. Solve the following system of equations by method of inversion.

$$x + y + z = -1, y + z = 2, x + y - z = 3. \quad (4)$$

Q.28.  $\Delta OAB$  is formed by the lines  $x^2 - 4xy + y^2 = 0$  and the line  $2x + 3y - 1 = 0$ . Find the equation of the median of the triangle drawn from origin  $O$ . (4)

Q.29. If  $\vec{a}, \vec{b}, \vec{c}$  are three non co-planar vectors, then prove that any vector  $\vec{r}$  in the space can be uniquely expressed as a linear combination of  $\vec{a}, \vec{b}, \vec{c}$ . (4)

Q.30. Solve the following L.P.P. graphically

$$\begin{aligned} \text{Maximize} \quad & z = 4x + 3y \\ \text{Subject to} \quad & 3x + y \leq 15, \\ & 3x + 4y \leq 24, \\ & x \geq 0, y \geq 0 \end{aligned} \quad (4)$$

Q.31. If  $y = f(x)$  is a differentiable function of  $x$  on interval  $I$  and  $y$  is one-one, onto and  $\frac{dy}{dx} \neq 0$  on  $I$ . Also

$$\text{if } f^{-1}(y) \text{ is differentiable function on } f(I) \text{ then prove that: } \frac{dx}{dy} = \frac{1}{\frac{dy}{dx}} \text{ where } \frac{dy}{dx} \neq 0$$

Hence find the derivative of the inverse of function  $y = 2x^3 - 6x$ . (4)

**Q.32.** Prove that:  $\int \sqrt{a^2 - x^2} \, dx = \frac{x}{2} \sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \left( \frac{x}{a} \right) + c.$  (4)

**Q.33.** The profit function  $p(x)$  of a firm selling  $x$  items per day is given by  $p(x) = (150 - x)x - 1625$ . Find the number of items the firm should manufacture per day to get maximum profit. Also find the maximum profit. (4)

**Q.34.** Evaluate:  $\int_0^a \frac{1}{x + \sqrt{a^2 - x^2}} \, dx$  (4)



# BOARD QUESTION PAPER: JULY 2022

## BIOLOGY

Time: 3 Hrs.

Max. Marks: 70

**General Instructions:**

The question paper is divided into **four** sections.

- (1) **Section A:** Q. No. 1 contains **Ten multiple choice** type of questions carrying **one** mark each.
  - (i) For each **multiple choice type of question**, it is mandatory to write the correct answer along with its alphabet, e.g., **(a) ..... / (b) ..... / (c) ..... / (d) ..... etc.** No mark/s shall be given if **ONLY** the correct answer or alphabet of the correct answer is written.
  - (ii) In case of **MCQ**, evaluation will be done for the **first attempt** only.  
Q. No. 2 contains **Eight very short answer** type of questions carrying **one** mark each.
- (2) **Section B:** Q. No. 3 to 14 are **short answer** type of questions carrying **two** marks each.
- (3) **Section C:** Q. No. 15 to 26 are **short answer** type of questions carrying **three** marks each.
- (4) **Section D:** Q. No. 27 to 31 are **long answer** type of questions carrying **four** marks each.
- (5) Begin the answer of each section on a new page.

**SECTION – A**

**Q.1. Select and write the correct answer for the following multiple choice type of questions:**

[10]

- (i) In lac operon the structural gene z codes for \_\_\_\_\_ enzyme.
 

(a) $\beta$ -galactosidase	(b) $\beta$ -galactoside permease
(c) transacetylase	(d) RNA polymerase
- (ii) The special hygroscopic tissue found in the aerial roots of some epiphytic plants is \_\_\_\_\_.
 

(a) velamen	(b) epiblema
(c) endodermis	(d) xylem
- (iii) Due to specific mating behaviour, the members of population do not mate in \_\_\_\_\_ type of isolation.
 

(a) Ecological	(b) Seasonal
(c) Ethological	(d) Mechanical
- (iv) The sequence of nitrogenous bases on DNA molecule is ATCGA. Which of the following is the correct complementary sequence of nitrogenous bases on mRNA Molecule?
 

(a) TAGCT	(b) TAGCA
(c) UAGCU	(d) UACGU
- (v) The oral vaccine for prevention of typhoid recommended by WHO is \_\_\_\_\_.
 

(a) typhoid polysaccharide	(b) typhin V
(c) typherix	(d) Ty2la
- (vi) The large holes in Swiss cheese are developed due to the production of large amounts of \_\_\_\_\_.
 

(a) O <sub>2</sub>	(b) CO <sub>2</sub>
(c) N <sub>2</sub>	(d) H <sub>2</sub>
- (vii) Miyawaki is a method of plantation adapted by the government for the project mission Harit Kranti from the country.
 

(a) Japan	(b) Bhutan
(c) China	(d) America
- (viii) In ecological succession, the \_\_\_\_\_ community does not evolve further.
 

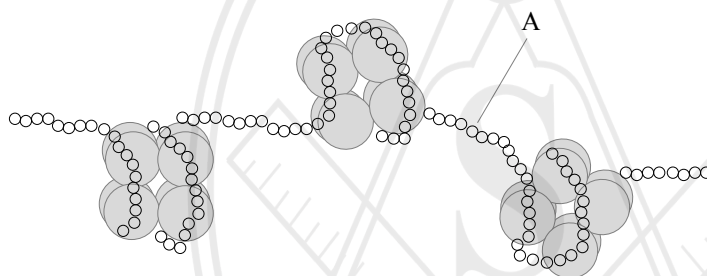
(a) seral	(b) pioneer
(c) intermediate	(d) climax

- (ix) Which of the following sets or organisms are used as cloning organisms in plant biotechnology?
- (a) *E.coli* and *Rhizobium* (b) *E.coli* and *Agrobacterium tumefaciens*  
 (c) *Azobacterium* and *Rhizobium* (d) *E.coli* and *Azobacterium*
- (x) *Aspergillus niger* is the microbial source of \_\_\_\_\_.
- (a) Vitamin C (b) Vitamin B<sub>2</sub>  
 (c) Vitamin B<sub>12</sub> (d) Vitamin B<sub>6</sub>

**Q.2. Answer the following questions:**

[8]

- (i) Write the name of the small molecule required to initiate / start the process of synthesis of new complementary strand during replication of DNA.
- (ii) Name the country where industrial melanism was observed in moths due to industrialization.
- (iii) Give the other name for epidermal cells in roots of plants.
- (iv) Name the hormone used for early rooting in propagation by cutting.
- (v) In human pharynx, there is a set of lymphoid organs called \_\_\_\_\_.
- (vi) State the other name for Dentist's nerve.
- (vii) Name the type of Mycorrhiza that grows in between and within the cortical cells of root.
- (viii) Identify the part labelled 'A' in the given diagram:

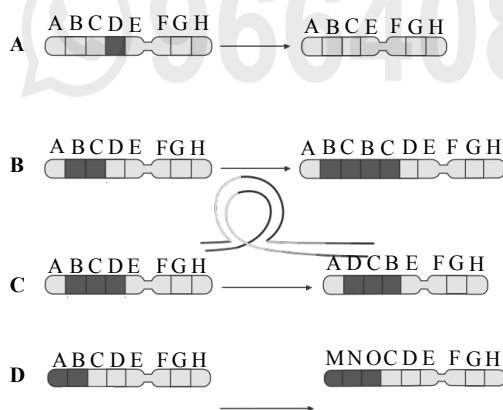


**SECTION – B**

**Attempt any EIGHT of the following questions:**

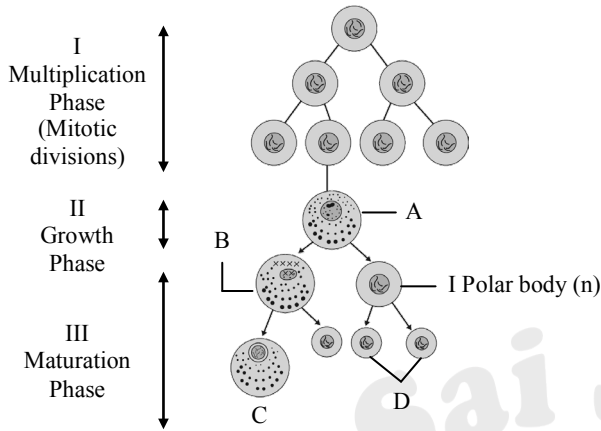
[16]

- Q.3.** Sketch and label the diagram of ovule most commonly seen in angiosperms.
- Q.4.** Explain "Law of dominance" with suitable example.
- Q.5.** A woman is unable to conceive due to blockage in her upper segment of oviduct. State the infertility treatment to be given to her and describe it.
- Q.6.** Identify the types of chromosomal aberrations in the following figures A, B, C, D:



- Q.7.** The process of transcription takes place on a part of DNA molecule known as transcription unit. Draw a well labelled diagram of the same showing different regions of the unit.

Q.8. Identify labels A, B, C, D:



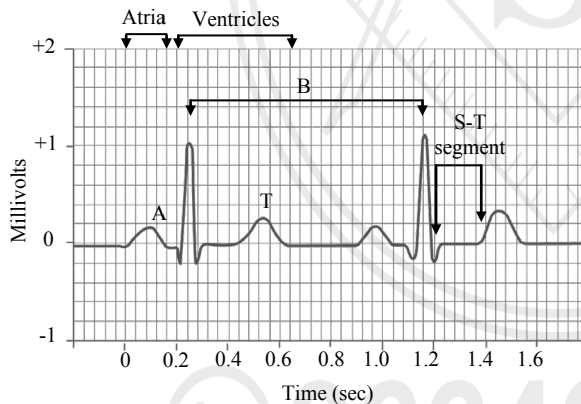
Q.9. Match the pairs and rewrite:

Column I		Column II	
(a)	Connecting link between ape and man	(1)	<i>Homo erectus</i>
(b)	Ape man	(2)	<i>Homo habilis</i>
(c)	Handy man like	(3)	Neanderthal man
(d)	Advanced prehistoric man	(4)	<i>Australopithecus</i>

Q.10. Define polyembryony. State its different types.

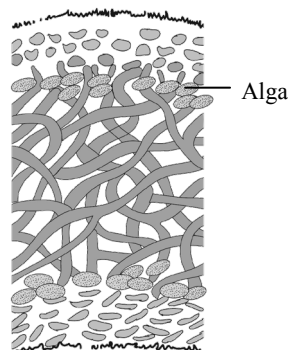
Q.11. Which are the major abiotic factors that influence habitat?

Q.12. Identify A and B in the given diagram and explain T wave.



Q.13. Water acts as a thermal buffer. Justify the statement.

Q.14. The following diagram indicates which type of interaction? Write a note on the same.





SECTION – C

Attempt any EIGHT of the following questions:

[24]

- Q.15. Suresh is doing his studies on a plant related to absorption of water. He found different forms of water available in the soil.
- Name them.
  - Which form of water is absorbed by the plants?
  - Name the region in the soil from where roots absorb water.
- Q.16. Name the stress hormone in plants. Describe its physiological effects.
- Q.17. (a) Sketch and label the diagram of brain to show ventricles in coronal plane.  
 (b) Name the cavity which is continuation of IV ventricle.
- Q.18. Complete the following chart and rewrite:

Blood Group	Genotype	Antigen on the Surface of RBC	Antibody in serum
A	$I^A I^A$ or $I^A I^O$	–	–
–	$I^B I^B$ or $I^B I^O$	B	a
AB	–	A and B	(Nil)
–	$I^O I^O$	(Nil)	–

- Q.19. Explain the various steps of biogas production.
- Q.20. How ‘melt in mouth’ vaccines are administered? Mention any two benefits of the same.
- Q.21. Enumerate or enlist the various levels of biodiversity. Explain any one of it.
- Q.22. Write down various sequential stages of hydrarch succession in plants after phytoplankton stage.
- Q.23. With the help of a suitable example, write the mechanism of hormone action through membrane receptors.
- Q.24. Classify the given proteins produced by rDNA technology to treat various diseases in human and rewrite as shown in the table:

Disorders / Diseases / Health Conditions	Recombinant Protein (s)
Atherosclerosis Anaemia Parturition Blood clots Diabetes Haemophilia A Haemophilia B	Platelet derived growth factor
(Factor VIII, Insulin, Relaxin, Factor IX, Erythropoietin, Tissue plasminogen activator)	

- Q.25. Write a note on transport of carbon dioxide by bicarbonate ions at tissue level.
- Q.26. Anita observed apical dominance in her plant. Name and describe the plant hormone that will reverse the effect.

SECTION – D

Attempt any THREE of the following questions:

[12]

- Q.27. (a) Kabban Park in Bengaluru is having dull flowers with strong fragrance, abundant nectar and edible pollen grains. Identify the type of pollination, the flowers are adapted for.  
 (b) The process of fruit formation without fertilization is termed as \_\_\_\_\_.  
 (c) Differentiate between albuminous and exalbuminous seeds.
- Q.28. Give reasons :
- Though fertilization takes place in the ampulla of fallopian tube, implantation of embryo takes place after reaching the uterus only.
  - Corpus luteum persists in the ovary after fertilization.
  - Explain the role of oxytocin hormone and describe the dilation stage of parturition.

- Q.29.** Give the graphic representation of back cross and test cross. Differentiate between them.
- Q.30.** (a) Name the nerve fibres internally connecting the cerebral hemispheres.  
(b) Name the sulci which divide each cerebral hemisphere into 4 lobes.  
(c) Describe the various functional areas found in the different lobes of cerebral hemispheres.
- Q.31.** (a) Describe the structure of lymphocytes and mention its types.  
(b) Name the disorder caused due to abnormal and uncontrolled increase in number of WBCs.  
(c) State the functions of neutrophils.

