

**NATIONAL BRAIN RESEARCH CENTRE(NBRC)**  
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**Sample Questions For Ph.D. Entrance Examination-2011**

**Note :** Sample questions are provided to give a general idea of the style of the questions that appear in the entrance test. These questions do not reflect the difficulty level of questions in the entrance test.

**PHYSICS**

1. Name the process or processes which alternate (s) the passage of gamma rays through matter:  
(a) Photoelectric effect      (b) Compton Recoils  
(c) Pair Production          (d) All of these
2. How many quantum numbers do characterise an electron within an atom:  
(a) Six                              (b) Five  
(c) Four                             (d) Three
3. Write down the total number of particles inside the nucleus in terms of mass number(A) and atomic number Z:  
(a)  $A-2Z$                         (b)  $2A-Z$   
(c)  $3A-2Z$                         (d) None of these
4. What is the name of the detecting device for discovery of positron:  
(a) Electron Microscope      (b) Geiger-Muller Counter  
(c) Bubble Chamber          (d) Cloud Chamber
5. Give the name of the process by which a positron and an electron coalesce to form photons:  
(a) Pair Annihilation          (b) Compton Scattering  
(c) Bremsstrahlung              (d) Rutherford Scattering

**CHEMISTRY**

6. When solid sodium chloride crystallises from a saturated solution, the entropy change of the system:  
(a) Decreases                      (b) Increases  
(c) Zero                                (d) Remains same with the surrounding
7. Pure water has a  $P_H = 7$  at  $25^\circ\text{C}$ . The water is heated to  $90^\circ\text{C}$ . Choose the right answer:  
(a)  $K_w$  value will decrease and water will be alkaline  
(b)  $K_w$  Value will decrease but water will remain neutral  
(c)  $K_w$  Value will increase and water will be acidic  
(d)  $K_w$  value will increase but water will remain neutral

8. The vapour pressure of pure components 'X' and 'Y' are 100 torr and 50 torr respectively at a particular temperature. Assuming solution of X & Y obeying Raoult's law, the mole fraction of 'X' in the vapour phase in equilibrium with a solution containing equimoles of 'X' and 'Y' is:
- (a) 0.33 (b) 0.66  
(c) 0.80 (d) 0.50
9. The half life time for a reaction at initial conc. of 0.1 mole/litre and 0.4 mole/litre are 200 sec and 50 sec respectively. The order of the reaction is:
- (a) 0 (b) 1  
(c) 2 (d) 3
10. Under equilibrium condition for the reaction  $2C(s)+O_2(g) \rightleftharpoons 2CO(g)$  the total pressure is 12 atm. The value of  $K_p$  is:
- (a) 16 (b) 0.5  
(c) 2 (d) 32

## **BIOLOGY**

11. The salivary gland of leech secrete the anticoagulating factor:
- (a) Hypotoxin (b) Antitoxin  
(c) Hirudin (d) None of these
12. The beak is toothed in:
- (a) Ostrich (b) Archaeopteryx  
(c) Penguin (d) Kiwi
13. Bombykol is:
- (a) A hormone (b) An enzyme  
(c) A pheromon (d) None of these
14. The major constituent of blood plasma (more than half) is:
- (a) Protein (b) Inorganic salts  
(c) Fatty substance (d) Sugar
15. Annual Ring indicates:
- (a) Age of the tree (b) Branching point  
(c) Scale bark (d) Adventitious root

## **MATHEMATICS**

16. If T is a real, skew-symmetric  $n \times n$  matrix, then for n odd:
- (a)  $\det T > 0$  (b)  $\det T < 0$   
(c)  $\det T = 0$  (d) None of these
17. The smallest subgroup which contains a fixed open subset of a topological group is:
- (a) Only open (b) Is only closed  
(c) Is both open and closed (d) All of these are false
18. A subset S of real numbers has at least one limiting point if:
- (a) S is bounded (b) S is infinite set  
(c) S is bounded and finite (d) S is bounded and infinite

19. Let  $F$  be a field of real numbers and  $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \in F_2$ , if  $D$  be the set of all matrices commuting

with  $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \in F_2$ , then:

- (a)  $D$  is isomorphic to the field of complex numbers      (b)  $D$  is isomorphic to the field of real numbers  
(c)  $D$  is not isomorphic to the field of complex numbers      (d) None of these

20. If  $T$  is a linear transformation on an inner product space  $V(F)$ , then which of the following is incorrect:

- (a) If  $T$  is self-adjoint, then  $\text{Tr } T$  is real      (b) If  $T \geq 0$  then  $\text{Tr } T \geq 0$   
(c) If  $T > 0$  then  $\text{Tr } T < 0$       (d) Not all the above are true

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