

## MODEL TEST PAPER XV

### CHEMISTRY

#### Q.1

For detection of phosphorus in an organic compound, the white coloured precipitate formed is of:

- (a)  $(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3$
- (b)  $\text{MgNH}_4\text{PO}_4$
- (c)  $\text{Mg}_2\text{P}_2\text{O}_7$
- (d)  $\text{Mo}(\text{PO}_4)_3$

#### Q.2

The polymer commonly used in the manufacture of unbreakable plastic crockery is made from :

- (a) Melamine and formaldehyde
- (b) Phenol and formaldehyde
- (c) Ethylene glycol and phthalic acid
- (d) Ethylene glycol and terephthalic acid

#### Q.3

A pan containing a liquid (b.pt.  $127^\circ\text{C}$ ) is placed over a strong flame capable of heating upto  $600^\circ\text{C}$ . Which of the following statements is correct about the liquid ?

- (a) Temperature of boiling liquid can rise above  $127^\circ\text{C}$  during boiling.
- (b) Average K.E. of liquid molecules will increase during boiling.
- (c) Temperature of boiling liquid will remain  $127^\circ\text{C}$ .
- (d) All the above are correct.

#### Q.4

The standard heat of formation of a compound is the enthalpy change for :

- (a) Formation of 1 mol. Of a substance at BTP.
- (b) Formation of 1 mol of a substance at  $0^\circ\text{C}$  and 1 atm. Pressure from its elements
- (c) Formation of 1 mol of a substance at 298 K and 1 atm. Pressure from its elements
- (d) Formation of 1 mol of a substance an any reaction at 298K and 1 atm. Pressure.

### Q.5

Point out wrong statement

- (a) Wave function  $\Psi$  can have positive as well as negative values.
- (b)  $\Psi^2$  has positive values only.
- (c) 3s-orbital has two nodes only.
- (d)  $\Psi$  give probability of finding an electron around the nucleus.

### Q.6

An aqueous solution of NaCl containing 5.85g.NaCl in 105.85g. of solution will freeze at about ( $K_f$  of water =  $1.86 \text{ km}^{-6}$ ) :

- (a)  $-1.86^\circ\text{C}$
- (b)  $-3.72^\circ\text{C}$
- (c)  $1.86^\circ\text{C}$
- (d)  $3.72^\circ\text{C}$

### Q.7

In paper chromatography :

- (a) Mobile phase is liquid and the stationary phase is solid.
- (b) Mobile phase is liquid and the stationary phase is liquid.
- (c) Mobile phase is liquid and the stationary phase is a thin liquid film adsorbed on the paper.
- (d) Both mobile and stationary phases are solids.

### Q.8

An antigen is :

- (a) Small fragment of a antibiotic
- (b) A steroidal hormone
- (c) A foreign molecule that while entering an organism induces certain responses
- (d) A drug taken against a particular allergy.

### Q.9

What is vat dye?

- (a) A dye that can be applied directly on a fibre sample taken in vat.
- (b) A colourless compound in the reduced state and coloured in the oxidized state.
- (c) Dye that can be applied only to fibres.
- (d) Dye that changes the colour with the change in pH of solution.

**Q.10**

Two solutions A and B maintained at 25°C each, show a rise in temperature when mixed with each other, the resultant solution which boils at a constant temperature may be classified as ;

- (a) Ideal solution.
- (b) Non ideal solution with positive deviation.
- (c) Minimum boiling azeotrope.
- (d) Maximum boiling azeotrope.

**Q.11**

What is edge length of unit cell, if the radius is 75 pm and it crystallises in a body centred cubic structure?

- (a) 150 pm
- (b) 300 pm
- (c) 173 pm
- (d) 87.5 pm

**Q.12**

When HCl is passed through a saturated solution of common salt pure NaCl is precipitated because :

- (a) HCl is highly ionized in solution.
- (b) HCl is highly soluble in water
- (c) The solubility product of NaCl is lowered by HCl.
- (d) The ionic product of  $[Na^+][Cl^-]$  exceeds the solubility product of NaCl

**Q.13**

Which of the following will have lower  $pK_a$  than benzoic acid ?

- (a) *p* –nitrobenzoic acid
- (b) *p* –hydroxybenzoic acid
- (c) *p* –aminobenzoic acid
- (d) All of these

**Q.14**

Compound A on reaction with  $Cl_2$ ,  $FeCl_3$  forms a compound B, compound B on reaction with Sn and HCl forms *m*-chloroaniline. The compound A is :

- (a) Nitrobenzene
- (b) Aniline
- (c) Benzotrile
- (d) Benzalamine

**Q.15**

Gold number is the unit of :

- (a) Coagulation power of an electrolyte.
- (b) Coagulation power of gold ions.
- (c) Protective capacity of hydrophilic sol.
- (d) Protective capacity of hydrophobic sol

**Q.16**

Point out incorrect statement

- (a) Alkali metals are more electropositive than alkaline earth metals
- (b) Alkali metals are less dense than alkaline earth metals
- (c) Sodium combines with oxygen at 575K to form mainly sodium peroxide.
- (d) Alkali metals are good oxidizing agents.

**Q.17**

The following compounds are subjected to dehydration with conc.  $\text{H}_2\text{SO}_4$  for getting corresponding alkenes, the formation of alkene will be noticed first in case of :

- (a) 2-Methyl-2-propanol
- (b) 2-Methyl-1-propanol
- (c) 2-Butanol
- (d) 2,2-Dimethyl-1-propanol

**Q.18**

If the pressure of a mixture of 56 g of  $\text{N}_2$  and 44.0g.  $\text{CO}_2$  is 3 atm., the partial pressure of  $\text{N}_2$  in the mixture is:

- (a) 1 atm.
- (b) 1.5 atm.
- (c) 2 atm.
- (d) 2.5 atm.

**Q.19**

A solution is prepared by taking 0.4M  $\text{CH}_3\text{COOH}$  and 0.4M  $\text{CH}_3\text{COONa}$  per litre of the solution.

What is pH of the solution ? ( $K_a=1.0 \times 10^{-5}$ )

- (a) 5.0
- (b) 5.26
- (c) 2.50
- (d) 4.74

**Q.20**

Aqua regia is a mixture of :

- (a) Equal volumes of conc.HCl : conc.  $\text{HNO}_3$  acid
- (b) 1 part of HCl and 3 parts of  $\text{HNO}_3$  acid
- (c) 3 part of conc.HCl and 1 part of conc. $\text{HNO}_3$  acid
- (d) Equal volume of conc.  $\text{HNO}_3$ , conc. HCl and water

**Q.21**

Intake of CO by haemoglobin in blood :

- (a) Increases efficiency of haemoglobin
- (b) Causes loss of oxygen carrying capacity of blood.
- (c) Causes reduction of haemoglobin.
- (d) All of these

**Q.22**

Hydrolysis of  $\text{XeF}_6$  gives

- (a)  $\text{XeO}_3$
- (b)  $\text{XeO}_6$
- (c)  $\text{Xe}(\text{OH})_3$
- (d) None of these

**Q.23**

A substance disintegrates by first order reaction. If 87.5% of it disintegrates in 60 minutes, the half life period of the substance is :

- (a) 20 min
- (b) 30 min
- (c) 180 min
- (d) 120 min

**Q.24**

EDTA forms an octahedral complex with metal X, the atoms of EDTA involved in coordination are :

- (a) six oxygen
- (b) 4 oxygen and 2 nitrogen
- (c) 2 oxygen and 4 nitrogen
- (d) 3 oxygen and 3 nitrogen

**Q.25**

Aluminium liberates hydrogen on reaction with :

- (a) Dil, HCl
- (b) NaOH
- (c) Water
- (d) Water , dil. HCl & NaOH

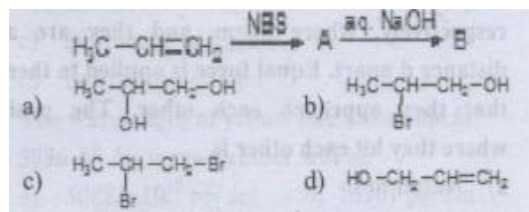
**Q.26**

The nitrogen oxide that can readily dimerize is :

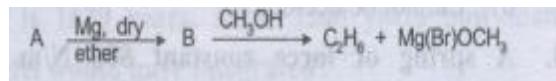
- (a) N<sub>2</sub>O
- (b) NO<sub>2</sub>
- (c) NO<sub>3</sub>
- (d) N<sub>2</sub>O<sub>5</sub>

**Q.27**

The final product 'B' in the following sequence of reaction is :

**Q.28**

The compound A and B in the following sequence of reaction are :



- (a) CH<sub>2</sub>=CH<sub>2</sub> & (CH<sub>3</sub>CH<sub>2</sub>)<sub>2</sub>Mg
- (b) CH<sub>3</sub>CH<sub>2</sub>Br & CH<sub>3</sub>CH<sub>2</sub>MgBr
- (c) CH<sub>3</sub>CH<sub>2</sub>Cl & CH<sub>3</sub>CH<sub>2</sub>MgCl
- (d) None of these

**Q.29**

Which of the following is not a sigma bonded Organo-metallic compound ?

- (a) [C<sub>2</sub>H<sub>5</sub>]<sub>2</sub>Zn
- (b) Cr(h<sub>6</sub>-C<sub>6</sub>H<sub>6</sub>)<sub>2</sub>
- (c) Mn<sub>2</sub>(CO)<sub>12</sub>
- (d) [(CH<sub>3</sub>)<sub>3</sub>Al]<sub>2</sub>

**Q.30**

Methoxyethane is kept with excess of HI at 370 K for some time, the products obtained should be :

- (a) Methanol & ethyl iodide
- (b) Ethanol and methyl iodide
- (c) Ethyl iodide & methyl iodide
- (d) Ethyl methyl oxonium iodide

**PHYSICS****Q.1**

Which of the following units denotes the dimensions of  $ML^2/Q^2$  where Q denotes the electric charge.

- (a) Wb/m<sup>2</sup>
- (b) Henry (H)
- (c) H/m<sup>2</sup>
- (d) Weber

**Q.2**

A stone dropped from a balloon which is at a height h reaches the ground after t seconds. From the same balloon if two stones are thrown, one upwards and other downwards with same velocity u and they reach the ground after  $t_1$  and  $t_2$  seconds respectively, then

- (a)  $t = t_1 - t_2$
- (b)  $t = (t_1 + t_2)/2$
- (c)  $t = \sqrt{t_1 t_2}$
- (d)  $t = \sqrt{(t_1^2 - t_2^2)}$

**Q.3**

Two bodies a and b have masses M and m respectively, where  $M > m$ , and they are at a distance d apart. Equal force is applied to them so that they approach each other. The position where they hit each other is

- (a) Nearer to B
- (b) Nearer to A
- (c) At equal distance from A and B
- (d) Cannot be decided

**Q.4**

A spring of force constant 800 N/m has an extension of 5 cm. The work done in extending it from 5 cm to 15 cm is

- (a) 16 J
- (b) 8 J
- (c) 32 J
- (d) 24 J

**Q.5**

The centripetal force for a vehicle moving on a track is provided by

- (a) Friction of tyres
- (b) Brakes
- (c) Driver
- (d) Steering wheel

**Q.6**

If the acceleration due to gravity at the surface of the earth is  $9.8 \text{ ms}^{-2}$  and the mass of earth is 80 times that of moon and radius of earth is 4 times that of moon, the value of G at moon's surface is

- (a)  $9.8 \text{ ms}^{-2}$
- (b) 1.96
- (c) 4.9
- (d) None of these

**Q.7**

The stress for elastic limit of a material is  $3.5 \times 10^8 \text{ Nm}^2$ . The minimum diameter of a rod made of this material which can support 500 N load without exceeding elastic limit will be

- (a) 1.35 cm
- (b) 1.35 mm
- (c)  $1.35 \times 10^{-6} \text{ m}$
- (d) 2mm

**Q.8**

Heat is flowing through two cylindrical rods A and B of same material having same temperature difference between their ends. The diameter of the rods A and B are in ratio 1 : 2 and their length in the ratio 2 : 1. The ratio of heat flow in rod A to that in B is

- (a) 1 : 2
- (b) 2 : 3
- (c) 4 : 1
- (d) 1 : 8



**Q.9**

If masses of all molecules of a gas are halved and their speeds doubled, the ratio of initial and final pressure is

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

**Q.10**

The net external force acting on the disc when its centre of mass is at a displacement  $x$  with respect to its equilibrium position is

- (a)  $-kx$
- (b)  $-2kx$
- (c)  $-2kx/3$
- (d)  $-4kx/3$

**Q.11**

If the temperature increases, the frequency of sound produced by organ pipe

- (a) Increases
- (b) Decreases
- (c) Remains same
- (d) Not definite

**Q.12**

Force acting upon a charged particle kept between plates of a charged condenser is  $F$ . If one of plates of condenser is removed, force acting on the same particle will become

- (a) Zero
- (b)  $F/2$
- (c)  $F$
- (d)  $2F$

**Q.13**

The current in a series circuit is 5A. when an additional resistance of  $2\Omega$  is inserted, the current drops to 4A. The original resistance of the circuit in Ohms is

- (a) 1.25
- (b) 8
- (c) 10
- (d) 20

**Q.14**

A galvanometer can withstand safely a maximum current of 5 mA. It is converted into a voltmeter reading up to 20 V connecting in series an external resistance of 3.96 k $\Omega$ . The resistance of galvanometer is

- (a) 36 $\Omega$
- (b) 40 $\Omega$
- (c) 44 $\Omega$
- (d) 48 $\Omega$

**Q.15**

Gauss ' law should be invalid if

- (a) There were magnetic monopoles
- (b) The inverse square law were not exactly true
- (c) The velocity of light were not a universal constant
- (d) None of these

**Q.16**

If N is the number of turns in a coil, then self inductance varies as

- (a) N $^{\circ}$
- (b) N $^2$
- (c) N
- (d) N

**Q.17**

A Short circuited coil is placed in a time varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were quadrupled and the wire radius halved, the electrical power dissipated would be

- (a) Halved
- (b) The same
- (c) Doubled
- (d) Quadrupled

Following questions consist of two statements printed as Statement 1 and Statement 2. While answering these questions you are required to select any one of the responses indicated as

1. If both Statement 1 and Statement 2 are true and Statement 2 is a correct explanation of Statement 1.
2. If both Statement 1 and Statement 2 are true but the Statement 2 is not a correct explanation of Statement 1.
3. If Statement 1 is true but the Statement 2 is false.
4. If Statement 1 is false but Statement 2 is true.

**Q.18**

Statement 1: Microwaves can be absorbed by the surface of earth

Statement 2: Microwaves cannot be reflected by ionsphere

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

**Q.19**

A person is suffering from far sightedness. When an object is placed closet to the eye which of the following lens is used?

- (a) Image formed beyond retina, converging lens
- (b) Image formed in front of retina, converging lens
- (c) Image formed in front of retina, diverging lens
- (d) Image formed beyond retina, diverging lens

**Q.20**

In the interference pattern, a particular set of fringes is formed on the screen. Now if the medium is slowly evacuated, then a well marking observer will find that the

- (a) Pattern is not changed
- (b) Pattern becomes hazy
- (c) Pattern slowly disappears
- (d) Pattern disappears instantaneously

**Q.21**

A limit on the performance of a resolving instrument is set by

- (a) Quantum nature of light
- (b) Interference of light
- (c) Diffraction of light
- (d) Polarization of light

**Q.22**

The wavelength of yellow line of sodium is  $5896 \text{ \AA}$ . Its wave number will be

- (a)  $50883 \times 10^{10}$
- (b) 16961 per cm
- (c) 17581 per cm
- (d) 50883 per cm

**Q.23**

One mg of substance has  $2.68 \times 10^{18}$  nuclei. Its half life is 1620 years. After 3240 years how many nuclei would have integrated?

- (a)  $1.82 \times 10^{18}$
- (b)  $1.34 \times 10^{18}$
- (c)  $0.67 \times 10^{18}$
- (d)  $2.01 \times 10^{18}$

**Q.24**

The electron in Bohr's orbit has

- (a) Kinetic energy greater than potential energy
- (b) Potential energy greater than kinetic energy
- (c) Both have same values
- (d) None of the above

**Q.25**

An npn transistor is connected in common emitter configuration in which collector supply is 8V and the voltage drop across the load resistance of  $800\Omega$  connected in the collector circuit is 0.8V. If current amplification factor is  $25/26$ , the power gain is

- (a) 6.93
- (b) 9.63
- (c) 3.69
- (d) 1

**Q.26**

Consider a neutral conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then

- (a) Negative and distributed uniformly over the surface of the sphere
- (b) Negative and appears only at the point on the sphere closet to the point charge
- (c) Negative and distributed non uniformly over the entire surface of the sphere
- (d) Zero

**Q.27**

A hydrogen atom and  $\text{Li}^{2+}$  ion are both in the second excited state. if  $l_H$  and  $l_{Li}$  are their respective electronic angular momenta and  $E_H$  and  $E_{Li}$  their respective energies, then

- (a)  $l_H > l_{Li}$  and  $|E_H| > |E_{Li}|$
- (b)  $l_H = l_{Li}$  and  $|E_H| < |E_{Li}|$
- (c)  $l_H = l_{Li}$  and  $|E_H| > |E_{Li}|$
- (d)  $l_H < l_{Li}$  and  $|E_H| < |E_{Li}|$

**Q.28**

A monoatomic ideal gas, initially at temperature  $T_1$  is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature  $T_2$  by releasing the piston suddenly. If  $L_1$  and  $L_2$  are the lengths of the gas column before and after expansion respectively, then  $T_1/T_2$  is given by

- (a)  $(L_1/L_2)^{2/3}$
- (b)  $(L_1/L_2)$
- (c)  $(L_2/L_1)$
- (d)  $(L_2/L_1)^{2/3}$

**Q.29**

A hollow double concave lens is made of very thin transparent material. It can be filled with air or either of two liquids  $L_1$  and  $L_2$  having refractive indices  $n_1$  and  $n_2$  respectively ( $n_2 > n_1 > 1$ ). The lens will diverge parallel beam of light if it is filled with

- (a) Air and placed in air
- (b) Air and immersed in  $L_1$
- (c)  $L_1$  and immersed in  $L_2$
- (d)  $L_2$  and immersed in  $L_1$

**Q.30**

One quarter section is cut from a uniform circular disc of radius  $R$ . This section has a mass perpendicular to its plane and passing through the centre of the original disc. Its moment of inertia about axis of rotation is

- (a)  $\frac{1}{2}MR^2$
- (b)  $\frac{1}{4}MR^2$
- (c)  $\frac{1}{8}MR^2$
- (d)  $\sqrt{2}MR^2$

**MATHEMATICS****Q.1**

Which of the following is the empty set

- (a)  $\{x: x \text{ is a real number and } x^2 - 1 = 0\}$
- (b)  $\{x: x \text{ is a real number and } x^2 + 1 = 0\}$
- (c)  $\{x: x \text{ is a real number and } x^2 - 9 = 0\}$
- (d)  $\{x: x \text{ is a real number and } x^2 = x + 2\}$

**Q.2**

Let  $P = \{(x, y); x^2 + y^2 = 1, x, y \in R\}$ , then P is

- (a) Reflexive
- (b) Symmetric
- (c) Transitive
- (d) Anti symmetric

**Q.3**

Let  $f(x) = |x - 1|$ , then

- (a)  $f(x^2) = [f(x)]^2$
- (b)  $f(|x|) = |f(x)|$
- (c)  $f(x + y) = f(x) + f(y)$
- (d) None of these

**Q.4**

The amplitude of  $\frac{1+i\sqrt{3}}{\sqrt{3}+1}$  is

- (a)  $\frac{\pi}{6}$
- (b)  $\frac{\pi}{4}$
- (c)  $\frac{\pi}{3}$
- (d) None of these

**Q.5**

If  $\sin \alpha, \sin^2 \alpha, 1$  are in A.P. where  $-\pi < \alpha < \pi$ , then  $\alpha$  lies in the interval

- (a)  $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- (b)  $\left(-\frac{\pi}{3}, \frac{\pi}{3}\right)$
- (c)  $\left(-\frac{\pi}{6}, \frac{\pi}{6}\right)$
- (d) None of these

**Q.6**

If  $x$  is real, then  $\frac{x^2-2x+4}{x^2+2x+4}$  takes values in the interval

- (a)  $\left[\frac{1}{3}, 3\right]$
- (b)  $\left(\frac{1}{3}, 3\right)$
- (c)  $(3, 3)$
- (d)  $\left(-\frac{1}{3}, 3\right)$

**Q.7**

How many 10 digits numbers can be written by using the digits 1 and 2

- (a)  ${}^{10}C_1$
- (b)  $2^{10}$
- (c)  ${}^{10}C_2$
- (d)  $10!$

**Q.8**

The greatest integer less than or equal to  $(\sqrt{2} + 1)^6$  is

- (a) 196
- (b) 197
- (c) 198
- (d) 199

**Q.9**

$1 + \left(\frac{1}{2} + \frac{1}{3}\right)\frac{1}{4} + \left(\frac{1}{4} + \frac{1}{5}\right)\frac{1}{4^2} + \left(\frac{1}{6} + \frac{1}{7}\right)\frac{1}{4^3} + \dots$  is

- (a)  $\text{Log } \sqrt{12}$
- (b)  $\text{Log } \sqrt{3}$
- (c)  $\text{Log } \sqrt{4}$
- (d) None of these

**Q.10**

If  $A$  is an orthogonal matrix, then

- (a)  $|A| = 0$
- (b)  $|A| = \pm 1$
- (c)  $|A| = \pm 2$
- (d) None of these

**Q.11**

If  $\Delta_1 = \begin{vmatrix} x & b & b \\ a & x & b \\ a & a & x \end{vmatrix}$  and  $\Delta_2 = \begin{vmatrix} x & b \\ a & x' \end{vmatrix}$  then

- (a)  $\Delta_1 = 3(\Delta_2)^2$
- (b)  $\frac{d}{dx}(\Delta_1) = 3\Delta_2$
- (c)  $\frac{d}{dx}(\Delta_1) = 3\Delta_2^2$
- (d)  $\Delta_1 = 3(\Delta_2)$

**Q.12**

The image of the point  $(-8, 12)$  with respect to the line mirror  $4x + 7y + 13 = 0$

- (a)  $(-16, -2)$
- (b)  $(-8, -1)$
- (c)  $(16, 8)$
- (d) None of these

**Q.13**

The locus of a point which moves such that the tangents from it to the two circles  $x^2 + y^2 - 5x - 3 = 0$  and  $3x^2 + 3y^2 + 2x + 4y - 6 = 0$  are equal, is given by

- (a)  $4x + 3y + 7 = 0$
- (b)  $17x + 4y + 3 = 0$
- (c)  $7x + 9y + 11 = 0$
- (d)  $13x - 4y + 15 = 0$

**Q.14**

The mid point of the chord  $2x + y - 4 = 0$  of the parabola  $y^2 = 4x$  is

- (a)  $\left(\frac{5}{2}, -1\right)$
- (b)  $\left(-1, \frac{5}{2}\right)$
- (c)  $\left(\frac{3}{2}, -1\right)$
- (d) None of these

**Q.15**

The ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  and the straight line  $y = mx + c$  intersect in real points only if

- (a)  $a^2m^2 < c^2 - b^2$
- (b)  $a^2m^2 > c^2 - b^2$
- (c)  $a^2m^2 \geq c^2 - b^2$
- (d)  $c \geq b$

**Q.16**

The function  $f(x) = \sin \frac{\pi x}{2} + 2 \cos \frac{\pi x}{3} - \tan \frac{\pi x}{4}$  is periodic with period

- (a) 6
- (b) 3
- (c) 4
- (d) 12



**Q.17**

If  $f(x) = \begin{cases} [\cos \pi x], & x > 1 \\ [x - 2], & 1 \leq x \leq 2 \end{cases}$  then  $f(x)$  is

- (a) Discontinuous and non differentiable at  $x = 1$  and  $x = 2$
- (b) Continuous and differentiable at  $x = 0$
- (c) Discontinuous as  $x = \frac{1}{2}$
- (d) Continuous but not differentiable at  $x = 2$

**Q.18**

The derivative of  $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$  with respect to  $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$  at  $x = 0$ , is

- (a)  $\frac{1}{8}$
- (b)  $\frac{1}{4}$
- (c)  $\frac{1}{2}$
- (d) 1

**Q.19**

The slope of the tangent of the curve  $x = t^2 + 3t - 8$ ,  $y = 2t^2 - 2t - 5$  at  $(2, -1)$  is

- (a)  $\frac{22}{7}$
- (b)  $\frac{6}{7}$
- (c)  $-6$
- (d) None of these

**Q.20**

The function  $f(x) = \cot^{-1} x + x$  increases in the interval

- (a)  $(1, \infty)$
- (b)  $(-1, \infty)$
- (c)  $(-\infty, \infty)$
- (d)  $(0, \infty)$

**Q.21**

The maximum value of  $\left(\frac{1}{2}\right)^x$  is

- (a)  $e$
- (b)  $e^e$
- (c)  $e^{\frac{1}{e}}$
- (d)  $\left(\frac{1}{e}\right)^{\frac{1}{e}}$

**Q.22**

$\int \cos^3 x e^{\log(\sin x)} dx$  is equal to

- (a)  $-\frac{\sin^4 x}{4} + c$
- (b)  $-\frac{\cos^4 x}{4} + c$
- (c)  $\frac{e^{\sin x}}{4} + c$
- (d) None of these

**Q.23**

If  $f(x) = \int_{-1}^x |t| dt$ , then for any  $x \geq 0$ ,  $f(x)$  equals

- (a)  $\frac{1}{2}(1 - x^2)$
- (b)  $\frac{1}{2}x^2$
- (c)  $\frac{1}{2}(1 + x^2)$
- (d) None of these

**Q.24**

If  $A$  the area lying between the curve  $y = \sin x$  and  $x$  axis between  $x = 0$  and  $x = \frac{\pi}{2}$ . Area of the region between the curve  $y = \sin 2x$  and  $x$  axis is the same interval is given by

- (a)  $\frac{A}{2}$
- (b)  $A$
- (c)  $2A$
- (d) None of these

**Q.25**

The projection of the vector  $\vec{a} = 4\hat{i} - 3\hat{j} + 2\hat{k}$  on the axis making equal acute angles with as coordinate axis is

- (a) 3
- (b)  $\sqrt{3}$
- (c)  $\frac{1}{\sqrt{3}}$
- (d) None of these

**Q.26**

The equation of the plane through the point (2, 2, 1) and (9, 3, 6) and perpendicular to  $2x + 6y + 6z - 1 = 0$  is

- (a)  $3x + 4y + 5z = 9$
- (b)  $3x + 4y - 5z = 9$
- (c)  $3x + 4y - 5z + 9 = 0$
- (d) None of these

**Q.27**

Dialing a telephone number an old man forgets the last two digits remembering only that these are different dialed at random. The probability that the number is dialed correctly is

- (a)  $\frac{1}{45}$
- (b)  $\frac{1}{90}$
- (c)  $\frac{1}{100}$
- (d) None of these

**Q.28**

The maximum value of  $\sin\left(x + \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{6}\right)$  in the interval  $\left(0, \frac{\pi}{2}\right)$  is attained by

- (a)  $\frac{\pi}{12}$
- (b)  $\frac{\pi}{6}$
- (c)  $\frac{\pi}{3}$
- (d)  $\frac{\pi}{2}$

**Q.29**

The equation  $\sin^{-1} x - \cos^{-1} x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$  has

- (a) No solution
- (b) Unique sol
- (c) Infinite number of solutions
- (d) None of these

**Q.30**

If  $1 + \sin \theta + \sin^2 \theta + \dots = 4 + 2\sqrt{3}$ ,  $0 < \theta < \pi$ ,  $\theta \neq \frac{\pi}{2}$ . Then  $\theta$  is equal to

- (a)  $\frac{\pi}{6}$
- (b)  $\frac{\pi}{3}$
- (c)  $\frac{\pi}{2}$
- (d)  $\frac{\pi}{4}$