



6th  
International  
Olympiad of  
Science



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## Question Paper

**CLASS - 12** Duration : 60 Minutes Total Questions : 40 Maximum Marks :100

**SCIENCE**

**1<sup>st</sup> Level**

iOS Roll Number

Student's Name

**TEST PAPER TYPE**

**AA**

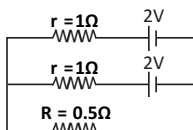
### INSTRUCTIONS

- Write your 12 digit iOS roll number and your name on top of the question paper in the given space.
- Filling up improper roll number may lead to unavailability of 'Result'.
- This question paper consist of 40 questions. Each question carries equal marking of 2.5 marks each.
- This paper is divided into 4 sections. Section A and B are compulsory for all the candidates. However section C and D are to be answered by the candidates as per their choice of subject, i.e. either Mathematics or Biology.
- Mark your answer (A, B, C, D or E) on the Answer Sheet with Pencil or Black/Blue Ball point Pen.
- This question paper contains 5 pages.
- Do not start attempting the test paper until you are asked to do so.
- Time taken by individual student to complete the paper will be one of the criteria for tie-breaker, if any.

**Note: Return this question paper along with answer sheet**

### SECTION - A | PHYSICS

- In the circuit shown in the figure given below, there are two identical batteries each of e.m.f. 2V and internal resistance  $1\ \Omega$  which are used to produce heat in a resistance  $R = 0.5\ \Omega$ . The maximum power that can be developed across R is:



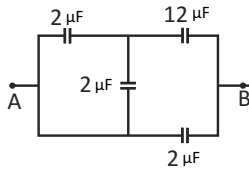
- (A) 0.72 W (B) 1.28 W  
(C) 2.00 W (D) 4.72 W  
(E) None of these

- If a current carrying metal wire of diameter 2 mm produces a maximum magnetic field of magnitude  $2 \times 10^{-3}\ \text{T}$ , then the current in the wire is:

- (A) 10 A (B) 20 A  
(C) 40 A (D)  $40\sqrt{2}\ \text{A}$   
(E) None of these

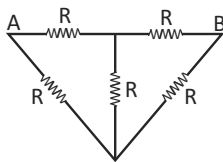
- In the region around a charge at rest, there is:
  - Magnetic field only
  - Electric field only
  - Neither electric nor magnetic field
  - Electric as well as magnetic field
  - None of these
- An electric dipole placed with its axis inclined at an angle to the direction of a uniform electric field experiences:
  - A force but no torque
  - A torque but no force
  - A force as well as a torque
  - Neither a force nor a torque
  - None of these
- When a ray of light enters a glass slab from air, its wavelength:
  - Decreases
  - Increases
  - Remains same
  - All of these
  - None of these

6. In the figure given below, four capacitors are connected. The effective capacitance between points A and B will be:



- (A)  $3 \mu\text{F}$  (B)  $4 \mu\text{F}$   
 (C)  $5 \mu\text{F}$  (D)  $6 \mu\text{F}$   
 (E) None of these

7. In a circuit shown in the given figure, the equivalent resistance between points A and B is:



- (A)  $\frac{3R}{4}$  (B)  $\frac{R}{2}$   
 (C)  $\frac{5R}{8}$  (D)  $2R$   
 (E) None of these

8. The innermost orbit of the hydrogen atom has a diameter of  $1.06 \text{ \AA}$ . What is the diameter of the tenth orbit?

- (A)  $5.3 \text{ \AA}$  (B)  $10.6 \text{ \AA}$   
 (C)  $53 \text{ \AA}$  (D)  $106 \text{ \AA}$   
 (E) None of these

9. A single-slit diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light?

- (A) There is no change in the diffraction pattern  
 (B) Diffraction fringes become narrower and crowded together  
 (C) Diffraction fringes become broader and farther apart  
 (D) The diffraction pattern disappears  
 (E) None of these

10. The radius of a nucleus is:

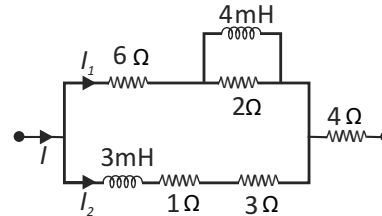
- (A) Proportional to its mass number  
 (B) Inversely proportional to its mass number  
 (C) Proportional to the cube root of its mass number  
 (D) Not related to its mass number  
 (E) None of these

11. Particle A has a charge  $+q$  and particle B has a charge  $+4q$ , each having the same mass  $m$ . What will be ratio of their speed  $v_A/v_B$ , if they are allowed to fall

from rest through the same potential difference?

- (A) 2 : 1 (B) 1 : 2  
 (C) 1 : 4 (D) 4 : 1  
 (E) None of these

12. In the circuit shown in figure given below,  $I_2 = 3 \text{ A}$  in the steady state. Find the potential difference across the  $4 \Omega$  resistor.

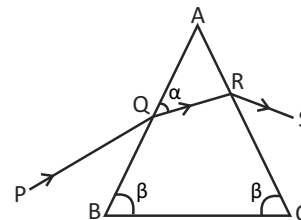


- (A) 12 V (B) 18 V  
 (C) 20 V (D) 24 V  
 (E) None of these

13. The magnifying power of a compound microscope is high when:

- (A) Both objective and eye-piece have long focal lengths  
 (B) Both objective and eye-piece have short focal lengths  
 (C) The objective has a long focal length and eye-piece has a short focal length  
 (D) The objective has a short focal length and the eye-piece has a long focal length  
 (E) None of these

14. A ray of light PQ is incident on an isosceles glass prism placed on a horizontal table. If the prism is in the minimum deviation position for the ray PQ, which of the following is true?



- (A)  $\alpha = \beta$  (B)  $\alpha > \beta$   
 (C)  $\alpha < \beta$  (D)  $\alpha + \beta = 90^\circ$   
 (E) None of these

15. What is the effect on the interference fringes in Young's double slit experiment if the width of the two slits are increased?

- (A) The fringe width increases  
 (B) The fringe width decreases  
 (C) The bright fringe are equally bright and equally spaced  
 (D) The bright fringes are no longer equally bright and equally spaced  
 (E) None of these

## SECTION - B | CHEMISTRY

16. In which one of the following mode of expression the concentration of a solution remains independent of temperature?

- (A) Molality  
(B) Normality  
(C) Formality  
(D) Molarity  
(E) None of these

17. The radioactive decay follows:

- (A) Zero-order kinetics  
(B) First-order kinetics  
(C) Second-order kinetics  
(D) Third-order kinetics  
(E) None of these

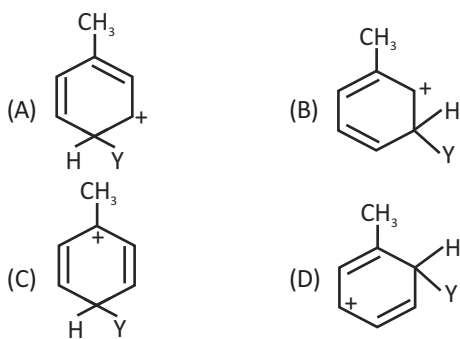
18. Which one of the following is the outer electronic configuration of copper?

- (A)  $(3d)^{10}(4s)^0$  (B)  $(3d)^9(4s)^2$   
(C)  $(3d)^{10}(4s)^1$  (D)  $(3d)^{10}(4s)^2$   
(E) None of these

19. Which one of the following colloidal system represents a sol?

- (A) Solid in gas  
(B) Solid in liquid  
(C) Liquid in solid  
(D) Liquid in gas  
(E) None of these

20. Which one of the following carbocations is expected to be most stable?



(E) None of these

21. Which one of the following ores contains both iron and copper?

- (A) Chalcopyrite (B) Azurite  
(C) Dolomite (D) Malachite  
(E) None of these

22. Which one of the following complex ions possesses  $dsp^2$  hybridization?

- (A)  $[\text{Ni}(\text{PF}_3)_4]$  (B)  $[\text{Ni}(\text{CO})_4]$   
(C)  $[\text{NiCl}_4]^{2-}$  (D)  $[\text{Ni}(\text{CN})_4]^{2-}$   
(E) None of these

23. One Curie of radioactivity is equal to:

- (A)  $6.7 \times 10^{10}$  disintegrations/s  
(B)  $5.7 \times 10^9$  disintegrations/s  
(C)  $3.7 \times 10^{10}$  disintegrations/s  
(D)  $4.7 \times 10^{11}$  disintegrations/s  
(E) None of these

24. In the chemical reaction,  $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ , the pressure of  $\text{CO}_2(\text{g})$  depends on:

- (A) The mass of  $\text{CaCO}_3(\text{s})$   
(B) Temperature of the system  
(C) The masses of both  $\text{CaCO}_3(\text{s})$  and  $\text{CaO}(\text{s})$   
(D) The mass of  $\text{CaO}(\text{s})$   
(E) None of these

25. A current of 13.4 A is passed through 1.0 L of 1.0 M HCl solution for 1.0 h. The volume of gases evolved would be about:

- (A) 11200 mL  
(B) 14900 mL  
(C) 18600 mL  
(D) 22400 mL  
(E) None of these

26. In the reaction  $\text{CH}_3 - \underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}} - \underset{\text{OH}}{\text{CH}_2} \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{X}$ , the

product X is:

- (A)  $\text{CH}_3 - \underset{\text{CH}_3}{\text{C}} = \text{CH}_2$  (B)  $\text{CH}_3 - \underset{\text{H}}{\text{C}} = \underset{\text{H}}{\text{C}} - \text{CH}_3$   
(C)  $\text{CH}_3 - \text{CH}_2 - \underset{\text{CH}_3}{\text{C}} = \text{O}$  (D)  $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CHO}$   
(E) None of these

27. If the equilibrium constant of the reaction  $\text{SO}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightleftharpoons \text{SO}_3(\text{g})$  is  $4 \times 10^{-3} \text{ atm}^{-1/2}$ , then the

equilibrium constant of the reaction  $2\text{SO}_3(\text{g}) \rightleftharpoons 2\text{SO}_2(\text{g}) + \text{O}_2(\text{g})$  would be:

- (A)  $6.25 \times 10^4 \text{ atm}$   
(B)  $8 \times 10^3 \text{ atm}$   
(C)  $0.25 \times 10^2 \text{ atm}$   
(D)  $2.25 \times 10^4 \text{ atm}$   
(E) None of these

28. Which one of the following results is observed when potassium thiocyanate is added to a solution of  $\text{CuSO}_4$ ?

- (A) There is precipitation of black-coloured  $\text{Cu}(\text{SCN})_2$   
(B) There is precipitation of blue-coloured  $\text{Cu}(\text{SCN})_2$   
(C) There is precipitation of red-coloured  $\text{Cu}(\text{SCN})_2$   
(D) There is no precipitation of  $\text{Cu}(\text{SCN})_2$   
(E) None of these

29. Which one of the following orders regarding nucleophilicity is correct?

- (A)  $\text{CH}_3\text{O}^- > \text{CH}_3\text{COO}^- > \text{HO}^-$   
 (B)  $\text{HO}^- > \text{CH}_3\text{COO}^- > \text{CH}_3\text{O}^-$   
 (C)  $\text{HO}^- > \text{CH}_3\text{O}^- > \text{CH}_3\text{COO}^-$   
 (D)  $\text{CH}_3\text{O}^- > \text{HO}^- > \text{CH}_3\text{COO}^-$   
 (E) None of these

30. Which one of the following compound gives the most stable carbonium ion on dehydration?

- (A)  $\text{CH}_3-\text{CH}(\text{CH}_3)-\text{CH}_2\text{OH}$   
 (B)  $\text{CH}_3-\text{C}(\text{CH}_3)_2-\text{OH}$   
 (C)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
 (D)  $\text{CH}_3-\text{CH}(\text{OH})-\text{CH}_2\text{CH}_3$   
 (E) None of these

### SECTION - C | MATHEMATICS

31. If  $f(x) = \frac{1-x}{1+x}$ , then  $f[f(\cos 2\theta)] =$

- (A)  $\tan 2\theta$   
 (B)  $\sec 2\theta$   
 (C)  $\cos 2\theta$   
 (D)  $\cot 2\theta$   
 (E) None of these

32. If the events A and B are mutually exclusive, then

- $P\left(\frac{A}{B}\right) =$   
 (A)  $\frac{P(A \cap B)}{P(B)}$  (B) 1  
 (C)  $\frac{P(A \cap B)}{P(A)}$  (D) 0  
 (E) None of these

33.  $\frac{d}{dx} \log(\log x) =$

- (A)  $\frac{x}{\log x}$  (B)  $(x \log x)^{-1}$   
 (C)  $\frac{\log x}{x}$  (D)  $\log x$   
 (E) None of these

34. If  $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ , then A is:

- (A) Non-singular (B) Skew-symmetric  
 (C) Symmetric (D) Singular  
 (E) None of these

35. If  $2\cos^{-1} \sqrt{\frac{1+x}{2}} = \frac{\pi}{2}$ , then  $x =$

- (A) 1 (B)  $-\frac{1}{2}$   
 (C) 0 (D)  $\frac{1}{2}$   
 (E) None of these

36. If  ${}^n P_5 = 9 \times {}^{n-1} P_4$ , then the value of n is:

- (A) 6 (B) 8  
 (C) 9 (D) 5  
 (E) None of these

37.  $y = 4 \sin 3x$  is a solution of the differential equation

- (A)  $\frac{dy}{dx} + 8y = 0$   
 (B)  $\frac{dy}{dx} - 8y = 0$   
 (C)  $\frac{d^2 y}{dx^2} + 9y = 0$   
 (D)  $\frac{d^2 y}{dx^2} - 9y = 0$   
 (E) None of these

38. If  $y = A \cos nx + B \sin nx$ , then  $\frac{d^2 y}{dx^2} =$

- (A)  $n^2 y$  (B)  $-y$   
 (C)  $-n^2 y$  (D)  $x$   
 (E) None of these

39.  $\int x \sec^2 x dx =$

- (A)  $x \tan x + \log \cos x + c$   
 (B)  $\frac{x^2}{2} \sec^2 x + \log \cos x + c$   
 (C)  $\tan x + \log \sec x + c$   
 (D)  $\tan x + \log \cos x + c$   
 (E) None of these

40. Consider the following relation:

- (1)  $A - B = A - (A \cap B)$   
 (2)  $A = (A \cap B) \cup (A - B)$   
 (3)  $A - (B \cap C) = (A - B) \cup (A - C)$

Which of these is/are correct:

- (A) 1 and 2 (B) 2 only  
 (C) 2 and 3 (D) 1 and 3  
 (E) None of these

## SECTION - D | BIOLOGY

31. In any food chain the largest population is that of:

- (A) Primary consumers  
 (B) Tertiary consumers  
 (C) Producers  
 (D) Decomposers  
 (E) None of these

32. The most stable ecosystem is:

- (A) Forest (B) Mountain  
 (C) Ocean (D) Desert  
 (E) None of these

33. Which one of the following reproduces by multiple fission?

- (A) Planaria (B) Plasmodium  
 (C) Hydra (D) All of these  
 (E) None of these

34. In modern synthetic theory the unit of evolution is:

- (A) Population (B) Species  
 (C) Genus (D) Individual  
 (E) None of these

35. What is the cotyledon of maize embryo called?

- (A) Plumule (B) Radicle  
 (C) Scutellum (D) Aleurone layer  
 (E) None of these

36. Concept of genetic drift was introduced by:

- (A) Julian Huxley (B) Hardy-Weinberg  
 (C) Sewall Wright (D) G.G. Simpson  
 (E) None of these

37. Which phase of meiosis is most directly related to the law of independent assortment?

- (A) Anaphase II (B) Prophase II  
 (C) Metaphase I (D) Metaphase II  
 (E) None of these

38. Extranuclear inheritance is a consequence of presence of genes in:

- (A) Endoplasmic reticulum and mitochondria  
 (B) Ribosomes and chloroplast  
 (C) Chloroplasts and mitochondria  
 (D) Lysosomes and ribosomes  
 (E) None of these

39. Genes A and B are essential for normal hearing. A deaf man marries a deaf woman and all their children have normal hearing. The genotypes of parents are:

- (A) AA bb and aa BB (B) Aa bb and aa Bb  
 (C) AA bb and AA bb (D) aa BB and aa Bb  
 (E) None of these

40. Which one of the following is not a hermaphrodite?

- (A) Blood fluke (B) Tapeworm  
 (C) Liver fluke (D) Earthworm  
 (E) None of these

