

2021-22



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## National Level Science Talent Search Examination

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### CLASS XII (PCB)

Please fill the following details immediately

Name \_\_\_\_\_

Hall Ticket No. \_\_\_\_\_

**Questions : 60**

**Time : 60 minutes**

#### INSTRUCTIONS

**Read all instructions carefully before attempting any question.**

- Ensure that the 'Class' printed here and inside, is the same as the test you are appearing for.
- You must complete the paper within the time allotted.
- Do not open this question paper until you are permitted to.
- You are not allowed to use a calculator.
- Figures herein are not to scale. Hence, you cannot depend on the estimate of size or measurement. Use your knowledge of the subject.
- Rough work shall be carried out only in the space provided for the same throughout this booklet. No separate sheets are allowed for the same.
- Return your answer sheet to the invigilator soon after completion and before leaving the examination hall. Take the question paper with you.
- There is no negative marking.
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**UCN/QP-XII(PCB)/01**



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**01** Dichloro-diphenyl-trichloroethane (DDT), a pesticide, has been largely replaced by other compounds. Why is this so ?

- (A) It becomes biomagnified at each stage in the food chain.
- (B) It breaks down readily in the soil.
- (C) It destroys one particular pest only.
- (D) It is water-soluble.

**02** DNA repairing is done by :

- (A) ligase
- (B) Protease
- (C) Nuclease
- (D) DNA polymerase I

**03** Which of the following correctly describes the number of chromosomes in the nuclei of different mammalian cells?

	Cells from which gametes develop	Eggs or sperms	Cells of embryo
(A)	Diploid	Diploid	Haploid
(B)	Haploid	Diploid	Haploid
(C)	Haploid	Haploid	Diploid
(D)	Diploid	Haploid	Diploid

SPACE FOR ROUGH WORK



**04** At which of the following moments is the sex of a baby determined ?

- (A) After the first few divisions of the zygote
- (B) At the moment of fertilisation
- (C) Between ovulation and fertilisation
- (D) When the young embryo is implanted on the uterus wall

**05** When the external temperature drops, the following changes may take place in the human body.

- (1) Shivering begins
- (2) Brain detects cooler blood
- (3) Body temperature falls
- (4) Body temperature rises

Which option indicates the sequence in which the changes occur ?

	First	→	Last	
(A)	1	4	3	2
(B)	2	3	1	4
(C)	3	2	1	4
(D)	3	2	4	1

SPACE for Rough work

**06** Homeostasis is best described as \_\_\_\_\_.

- (A) the control of concentration of water in the blood
- (B) the control of the supply of nutrients to cells
- (C) the maintenance of a stable environment for cells
- (D) the removal of waste from the cells

**07** Albinism in humans is a condition caused by a recessive gene. In albinos, pigment fails to develop in the skin, hair and eyes. If two albinos marry, what is the chance of their having a normal child ?

- (A) 0%
- (B) 25%
- (C) 50%
- (D) 100%

**08** Term ecology was first used by

- (A) Reiter
- (B) Cuvier
- (C) Haeckel
- (D) Malthus

**09** Which of the following is specifically used in genetic engineering ?

- (A) Ligase
- (B) Gyrase
- (C) DNA polymerase
- (D) Restriction endonuclease

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**SPACE FOR ROUGH WORK**

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- 10** Reduction (meiotic) division in Pteridophyta occurs
- (A) during gamete formation
  - (B) after spore formation
  - (C) during spore formation
  - (D) after gamete formation
- 11** Leaf abscission, fruit fall, and bud dormancy occurs by which phytohormone ?
- (A) Auxin
  - (B) Cytokinin
  - (C) Gibberellins
  - (D) Abscissic acid
- 12** A person with blood group A has
- (A) antigen A and antibody b
  - (B) antigen B and antibody a
  - (C) both antibodies
  - (D) no antibody and no antigen
- 13** If water enters in a cell, the pressure exerted by its swollen protoplast is
- (A) turgor pressure
  - (B) DPD
  - (C) osmotic pressure
  - (D) imbibition

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**SPACE for Rough work**

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- 14** At cellular level which of these get first affected by  $SO_2$  pollution
- (A) chloroplast (B) nucleus  
(C) mitochondria (D) cells membrane
- 15** Chemiosmotic mechanism of ATP production in aerobic respiration was given by
- (A) Krebs (B) Calvin  
(C) Hatch and Slack (D) Peter Mitchell
- 16** Which of the following sugar is found in nucleic acid ?
- (A) Dextrose (B) Glucose  
(C) Levulose (D) Deoxyribose
- 17** In Nematohelminthes, the coelom is
- (A) acoelom (B) pseudocoelom  
(C) enterocoelom (D) haemocoel
- 18** Carbamates pesticides act by combining with acetylcholine esterase enzyme. Which one of the following is a carbamate ?
- (A) Propoxur (B) Aldicarb  
(C) Carbofuran (D) All of the above

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SPACE FOR ROUGH WORK

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- 19** Some organisms resemble other organisms and thus escape from enemies. This phenomenon is known as
- (A) homology                      (B) variation  
(C) analogy                        (D) mimicry
- 20** Mechanical support, enzyme circulation, protein synthesis and detoxification of drugs are function of
- (A) ER                                (B) ribosomes  
(C) dictyosomes                  (D) chloroplast
- 21** Characteristic of mammalian liver is
- (A) Kupffer's cells and leucocytes  
(B) Leucocytes and canaliculae  
(C) Glisson's capsules and Kupffer cells  
(D) Glisson's capsules and leucocytes
- 22** Synthesis of amino acids to prove that amino acids were formed in primitive ocean was experimentally proved by
- (A) Sydeny Fox                      (B) Oparin  
(C) Haldane                         (D) Stanley Miller

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SPACE FOR ROUGH WORK

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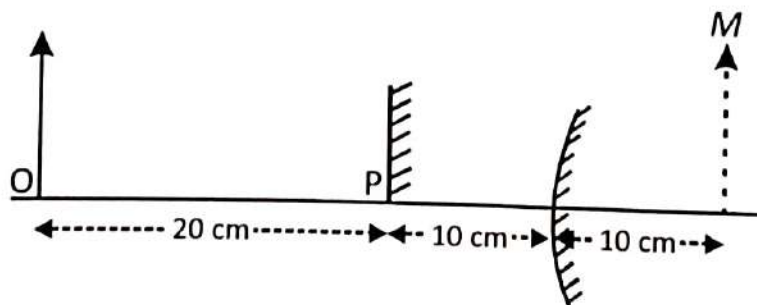
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- 23** Bacterial flagella do not show ATPase activity and 9 + 2 organization. These are chemically
- (A) flagellin                      (B) pilin  
(C) tubulin                        (D) bacterin
- 24** Phytochromes are
- (A) chemicals regulating flowering  
(B) chemicals regulating growth from seed to adulthood  
(C) hormones regulating growth from seed to adult hood  
(D) regulators synthesized by plants and influencing physiological process
- 25** Certain bacteria living in the soil poor in oxygen convert nitrates into nitrites and then to free nitrogen and such bacteria are termed as
- (A) nitrogen fixing bacteria  
(B) denitrifying bacteria  
(C) ammonifying bacteria  
(D) saprophytic bacteria

SPACE FOR ROUGH WORK



- 26** A current of 10 A is maintained in a conductor of cross-section  $10^{-4} \text{ m}^2$ . If the number density of free electrons be  $9 \times 10^{28} \text{ m}^{-3}$ , calculate the drift velocity of free electrons. Given charge on electron,  $e = 1.6 \times 10^{-19} \text{ C}$ .
- (A)  $3.12 \times 10^{-3} \text{ m s}^{-1}$       (B)  $4.56 \times 10^{-4} \text{ m s}^{-1}$   
 (C)  $5.78 \times 10^{-5} \text{ m s}^{-1}$       (D)  $6.94 \times 10^{-6} \text{ m s}^{-1}$
- 27** The amplitude of magnetic field of a plane e.m. wave is  $8 \times 10^{-7} \text{ T}$ . Calculate the amplitude of the electric field.
- (A) 118 V/m      (B) 240 V/m  
 (C) 356 V/m      (D) 497 V/m
- 28** Three charges  $10 \mu\text{C}$ ,  $5 \mu\text{C}$  and  $-5 \mu\text{C}$  are placed in air at the three corners A, B and C of an equilateral triangle of side 0.1 m. Find the resultant force experienced by charge placed at corner A.
- (A) 15 N    (B) 35 N    (C) 45 N    (D) 55 N
- 29** A small plane mirror strip is kept at a distance of 10 cm in front of a convex mirror, with its plane normal to the principal axis. An object is placed at a distance of 20 cm from the plane mirror as shown below. Calculate the focal length of the convex mirror, if the images formed by the plane mirror and the convex mirror coincide, without parallax.

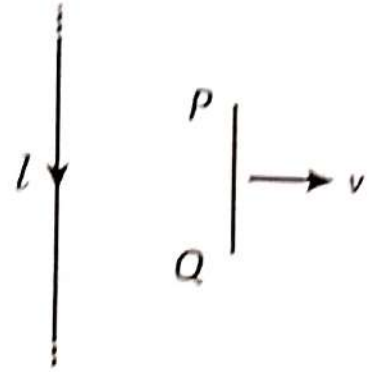


- (A) + 25 cm    (B) - 20 cm    (C) + 15 cm    (D) - 10 cm

- 30** 60 J of work must be done to move electric charge equal to 5 C from a point, where potential is +20 V to another point, where potential is V volt. Find the value of V.  
 (A) 14 V    (B) 18 V    (C) 24 V    (D) 32 V
- 31** Of the following pairs of species, which one will have the same electronic configuration for both members ?  
 (A)  $\text{Li}^+$  and  $\text{Na}^+$                       (B) He and  $\text{Ne}^+$   
 (C) H and Li                                  (D) C and  $\text{N}^+$
- 32** A bar magnet placed in a uniform magnetic field of strength 0.3 T, with its axis at  $30^\circ$  to the field, experiences a torque of 0.06 N m. What is the magnetic moment of the bar magnet ?  
 (A)  $0.3 \text{ A m}^2$                               (B)  $0.5 \text{ A m}^2$   
 (C)  $0.9 \text{ A m}^2$                               (D)  $0.4 \text{ A m}^2$
- 33** A photocell is illuminated by a small bright source placed 1 m away. When the same source of light is placed 0.5 m away, the number of electrons emitted by photocathode would  
 (A) decrease by a factor of 4.  
 (B) increase by a factor of 4.  
 (C) decrease by a factor of 2.  
 (D) increase by a factor of 2.
- 34** The frequency of an alternating current is 50 Hz and it has a peak value of 10 A. Find the time taken for the current to reach the peak value starting from zero.  
 (A)  $0.2 \times 10^{-9} \text{ s}$                               (B)  $0.3 \times 10^{-7} \text{ s}$   
 (C)  $0.4 \times 10^{-5} \text{ s}$                               (D)  $0.5 \times 10^{-3} \text{ s}$



- 35** A steady current  $I$  flows in an infinitely long straight wire. A conducting rod parallel to the wire moves away from it with constant velocity  $v$  as shown in figure. If P and Q are the ends of the rod, then



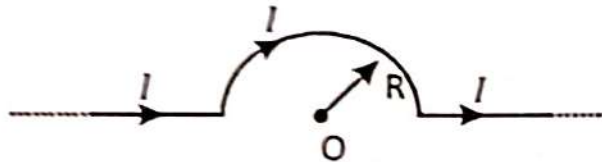
- (A) P is positive w.r.t. Q  
 (B) P is negative w.r.t. Q  
 (C) Both are at the same potential  
 (D) Nothing can be said because the rod does not form a loop.
- 36** A series battery of 6 lead accumulators each of emf 2.0 V and internal resistance  $0.25 \Omega$  is charged by a 230 V d.c. mains. To limit the charging current, a series resistance of  $53 \Omega$  is used in the charging circuit. What is (a) the power supplied by the mains and (b) the power dissipated as heat both in W ?
- (A) 1650, 534 (B) 735, 615  
 (C) 815, 752 (D) 920, 872
- 37** The Young's double slit experiment is performed with blue and with green light of wavelength  $4360 \text{ \AA}$  and  $5460 \text{ \AA}$  respectively. If  $x$  is the distance of 4th maximum from the central one, then
- (A)  $x$  (blue) =  $x$  (green) (B)  $x$  (blue) >  $x$  (green)  
 (C)  $x$  (blue) <  $x$  (green) (D)  $\frac{x(\text{blue})}{x(\text{green})} = \frac{5460}{4360}$



- 38 An electric dipole consists of two charges  $+5 \mu\text{C}$  and  $-5 \mu\text{C}$  separated by a distance of  $1.5^\circ \text{ A}$ . The dipole is placed in a uniform electric field of strength  $5 \times 10^5 \text{ Vm}^{-1}$ . Find its potential energy.

- (A)  $1.23 \times 10^{-8} \text{ J}$                       (B)  $2.97 \times 10^{-9} \text{ J}$   
 (C)  $3.75 \times 10^{-10} \text{ J}$                       (D)  $4.18 \times 10^{-11} \text{ J}$

- 39 The magnetic field  $B$  at the centre  $O$  of the semi-circular wire as shown below is given by



- (A)  $\frac{\mu_0 I}{2R}$  (inwards)                      (B)  $\frac{\mu_0 I}{4R}$  (inwards)  
 (C)  $\frac{\mu_0 I}{2R}$  (outwards)                      (D)  $\frac{\mu_0 I}{4R}$  (outwards)

- 40 A photocell employs photoelectric effect to convert

- (A) change in the frequency of light into a change in the electric current.  
 (B) change in the frequency of light into a change in electric voltage.  
 (C) change in the intensity of illumination into a change in photoelectric current.  
 (D) change in the intensity of illumination into a change in the work function of the photocathode.

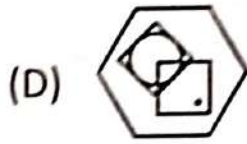
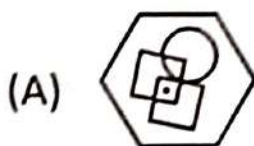
- 41 30 mL of 0.13 M  $\text{NiSO}_4$  is electrolysed using a current of 360 milliamperes for 35.3 minutes. How much of the metal would have been plated out if current efficiency is 100% ? ( $\text{Ni} = 58.7$ )
- (A) 0.1165 g (B) 0.2318 g  
(C) 1.9387 g (D) 2.1794 g
- 42 Amongst the following, identify the species with an atom in + 6 oxidation state
- (A)  $\text{MnO}_4^-$  (B)  $\text{Cr}(\text{CN})_6^{3-}$  (C)  $\text{NiF}_6^{2-}$  (D)  $\text{CrO}_2\text{Cl}_2$
- 43 The radius of a divalent cation  $\text{A}^{2+}$  is 94 pm and of divalent anion  $\text{B}^{2-}$  is 146 pm. The compound AB has
- (A) rock salt structure  
(B) zinc blende structure  
(C) antifluorite structure  
(D) cesium chloride like structure
- 44 The basicities of phosphorous acid, orthophosphoric acid and meta phosphoric acid are respectively
- (A) 3, 2 and 1 (B) 2, 3 and 1  
(C) 2, 1 and 3 (D) 1, 2 and 3
- 45 Aniline is treated with a mixture of sodium nitrite and hypophosphorous acid, the product formed is
- (A) Aniline diazonium hypophosphite  
(B) Benzene  
(C) Anilinium hypophosphite  
(D) Aniline diazonium hypophosphite

- 46** Primary, secondary and tertiary alcohols may be distinguished by converting them into the corresponding nitroparaffins which are then treated with
- (A) Aqueous NaOH      (B) Conc.  $H_2SO_4$   
 (C) Conc. HCl      (D)  $NaNO_2 + \text{dil. HCl}$
- 47** Ferrous and ferric ions in solution may be distinguished by
- (A) Silver nitrate solution  
 (B) Lead acetate solution  
 (C) Acidified solution of  $KMnO_4$   
 (D) Sodium chloride solution
- 48** Calculate the half life period of a first order reaction where the specific rate constant is  $200 \text{ s}^{-1}$ .
- (A)  $1.253 \times 10^{-7} \text{ s}$       (B)  $2.768 \times 10^{-5} \text{ s}$   
 (C)  $3.465 \times 10^{-3} \text{ s}$       (D)  $4.812 \times 10^{-2} \text{ s}$
- 49** Of the following statements about enzymes which one is/are not true ?
- (i) Enzymes lack in nucleophilic groups.  
 (ii) Enzymes are highly specific both in binding chiral substrates and in catalysing their reactions.  
 (iii) Enzymes catalyse chemical reactions by lowering the energy of activation.  
 (iv) Pepsin is a proteolytic enzyme.
- (A) (i) and (iv)      (B) (i) and (iii)  
 (C) (ii), (iii) and (iv)      (D) (i)



- 50** What is the shape of  $\text{Fe}(\text{CO})_5$  molecule ?  
(A) Tetrahedral (B) Octahedral  
(C) Trigonal bipyramidal (D) Square pyramidal
- 51** 12 g of urea is dissolved in 1 litre of water and 68.4 g of sucrose is dissolved in 1 litre of water. The lowering of vapour pressure of first case is  
(A) equal to second (B) greater than second  
(C) less than second (D) double that of second
- 52** Arsenic sulphide is a negative sol. The reagent with least precipitating power is  
(A)  $\text{AlCl}_3$  (B)  $\text{NaCl}$   
(C)  $\text{CaF}_2$  (D) Glucose
- 53** Isobutyl bromide may be obtained from isobutylene and  $\text{HBr}$  in the presence of  
(A) Peroxide (B) Hydroquinone  
(C) Diphenylamine (D) All the above
- 54** The correct order of bond angles (smallest first) in  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{BF}_3$  and  $\text{SiH}_4$  is  
(A)  $\text{H}_2\text{S} < \text{SiH}_4 < \text{NH}_3 < \text{BF}_3$   
(B)  $\text{NH}_3 < \text{H}_2\text{S} < \text{SiH}_4 < \text{BF}_3$   
(C)  $\text{H}_2\text{S} < \text{NH}_3 < \text{SiH}_4 < \text{BF}_3$   
(D)  $\text{H}_2\text{S} < \text{NH}_3 < \text{BF}_3 < \text{SiH}_4$
- 55** Aldol condensation will not take place in :  
(A)  $\text{HCHO}$  (B)  $\text{CH}_3\text{CH}_2\text{CHO}$   
(C)  $\text{CH}_3\text{CHO}$  (D)  $\text{CH}_3\text{COCH}_3$

- 56** To which hexagon below can a dot be added so that both dots then meet the same conditions as in the hexagon above ?



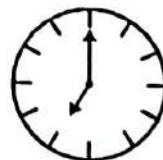
- 57** Should there be a compulsory military training for each college student in India ?

- I) No, this goes against the basic democratic right of an individual to choose his/her own programs.
- II) Yes, this is the only way to build a strong and powerful nation.

- (A) If only (I) is strong
- (B) If only (II) is strong
- (C) If either (I) or (II) is strong
- (D) If both (I) and (II) are strong

SPACE FOR ROUGH WORK

- 58** On a certain island, the rainfall follows a very reliable pattern. If it rains in the morning, it is clear in the afternoon. One family comes to the island for their vacation. When they leave, there are 12 clear mornings and 13 clear afternoons. How long was their vacation if it rained for 15 days ?
- (A) 20 days                      (B) 22 days  
(C) 28 days                      (D) 18 days
- 59** If  $X + Y$  means  $X$  is the daughter of  $Y$ ;  $X - Y$  means  $X$  is the brother of  $Y$ ;  $X \% Y$  means  $X$  is the father of  $Y$  and  $X \times Y$  means  $X$  is the sister of  $Y$ . Which of the following means  $I$  is the niece of  $J$  ?
- (A)  $J - N \% C \times I$               (B)  $I \times C - N \% J$   
(C)  $J + M \times C \% I$               (D)  $I \times C + N - J$
- 60** Exactly how many minutes is it before 7:00 am, if 40 min ago it was three times as many minutes past 2:00 am ?



- (A) 60      (B) 65      (C) 70      (D) 75

SPACE for Rough work