

# INDRAPRASTHA CET

## Engineering Entrance Exam

### Physics

- How many seconds are there in a light fermi ?  
 (a)  $10^{-15}$ s (b)  $3.0 \times 10^8$  s  
 (c)  $3.33 \times 10^{-24}$ s (d)  $3.3 \times 10^{-7}$  s
- A machine is delivering constant power to drive a body along a straight line. What is the relation between the distance travelled by the body against time ?  
 (a)  $s^2 \propto t^3$  (b)  $s^2 \propto t^{-5}$   
 (c)  $s^3 \propto t^2$  (d)  $s \propto t^3$
- The square of resultant of two equal forces is three times their product. Angle between the forces is  
 (a)  $\pi$  (b)  $\frac{\pi}{2}$   
 (c)  $\frac{\pi}{4}$  (d)  $\frac{\pi}{3}$
- An object placed on a ground is in stable equilibrium. If the object is given a slight push then initially the position of centre of gravity  
 (a) moves nearer to ground  
 (b) rises higher above the ground  
 (c) remains as such  
 (d) may remain at same level
- How much work must be done by a force on 50 kg body in order to accelerate it from rest to 20 m/s in 10 s ?  
 (a)  $10^3$  J (b)  $10^4$  J  
 (c)  $2 \times 10^3$  J (d)  $4 \times 10^4$  J
- Moment of inertia of circular loop of radius  $R$  about the axis of rotation parallel to horizontal diameter at a distance  $R/2$  from it is  
 (a)  $MR^2$  (b)  $\frac{1}{2}MR^2$   
 (c)  $2MR^2$  (d)  $\frac{3}{4}MR^2$
- What will happen to the weight of the body at the south pole, if the earth stops rotating about its polar axis ?  
 (a) No change  
 (b) Increases  
 (c) Decreases but does not become zero  
 (d) Reduces to zero
- A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to  
 (a)  $Y^2$  (b)  $Y$   
 (c)  $\frac{1}{Y}$  (d)  $\frac{1}{Y^2}$
- A common hydrometer reads specific gravity of liquids. Compared to the 1.6 mark of the stem the mark 1.5 will be  
 (a) upwards  
 (b) downwards  
 (c) in the same place  
 (d) may be upward or downward depending upon the hydrometer
- A balloon contains 500 m<sup>3</sup> of He at 27°C and 1 atmospheric pressure. The volume of He at -3°C and 0.5 atmospheric pressure will be  
 (a) 700 m<sup>3</sup> (b) 900 m<sup>3</sup>  
 (c) 1000 m<sup>3</sup> (d) 500 m<sup>3</sup>
- Which of the following is different from others ?  
 (a) Wavelength (b) Velocity  
 (c) Frequency (d) Amplitude
- Two pendulums have time periods  $T$  and  $5T/4$ . They starts SHM at the same time from the mean position. What will be the phase difference between them after the bigger pendulum completed one oscillation ?  
 (a) 45° (b) 90°  
 (c) 60° (d) 30°
- A balloon is filled with hydrogen. For sound waves, this balloon behaves like  
 (a) a converging lens  
 (b) a diverging lens  
 (c) a concave mirror  
 (d) None of the above

two point charges are doubled and distance is halved. Force of interaction becomes  $n$  times, where  $n$  is

- (a) 1  
(b) 16

bubbles have radii in the ratio of 2:1. The ratio of excess pressures inside

- (a) 1 : 4  
(b) 4 : 1

phenomenon of Brownian movement may be evidence of

- (a) kinetic theory of matter  
(b) quantum theory of radiation  
(c) molecular theory of light  
(d) electric phenomenon

waves of slightly different frequencies propagating in the same direction interfere due to

- (a) interference  
(b) diffraction  
(c) diffraction  
(d) refraction

ice block floats in a liquid whose density is less than that of water. A part of block is outside the liquid. When whole of ice has melted, the level of liquid will

- (a) rise  
(b) in same  
(c) rise then go down  
(d) go down

two particles of different masses of 2 kg and 10 kg are moving with velocities 2 m/s and 10 m/s respectively towards each other due to mutual gravitational attraction. What is the velocity of centre of mass?

- (a) 2 m/s  
(b) 6 m/s  
(c) 10 m/s  
(d) Zero

the displacement of an oscillating particle is given by  $y = A \sin(Bx + Ct + D)$ . The dimensional formula for  $(ABCD)$  is

- (a)  $[M^0L^0T^0]$   
(b)  $[M^0L^0T^{-1}]$   
(c)  $[M^0L^0T^{-1}]$   
(d)  $[M^0L^0T^0]$

two wires having intensities in the ratio of 4:1 produce interference. The ratio of maximum to minimum intensity is equal to

- (a) 8 : 1  
(b) 9 : 1  
(c) 16 : 1  
(d) 2 : 1

two wires each of same length, diameter and material are connected to each other to form a parallel combination. If the resistance of each wire is  $R$ , then

equivalent resistance across the opposite corners is

- (a)  $R$   
(b)  $R/2$   
(c)  $R/4$   
(d) None of these

23. An electric motor runs on DC source of emf 200 V and draws a current of 10 A. If the efficiency be 40% then the resistance of armature is

- (a)  $2 \Omega$   
(b)  $8 \Omega$   
(c)  $12 \Omega$   
(d)  $16 \Omega$

24. A capacitor having capacity of  $2.0 \mu\text{F}$  is charged to 200 V and then the plates of the capacitor are connected to a resistance wire. The heat produced in joule will be

- (a)  $2 \times 10^{-2}$   
(b)  $4 \times 10^{-2}$   
(c)  $4 \times 10^4$   
(d)  $4 \times 10^{10}$

25. A voltmeter of range 2V and resistance  $300 \Omega$  cannot be converted into ammeter of range

- (a) 1 A  
(b) 1 mA  
(c) 100 mA  
(d) 10 mA

26. If a magnet is suspended at angle  $30^\circ$  to the magnetic meridian, the dip needle makes an angle of  $45^\circ$  with the horizontal. The real dip is

- (a)  $\tan^{-1}(\sqrt{3}/2)$   
(b)  $\tan^{-1}(\sqrt{3})$   
(c)  $\tan^{-1}(\sqrt{3}/2)$   
(d)  $\tan^{-1}(2\sqrt{3})$

27. Which quantity is increased in step-down transformer?

- (a) Current  
(b) Voltage  
(c) Power  
(d) Frequency

28. The ratio of intensity at the centre of a bright fringe to the intensity at a point distant one fourth of the distance between two successive bright fringes will be

- (a) 4  
(b) 3  
(c) 2  
(d) 1

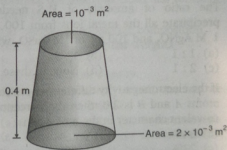
29. Which has more luminous efficiency?

- (a) A 40 W bulb  
(b) A 40 W fluorescent tube  
(c) Both have same  
(d) Cannot say

30. When a ray of light enters from one medium to another, then its velocity in second medium becomes double. The maximum value of angle of incidence, so that total internal reflection may not take place will be

- (a)  $60^\circ$   
(b)  $180^\circ$   
(c)  $90^\circ$   
(d)  $30^\circ$

31. What should be the velocity of an electron so that its momentum becomes equal to that of a photon of wavelength  $5200 \text{ \AA}$  ?  
 (a)  $700 \text{ m/s}$  (b)  $1000 \text{ m/s}$   
 (c)  $1400 \text{ m/s}$  (d)  $2800 \text{ m/s}$
32. A radioactive element has half-life period of 600 yrs. After 3000 yrs, what amount will remain ?  
 (a)  $\frac{1}{2}$  (b)  $\frac{1}{16}$   
 (c)  $\frac{1}{8}$  (d)  $\frac{1}{32}$
33. Beyond which frequency, the ionosphere bends any incident electromagnetic radiation but do not reflect it back towards the earth ?  
 (a) 50 MHz (b) 40 MHz  
 (c) 30 MHz (d) 20 MHz
34. In intrinsic semiconductor at room temperature number of electrons and holes are  
 (a) equal (b) zero  
 (c) unequal (d) infinite
35. The unit of thermal conductance is  
 (a)  $\text{WK}^{-1}$  (b)  $\text{JK}^{-1}$   
 (c) WK (d) JK
36. The value of  $P$  so that the vectors  $2\hat{i} - \hat{j} + \hat{k}$ ,  $\hat{i} + 2\hat{j} - 3\hat{k}$  and  $3\hat{i} + P\hat{j} + 5\hat{k}$  are coplanar should be :  
 (a) 16 (b) -4  
 (c) 4 (d) -8
37. A capacitor of capacitance  $C$  has charge  $Q$  and stored energy is  $W$ . If the charge is increased to  $2Q$ , the stored energy will be  
 (a)  $\frac{W}{4}$  (b)  $\frac{W}{2}$   
 (c)  $2W$  (d)  $4W$
38. Pure silicon at 300 K has equal electron  $n_e$  and hole ( $n_h$ ) concentration of  $1.5 \times 10^{16} \text{ m}^{-3}$ . Doping by indium increases  $n_h$  to  $4.5 \times 10^{22} \text{ m}^{-3}$ . The  $n_e$  in the doped silicon is  
 (a)  $9 \times 10^5$  (b)  $5 \times 10^9$   
 (c)  $2.25 \times 10^{11}$  (d)  $3 \times 10^{19}$
39. A cylindrical conductor is placed near another positively charged conductor. The net charge acquired by the cylindrical conductor will be  
 (a) positive only  
 (b) negative only  
 (c) zero  
 (d) either positive or negative
40. If the unit of force is 1 kilo newton, the length is 1 km and time 100 s, what will be the unit of mass ?  
 (a) 1,000 kg (b) 1 kg  
 (c) 10,000 kg (d) 100 kg
41. The maximum tension which an inextensible ring of mass 0.1 kg/m can bear is 10 N. The maximum velocity in m/s with which it can be rotated is  
 (a) 10 (b)  $\sqrt{10}$   
 (c) 20 (d) 15
42. If there were a reduction in gravitational effect, which of the following forces do you think would change in some respect ?  
 (a) Magnetic force (b) Electrostatic force  
 (c) Viscous force (d) Archimedes' uplift
43. The breaking force for a wire of diameter  $D$  of a material is  $F$ . The breaking force for a wire of the same material of radius  $D$  is  
 (a)  $F$  (b)  $2F$   
 (c)  $\frac{F}{4}$  (d)  $4F$
44. A uniformly tapering vessel is filled with a liquid of density  $900 \text{ kg/m}^3$ . The force that acts on the base of the vessel due to the liquid is ( $g = 10 \text{ m/s}^2$ )



- (a) 3.6 N (b) 7.2 N  
 (c) 9.0 N (d) 14.4 N
45. If pressure of a gas contained in a closed vessel is increased by 0.4% when heated by  $1^\circ\text{C}$ , its initial temperature must be  
 (a) 250 K (b)  $250^\circ\text{C}$   
 (c) 2500 K (d)  $25^\circ\text{C}$
46. Lines of force due to earth's horizontal magnetic field are  
 (a) parallel and straight  
 (b) concentric circles  
 (c) elliptical  
 (d) curved lines

o thermometers are constructed in the same way except that one has a spherical bulb and the other a cylindrical bulb, which one responds quickly to temperature changes?

- Spherical bulb thermometer  
 Cylindrical bulb thermometer  
 Both equally  
 None of the above

What is the fractional change in tension necessary in a sonometer of fixed length to produce a note one octave lower than before?

- (a)  $\frac{1}{4}$   
 (b)  $\frac{1}{2}$   
 (c)  $\frac{2}{3}$   
 (d)  $\frac{3}{4}$

## Chemistry

ethyl acetate is obtained when methyl magnesium bromide reacts with

- (a) ethyl formate  
 (b) ethyl chloroformate  
 (c) acetyl chloride  
 (d) carbon dioxide

most stable hydride is

- (a)  $\text{NH}_3$   
 (b)  $\text{PH}_3$   
 (c)  $\text{AsH}_3$   
 (d)  $\text{SbH}_3$

The ratio of amounts of  $\text{H}_2\text{S}$  needed to precipitate all the metal ions from 100 mL of 0.1 M  $\text{AgNO}_3$  and 100 mL of 1M  $\text{CuSO}_4$  will be

- (a) 1 : 1  
 (b) 1 : 2  
 (c) 2 : 1  
 (d) None of these

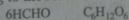
The electronegativity difference between two atoms A and B is 2.0, then the percentage of ionic character in the molecule is

- (a) 54%  
 (b) 46%  
 (c) 23%  
 (d) 72%

Which of the following reaction defines  $\Delta H_f^\circ$ ?

- (a)  $\text{C}_{(\text{diamond})} + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$   
 (b)  $\frac{1}{2} \text{H}_2(\text{g}) + \frac{1}{2} \text{F}_2(\text{g}) \longrightarrow \text{HF}(\text{g})$   
 (c)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})$   
 (d)  $\text{CO}(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$

Formaldehyde polymerizes to form glucose according to the reaction



The theoretically computed equilibrium constant for this reaction is found to be

49. If battery of 6 V is connected to the terminals of three metre long wire of uniform thickness and resistance of the order of 100 ohm, the difference of potential between two points separated by 50 cm in the wire will be

- (a) 1 V  
 (b) 1.5 V  
 (c) 2 V  
 (d) 3 V

50. In an electromagnetic wave, the electric and magnetising fields are 100 V/m and 0.265 A/m. The maximum energy flow is

- (a) 26.5  $\text{W/m}^2$   
 (b) 36.5  $\text{W/m}^2$   
 (c) 46.7  $\text{W/m}^2$   
 (d) 765  $\text{W/m}^2$

$6 \times 10^{22}$ . If 1 M solution of glucose dissociates according to the above equilibrium, the concentration of formaldehyde in the solution will be

- (a)  $1.6 \times 10^{-2} \text{M}$   
 (b)  $1.6 \times 10^{-4} \text{M}$   
 (c)  $1.6 \times 10^{-6} \text{M}$   
 (d)  $1.6 \times 10^{-8} \text{M}$

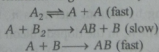
7. The electronic configuration of a dipositive ion  $\text{M}^{2+}$  is 2, 8, 14 and its mass number is 56. The number of neutrons present is

- (a) 32  
 (b) 42  
 (c) 30  
 (d) 34

8. If X is the total number of collisions which a gas molecule registers with others per unit time under particular conditions, then the collision frequency of the gas containing N molecules per unit volume is

- (a)  $X/N$   
 (b)  $NX$   
 (c)  $2NX$   
 (d)  $NX/2$

9. A hypothetical reaction  $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB}$  follows the mechanism as given below,



The order of the overall reaction is

- (a) 2  
 (b) 1  
 (c)  $1\frac{1}{2}$   
 (d) 0

10. The mass of helium atom of mass number 4 is 4.0026 amu, while that of the neutron and proton are 1.0087 and 1.0078 respectively on the same scale. Hence, the nuclear binding

energy per nucleon in the helium atom is nearly

- (a) 5 MeV (b) 7 MeV  
(c) 10 MeV (d) 14 MeV

11. Which of the following statements is correct ?

Dielectric constant of  $H_2O_2$

- (a) increases with dilution  
(b) decreases with dilution  
(c) is unaffected on dilution  
(d) None of the above

12. For the square planar complex

$[M(a)(b)(c)(d)]$  (where,  $M$  = central metal and  $a, b, c$  and  $d$  are monodentate ligands), the number of possible geometrical isomers are

- (a) 1 (b) 2  
(c) 3 (d) 4

13. Potash alum dissolves in water to give a/an

- (a) acidic solution of  $H_2SO_4$   
(b) alkaline solution  
(c) acidic solution of HCl  
(d) neutral solution

14. The discovery of which of the following group of elements gave death blow to the Newland's law of octaves ?

- (a) Inert gases (b) Alkaline earths  
(c) Rare earths (d) Actinides

15. Van't Hoff factor more than unity indicates that the solute in solution has

- (a) dissociated  
(b) associated  
(c) Both (a) and (b)  
(d) cannot say anything

16. How many number of atoms are there in a cube based unit cell having one atom on each corner and two atoms on each body diagonal of cube ?

- (a) 8 (b) 6  
(c) 4 (d) 9

17. Bleeding due to a cut can be stopped by applying ferric chloride solution in the laboratory. This is due to

- (a) co-agulation of negatively charged blood particles by  $Fe^{3+}$  ions  
(b) co-agulation of positively charged blood particles by  $Cl^-$  ions  
(c) reaction taking place between ferric ions and the haemoglobin forming a complex  
(d) common element, iron, in both  $FeCl_3$  and haemoglobin.

18. Which one of the following solutions will have highest conductivity ?

- (a) 0.1 M  $CH_3COOH$  (b) 0.1 M NaCl  
(c) 0.1 M  $KNO_3$  (d) 0.1 M HCl

19. One of the following metals forms a volatile compound and this property is taken advantage for its extraction. This metal is

- (a) iron (b) nickel  
(c) cobalt (d) tungsten

20. If  $Na^+$  ion is larger than  $Mg^{2+}$  ion and  $S^{2-}$  ion is larger than  $Cl^-$  ion, which of the following will be stable soluble in water ?

- (a) Sodium chloride  
(b) Sodium sulphide  
(c) Magnesium chloride  
(d) Magnesium sulphide

21. Impurities of Cu and Ag from gold are removed by

- (a) boiling impure gold with dil.  $H_2SO_4$   
(b) boiling impure gold with conc.  $H_2SO_4$   
(c) electrolytically  
(d) Both (b) and (c)

22. Which of the following salt would give  $SO_2$  with hot and dil.  $H_2SO_4$  and also decolourises  $Br_2$  water ?

- (a)  $Na_2SO_3$  (b)  $NaHSO_4$   
(c)  $Na_2SO_4$  (d)  $Na_2S$

23. If two compounds have the same empirical formula but different molecular formulae, they must have

- (a) different percentage composition  
(b) different molecular weights  
(c) same viscosity  
(d) same vapour density

24. Among the following which one has weakest carbon-halogen bond ?

- (a) Benzyl bromide (b) Bromobenzene  
(c) Vinyl bromide (d) Benzyl chloride

25. Petrochemicals can be used to prepare

- (a) synthetic fibres (b) pesticides  
(c) plastics (d) All of these

26. *tert*-butyl methyl ether on heating with anhydrous HI in ether gives

- (a)  $CH_3OH + (CH_3)_3Cl$   
(b)  $CH_3I + (CH_3)_3COH$   
(c)  $CH_3I + (CH_3)_3Cl$   
(d) None of the above

27. The correctly reported answer of the addition of 4.523, 2.3 and 6.24 will have significant figures

- (a) two (b) three  
(c) four (d) five

What happens if  $\text{CCl}_4$  is treated with  $\text{AgNO}_3$  ?  
 A white ppt. of  $\text{AgCl}$  will form  
 $\text{NO}_2$  will be evolved  
 $\text{CCl}_4$  will dissolve in  $\text{AgNO}_3$   
 Nothing will happen

Which is more stable isotope of Na. Find out the process by which  $^{24}_{11}\text{Na}$  can undergo

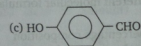
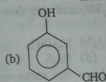
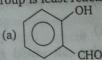
radioactive decay

- (a)  $\beta^-$  emission  
 (b)  $\alpha$ -emission  
 (c)  $\beta^+$  emission  
 (d) K electron capture

Heat of combustion of solid benzoic acid at constant volume is  $-321.30 \text{ kJ}$  at  $27^\circ\text{C}$ . The heat of combustion at constant pressure is :

- (a)  $-321.30 - 300 \text{ R}$  (b)  $-321.30 + 300 \text{ R}$   
 (c)  $-321.30 - 150 \text{ R}$  (d)  $-321.30 + 900 \text{ R}$

Which of the following compounds —OH group is least reactive ?



- (d) All are equally reactive.

Iodoform is obtained when ethanol is heated with

- (a)  $\text{KI}$  and aq  $\text{KOH}$  (b)  $\text{I}_2$  and aq  $\text{KOH}$   
 (c)  $\text{I}_2/\text{aq KI}$  (d)  $\text{HI}$  and  $\text{HIO}_3$

The total number of acyclic isomers including the stereoisomers (geometrical and optical), with the molecular formula  $\text{C}_4\text{H}_7\text{Cl}$  is

- (a) 12 (b) 11  
 (c) 10 (d) 9

The alkyl halides that can be made by free radical halogenation of alkanes are

- (a)  $\text{RCl}$ , and  $\text{RBr}$  but not  $\text{RF}$  or  $\text{RI}$   
 (b)  $\text{RF}$ ,  $\text{RCl}$  and  $\text{RBr}$  but not  $\text{RI}$   
 (c)  $\text{RF}$ ,  $\text{RCl}$ ,  $\text{RBr}$ ,  $\text{RI}$   
 (d)  $\text{RF}$ ,  $\text{RCl}$  and  $\text{RI}$  but  $\text{RBr}$

5. Silica is a/an

- (a) acidic flux only  
 (b) gangue only

- (c) basic flux only  
 (d) both gangue and acidic flux

36. The nodes present in  $3p$ -orbitals are

- (a) one spherical, one planar  
 (b) two spherical  
 (c) two planar  
 (d) one planar

37. The number of  $\alpha$ - and  $\beta$ -particles emitted in nuclear reaction  ${}_{90}\text{Th}^{228} \longrightarrow {}_{83}\text{Bi}^{212}$  are respectively

- (a) 4, 1  
 (b) 3, 7  
 (c) 8, 1  
 (d) 4, 7

38. Two bottles  $A$  and  $B$  contains  $1 \text{ M}$  and  $1 \text{ m}$  aqueous solution of sulphuric acid respectively

- (a)  $A$  is more concentrated than  $B$   
 (b)  $B$  is more concentrated than  $A$   
 (c) concentration of  $A$  is equal to concentration of  $B$   
 (d) it is not possible to compare the concentrations

39. A salt on treatment with dil.  $\text{HCl}$  gives a pungent smelling gas and a yellow precipitate. The salt gives green flame test and a yellow precipitate with potassium chromate the salt is

- (a)  $\text{NiSO}_4$  (b)  $\text{BaS}_2\text{O}_3$   
 (c)  $\text{PbS}_2\text{O}_3$  (d)  $\text{CuSO}_4$

40. Which of the oxide of manganese is amphoteric ?

- (a)  $\text{MnO}_2$  (b)  $\text{Mn}_2\text{O}_3$   
 (c)  $\text{Mn}_2\text{O}_7$  (d)  $\text{MnO}$

41. Which of the following alkenes is most reactive towards cationic polymerization ?

- (a)  $\text{CH}_2=\text{CHCH}_3$  (b)  $\text{H}_2\text{C}=\text{CHCl}$   
 (c)  $\text{H}_2\text{C}=\text{CHC}_6\text{H}_5$  (d)  $\text{H}_2\text{C}=\text{CHCO}_2\text{CH}_3$

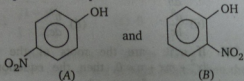
42. An organic compound,  $\text{C}_3\text{H}_6\text{O}$  does not give a precipitate with 2, 4-dinitrophenyl hydrazine reagent and does not react with metallic sodium. It could be

- (a)  $\text{CH}_3-\text{CH}_2-\text{CHO}$   
 (b)  $\text{CH}_2=\text{CH}-\text{CH}_2\text{OH}$   
 (c)  $\text{CH}_3-\text{CO}-\text{CH}_3$   
 (d)  $\text{CH}_2=\text{CH}-\text{O}-\text{CH}_3$

43. Oxidation of 1-butene with hot  $\text{KMnO}_4$  solution produces

- (a)  $\text{CH}_3\text{CH}_2\text{COOH} + \text{HCOOH}$   
 (b)  $\text{CH}_3\text{CH}_2\text{COOH} + \text{CO}_2$   
 (c)  $\text{CH}_3\text{COOH} + \text{CO}_2$   
 (d)  $(\text{CH}_3)_2\text{C}=\text{O} + \text{CO}_2$

44. A mixture of 1-chlorobutane and 2-chlorobutane when treated with alcoholic KOH gives
- 1-butene
  - 2-butene
  - isobutylene
  - mixture of 1-butene + 2-butene
45. Out of the two compounds shown below, the vapour pressure of B at a particular temperature is expected to be



- higher than that of A
  - lower than that of B
  - same as that of A
  - can be higher or lower depending upon the size of the vessel
46. Roasted tin stone ore after washing with water is known as
- block tin
  - white tin
  - black tin
  - granulated tin
47. Which of the following has strongest hydrogen bonding?
- Ethylamine
  - Ammonia
  - Ethyl alcohol
  - Diethyl ether
48. Consider the following statements:  
The rate law for the acid catalysed hydrolysis of an ester being given as  
Rate =  $k [H^+][ester]$  =  $k'[ester]$ . If the acid concentration is doubled at constant ester concentration
- The second order rate constant,  $k$  is doubled.
  - The pseudo first order rate constant,  $k$  is doubled.
  - The rate of the reaction is doubled
- Which of the above statements are correct?
- 1 and 2
  - 2 and 3
  - 1 and 3
  - 1, 2 and 3
49. A fibrous mineral which can withstand red hot flames without any damage is:
- talc
  - glass wool
  - soap stone
  - asbestos
50. When *o*- or *p*-phenolsulphonic acid is treated with bromine water, the product formed is:
- 2, 4-dibromophenol
  - 2, 4, 6-tribromophenol
  - 3-bromophenol boric acid
  - 3, 5-dibromophenol

## Mathematics

1. Let  $\vec{a}$  and  $\vec{b}$  be two equal vectors inclined at an angle  $\theta$ , then  $a \sin \frac{\theta}{2}$  is equal to
- $\frac{|\vec{a} - \vec{b}|}{2}$
  - $\frac{|\vec{a} + \vec{b}|}{2}$
  - $|\vec{a} - \vec{b}|$
  - $|\vec{a} + \vec{b}|$
2.  $\int \frac{dx}{x^2 + 4x + 13}$  is equal to
- $\log(x^2 + 4x + 13) + c$
  - $\frac{1}{3} \tan^{-1} \left( \frac{x+2}{3} \right) + c$
  - $\log(2x+4) + c$
  - $\frac{1}{(x^2 + 4x + 13)^2} + c$
3. The general solution of  $y^2 dx + (x^2 - xy + y^2) dy = 0$  is
4.  $\int_0^{\pi/4} (\cos x - \sin x) dx + \int_{\pi/4}^{5\pi/4} (\sin x - \cos x) dx + \int_{2\pi}^{\pi/4} (\cos x - \sin x) dx$  is equal to
- $\sqrt{2} - 2$
  - $2\sqrt{2} - 2$
  - $3\sqrt{2} - 2$
  - $4\sqrt{2} - 2$
5. Out of 40 consecutive natural numbers, two are chosen at random. Probability that the sum of the number is odd, is



- (a)  $\frac{14}{29}$  (b)  $\frac{20}{39}$   
 (c)  $\frac{1}{2}$  (d) None of these

6. Equation of tangents to the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$ , which are perpendicular to the line  $3x + 4y = 7$ , are

- (a)  $4x - 3y = \pm\sqrt{20}$  (b)  $4x - 3y = \pm\sqrt{12}$   
 (c)  $4x - 3y = \pm\sqrt{2}$  (d)  $4x - 3y = \pm 1$

7. If  $\vec{a}$  is perpendicular to  $\vec{b}$  and  $\vec{c}$ ,  $|\vec{a}| = 2$ ,  $|\vec{b}| = 3$ ,  $|\vec{c}| = 4$  and the angle between  $\vec{b}$  and  $\vec{c}$  is  $\frac{2\pi}{3}$ ,

then  $[\vec{a} \vec{b} \vec{c}]$  is equal to

- (a)  $4\sqrt{3}$  (b)  $6\sqrt{3}$   
 (c)  $12\sqrt{3}$  (d)  $18\sqrt{3}$

8. The solution of the equation  $\frac{d^2y}{dx^2} = e^{-2x}$  is

- (a)  $y = \frac{1}{4} e^{-2x} + \frac{cx}{2} + d$   
 (b)  $y = \frac{1}{4} e^{-2x} + cx + d$   
 (c)  $y = \frac{1}{4} e^{-2x} + cx^2 + d$   
 (d)  $y = \frac{1}{4} e^{-2x} + cx^3 + d$

9. The value of  $\int_2^3 \frac{x+1}{x^2(x-1)} dx$  is

- (a)  $\log \frac{16}{9} + \frac{1}{6}$  (b)  $\log \frac{16}{9} - \frac{1}{6}$   
 (c)  $2 \log 2 - \frac{1}{6}$  (d)  $\log \frac{4}{3} - \frac{1}{6}$

10. The length of the chord of the parabola  $x^2 = 4y$  passing through the vertex and having slope  $\cot \alpha$  is

- (a)  $4 \cos \alpha \operatorname{cosec}^2 \alpha$  (b)  $4 \tan \alpha \sec \alpha$   
 (c)  $4 \sin \alpha \sec^2 \alpha$  (d) None of these

11. The records of a hospital show that 10% of the cases of a certain disease are fatal. If 6 patients are suffering from the disease, then the probability that only three will die, is

- (a)  $8748 \times 10^{-5}$  (b)  $1458 \times 10^{-5}$   
 (c)  $1458 \times 10^{-6}$  (d)  $41 \times 10^{-6}$

12. From the point  $P(16, 7)$  tangents  $PQ$  and  $PR$  are drawn to the circle  $x^2 + y^2 - 2x - 4y - 20 = 0$ . If  $c$  be the centre of the circle, then area of quadrilateral  $PCQR$  is

- (a) 450 sq unit (b) 15 sq unit  
 (c) 50 sq unit (d) 75 sq unit

13. If  $\tan x = \frac{b}{a}$ , then the value of

$a \cos 2x + b \sin 2x$  is

- (a)  $a$  (b)  $a - b$   
 (c)  $a + b$  (d)  $b$

14. In a triangle  $ABC$ , right angled at  $C$ , the value of  $\cot A + \cot B$  is

- (a)  $\frac{c^2}{ab}$  (b)  $a + b$   
 (c)  $\frac{a^2}{bc}$  (d)  $\frac{b^2}{ac}$

16. If  $\alpha, \beta$  are the roots of the equation  $lx^2 + mx + n = 0$ , then the equation whose roots are  $\alpha^3\beta$  and  $\alpha\beta^3$ , is

- (a)  $l^3x^2 - nl(m^2 - 2nl)x + n^4 = 0$   
 (b)  $l^3x^2 + nl(m^2 - 2nl)x + n^4 = 0$   
 (c)  $l^3x^2 + nl(m^2 - 2nl)x - n^4 = 0$   
 (d)  $l^3x^2 - nl(m^2 + 2nl)x + n^4 = 0$

17. The value of  $2^{1/4} \cdot 4^{1/8} \cdot 8^{1/16} \cdot 16^{1/32} \dots$

- (a)  $3/2$  (b)  $5/2$   
 (c)  $2$  (d)  $1$

18.  $\begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix} [2 \ 1 \ -1]$  is equal to

- (a)  $\begin{bmatrix} 2 \\ -1 \\ -2 \end{bmatrix}$  (b)  $\begin{bmatrix} 2 & 1 & -1 \\ -2 & -1 & 1 \\ 4 & 2 & -2 \end{bmatrix}$   
 (c)  $[-1]$  (d) not defined

19.  $\lim_{x \rightarrow \infty} \frac{(2x-3)(3x-4)}{(4x-5)(5x-6)}$  is equal to

- (a)  $\frac{1}{10}$  (b)  $0$   
 (c)  $\frac{1}{5}$  (d)  $\frac{3}{10}$

20. Function  $f(x) = \begin{cases} x-1, & x < 2 \\ 2x-3, & x \geq 2 \end{cases}$  is a

continuous function

- (a) for  $x = 2$  only  
 (b) for all real values of  $x$  such that  $x \neq 2$   
 (c) for all real values of  $x$   
 (d) for all integral values of  $x$  only

21. Differential coefficient of  $\sqrt{\sec \sqrt{x}}$  is

- (a)  $\frac{1}{4\sqrt{x}} \sec \sqrt{x} \sin \sqrt{x}$   
 (b)  $\frac{1}{4\sqrt{x}} (\sec \sqrt{x})^{3/2} \cdot \sin \sqrt{x}$   
 (c)  $\frac{1}{2} \sqrt{x} \sec \sqrt{x} \sin \sqrt{x}$   
 (d)  $\frac{1}{2} \sqrt{x} (\sec \sqrt{x})^{3/2} \cdot \sin \sqrt{x}$



22. The function  $x^5 - 5x^4 + 5x^3 - 1$  is  
 (a) neither maximum nor minimum at  $x = 0$   
 (b) maximum at  $x = 0$   
 (c) maximum at  $x = 1$  and minimum at  $x = 3$   
 (d) minimum at  $x = 0$
23. If  $x = y\sqrt{1-y^2}$ , then  $\frac{dy}{dx}$  is equal to  
 (a)  $x$  (b)  $\frac{\sqrt{1-y^2}}{1+2y^2}$   
 (c)  $\frac{\sqrt{1-y^2}}{1-2y^2}$  (d) 0
24. If the planes  $x + 2y + kz = 0$  and  $2x + y - 2z = 0$ , are at right angles, then the value of  $k$  is  
 (a) 2 (b) -2  
 (c)  $\frac{1}{2}$  (d)  $-\frac{1}{2}$
25. The ratio in which the line joining  $(2, 4, 5)$ ,  $(3, 5, -4)$  is divided by the  $yz$ -plane is  
 (a) 2 : 3 (b) 3 : 2  
 (c) -2 : 3 (d) 4 : -3
26. If the lines  $3x + 4y + 1 = 0$ ,  $5x + \lambda y + 3 = 0$  and  $2x + y - 1 = 0$  are concurrent, then  $\lambda$  is equal to  
 (a) -8 (b) 8  
 (c) 4 (d) -4
27. The value of  $\int_0^1 \frac{x^4 + 1}{x^2 + 1} dx$  is  
 (a)  $\frac{1}{6}(3 - 4\pi)$  (b)  $\frac{1}{6}(3\pi + 4)$   
 (c)  $\frac{1}{6}(3 + 4\pi)$  (d)  $\frac{1}{6}(3\pi - 4)$
28. The solution of the differential equation  $\frac{dy}{dx} = y \tan x - 2 \sin x$ , is  
 (a)  $y \sin x = c + \sin 2x$   
 (b)  $y \cos x = c + \frac{1}{2} \sin 2x$   
 (c)  $y \cos x = c - \sin 2x$   
 (d)  $y \cos x = c + \frac{1}{2} \cos 2x$
29. The value of  $1 - \log 2 + \frac{(\log 2)^2}{2!} - \frac{(\log 2)^3}{3!} + \dots$  is  
 (a)  $\log 3$  (b)  $\log 2$   
 (c)  $\frac{1}{2}$  (d) None of these
30. The maximum value of  $f(x) = \frac{x}{4+x^2}$  on  $[-1, 1]$  is
- (a)  $-\frac{1}{3}$  (b)  $-\frac{1}{4}$   
 (c)  $\frac{1}{5}$  (d)  $\frac{1}{6}$
31. If the radius of a circle be increasing at a uniform rate of 2 cm/s. The area of increasing of area of circle, at the instant when the radius is 20 cm, is  
 (a)  $70\pi \text{ cm}^2/\text{s}$  (b)  $70 \text{ cm}^2/\text{s}$   
 (c)  $80\pi \text{ cm}^2/\text{s}$  (d)  $80 \text{ cm}^2/\text{s}$
32. If  $P(A) = P(B) = x$  and  $P(A \cap B) = P(A' \cap B') = \frac{1}{3}$ , then  $x$  is equal to  
 (a)  $\frac{1}{2}$  (b)  $\frac{1}{3}$   
 (c)  $\frac{1}{4}$  (d)  $\frac{1}{6}$
33. The focus of the parabola  $y^2 - x - 2y + 2 = 0$  is  
 (a)  $(\frac{1}{4}, 0)$  (b)  $(1, 2)$   
 (c)  $(\frac{5}{4}, 1)$  (d)  $(\frac{3}{4}, \frac{5}{2})$
34. The equation of normal at the point  $(0, 3)$  of the ellipse  $9x^2 + 5y^2 = 45$  is  
 (a)  $x$ -axis (b)  $y$ -axis  
 (c)  $y + 3 = 0$  (d)  $y - 3 = 0$
35. The equation of the tangent parallel to  $y - x + 5 = 0$  drawn to  $\frac{x^2}{3} - \frac{y^2}{2} = 1$  is  
 (a)  $x - y + 1 = 0$  (b)  $x - y + 2 = 0$   
 (c)  $x + y - 1 = 0$  (d)  $x + y + 2 = 0$
36. Let the functions  $f, g, h$  are defined from the set of real numbers  $R$  to  $R$  such that  $f(x) = x^2 - 1$ ,  $g(x) = \sqrt{x^2 + 1}$  and  $h(x) = \begin{cases} 0, & \text{if } x < 0 \\ x, & \text{if } x \geq 0 \end{cases}$ , then  $h \circ (f \circ g)(x)$  is defined by  
 (a)  $x$  (b)  $x^2$   
 (c) 0 (d) None of these
37. The angle of elevation of the sun, if the length of the shadow of a tower is  $\sqrt{3}$  times the height of the pole, is  
 (a)  $150^\circ$  (b)  $30^\circ$   
 (c)  $60^\circ$  (d)  $45^\circ$
38. If  $\sin A = n \sin B$ , then  $\frac{n-1}{n+1} \tan \frac{A+B}{2}$  is equal to  
 (a)  $\sin \frac{A-B}{2}$  (b)  $\tan \frac{A-B}{2}$   
 (c)  $\cot \frac{A-B}{2}$  (d) None of these

9.  $3 \tan^{-1} a$  is equal to

- (a)  $\tan^{-1} \frac{3a + a^3}{1 + 3a^2}$   
 (b)  $\tan^{-1} \frac{3a - a^3}{1 + 3a^2}$   
 (c)  $\tan^{-1} \frac{3a + a^3}{1 - 3a^2}$   
 (d)  $\tan^{-1} \frac{3a - a^3}{1 - 3a^2}$

10. In which quadrant of the complex plane, the point  $\frac{1 + 2i}{1 - i}$  lies?

- (a) Fourth (b) First  
 (c) Second (d) Third

11. If  $\sin \alpha$  and  $\cos \alpha$  are the roots of the equation  $px^2 + qx + r = 0$ , then

- (a)  $p^2 + q^2 - 2pr = 0$   
 (b)  $p^2 - q^2 + 2pr = 0$   
 (c)  $p^2 - q^2 - 2pr = 0$   
 (d)  $p^2 + q^2 + 2qr = 0$

12. If  $a, b, c$  are in GP, then the equations  $ax^2 + 2bx + c = 0$  and  $dx^2 + 2ex + f = 0$  have a common root, if  $\frac{d}{a}, \frac{e}{b}, \frac{f}{c}$  are in

- (a) AP (b) GP  
 (c) HP (d) None of these

13. In the expansion of  $\left(2x^2 - \frac{1}{x}\right)^{12}$ , the term independent of  $x$  is

- (a) 8th (b) 7th  
 (c) 9th (d) 10th

14. The general value of  $\theta$  in the equation  $\cos \theta = \frac{1}{\sqrt{2}}, \tan \theta = -1$  is

- (a)  $2n\pi + \frac{\pi}{6}, n \in I$   
 (b)  $2n\pi + \frac{7\pi}{4}, n \in I$   
 (c)  $n\pi + (-1)^n \frac{\pi}{3}, n \in I$   
 (d)  $n\pi + (-1)^n \frac{\pi}{4}, n \in I$

45. If  $A = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$ , then  $A^{-1}$  is equal to

- (a)  $\begin{bmatrix} -5 & -2 \\ -3 & 1 \end{bmatrix}$   
 (b)  $\begin{bmatrix} 5/11 & 2/11 \\ 3/11 & -1/11 \end{bmatrix}$   
 (c)  $\begin{bmatrix} -5/11 & -2/11 \\ -3/11 & -1/11 \end{bmatrix}$   
 (d)  $\begin{bmatrix} 5 & 2 \\ 3 & -1 \end{bmatrix}$

46. The value of  $\lim_{x \rightarrow \infty} \left( \frac{x^2 + bx + 4}{x^2 + ax + 5} \right)$  is

- (a)  $\frac{b}{a}$  (b) 0  
 (c) 1 (d)  $\frac{4}{5}$

47. Let  $f(x) = \begin{cases} \frac{\sin \pi x}{5x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ , if  $f(x)$  is

continuous at  $x = 0$ , then  $k$  is equal to

- (a)  $\frac{\pi}{5}$  (b)  $\frac{5}{\pi}$   
 (c) 1 (d) 0

48. If  $\theta$  be the angle between the vectors

$\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$  and  $\vec{b} = 6\hat{i} - 3\hat{j} + 2\hat{k}$ , then

- (a)  $\cos \theta = \frac{4}{21}$   
 (b)  $\cos \theta = \frac{3}{19}$   
 (c)  $\cos \theta = \frac{2}{19}$   
 (d)  $\cos \theta = \frac{5}{21}$

49. Let  $\vec{a}, \vec{b}$  and  $\vec{c}$  be vectors with magnitudes 3, 4

and 5 respectively and  $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ , then the

values of  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$  is

- (a) 47 (b) 25  
 (c) 50 (d) -25

50. The maximum value of  $z = 4x + 2y$  subjected to the constraints

$2x + 3y \leq 18, x + y \geq 10, x, y \geq 0$

- (a) 20 (b) 36  
 (c) 40 (d) None of these





■ ■ Answers ■ ■

⇒ PHYSICS

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (c)  | 2. (a)  | 3. (d)  | 4. (b)  | 5. (b)  | 6. (d)  | 7. (a)  | 8. (c)  | 9. (a)  | 10. (b) |
| 11. (d) | 12. (b) | 13. (b) | 14. (d) | 15. (a) | 16. (a) | 17. (a) | 18. (b) | 19. (d) | 20. (b) |
| 21. (c) | 22. (a) | 23. (c) | 24. (b) | 25. (b) | 26. (d) | 27. (a) | 28. (c) | 29. (b) | 30. (d) |
| 31. (c) | 32. (d) | 33. (b) | 34. (a) | 35. (a) | 36. (b) | 37. (d) | 38. (b) | 39. (c) | 40. (c) |
| 41. (a) | 42. (d) | 43. (c) | 44. (b) | 45. (a) | 46. (a) | 47. (b) | 48. (d) | 49. (a) | 50. (a) |

⇒ CHEMISTRY

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b)  | 2. (a)  | 3. (b)  | 4. (b)  | 5. (b)  | 6. (b)  | 7. (c)  | 8. (d)  | 9. (c)  | 10. (b) |
| 11. (a) | 12. (c) | 13. (a) | 14. (a) | 15. (a) | 16. (d) | 17. (a) | 18. (d) | 19. (b) | 20. (d) |
| 21. (d) | 22. (a) | 23. (b) | 24. (a) | 25. (d) | 26. (b) | 27. (b) | 28. (d) | 29. (a) | 30. (c) |
| 31. (a) | 32. (b) | 33. (a) | 34. (a) | 35. (d) | 36. (a) | 37. (a) | 38. (a) | 39. (b) | 40. (a) |
| 41. (c) | 42. (d) | 43. (b) | 44. (d) | 45. (a) | 46. (c) | 47. (c) | 48. (b) | 49. (d) | 50. (b) |

⇒ MATHEMATICS

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a)  | 2. (b)  | 3. (a)  | 4. (d)  | 5. (b)  | 6. (a)  | 7. (c)  | 8. (b)  | 9. (b)  | 10. (a) |
| 11. (b) | 12. (d) | 13. (a) | 14. (a) | 15. (d) | 16. (a) | 17. (c) | 18. (b) | 19. (d) | 20. (c) |
| 21. (b) | 22. (c) | 23. (c) | 24. (a) | 25. (a) | 26. (b) | 27. (d) | 28. (d) | 29. (c) | 30. (d) |
| 31. (c) | 32. (a) | 33. (c) | 34. (b) | 35. (a) | 36. (b) | 37. (b) | 38. (b) | 39. (d) | 40. (c) |
| 41. (b) | 42. (a) | 43. (c) | 44. (b) | 45. (b) | 46. (c) | 47. (a) | 48. (a) | 49. (d) | 50. (d) |