

MET 2008 Memory Based Question Paper PDF

Chemistry

- Which of the following is diamagnetic ?
(a) H_2^+ (b) O_2
(c) Li_2 (d) He_2^+
- Which of the following can participate in linkage isomerism ?
(a) NO_2^-
(b) $H_2\ddot{N}CH_2CH_2\ddot{N}H_2$
(c) H_2O
(d) $:NH_3$
- By heating phenol with chloroform in alkali, it is converted into
(a) salicylic acid
(b) salicylaldehyde
(c) anisole
(d) phenyl benzoate
- Osmotic pressure observed when benzoic acid is dissolved in benzene is less than that expected from theoretical considerations. This is because
(a) benzoic acid is an organic solute
(b) benzoic acid has higher molar mass than benzene
(c) benzoic acid gets associated in benzene
(d) benzoic acid gets dissociated in benzene
- The formula mass of Mohr's salt is 392. The iron present in it is oxidised by $KMnO_4$ in acid medium. The equivalent mass of Mohr's salt is
(a) 392 (b) 31.6
(c) 278 (d) 156
- Solubility product of a salt AB is $1 \times 10^{-8} M^2$ in a solution in which the concentration of A^+ ions is $10^{-3} M$. The salt will precipitate when the concentration of B^- ions is kept
(a) between $10^{-8} M$ to $10^{-7} M$
(b) between $10^{-7} M$ to $10^{-8} M$
(c) $> 10^{-5} M$
(d) $< 10^{-8} M$
- The decomposition of a certain mass of $CaCO_3$ gave $11.2 dm^3$ of CO_2 gas at STP. The mass of KOH required to completely neutralise the gas is
(a) 56 g (b) 28 g
(c) 42 g (d) 20 g
- The basicity of aniline is less than that of cyclohexylamine. This is due to
(a) $+R$ -effect of $-NH_2$ group
(b) $-I$ -effect of $-NH_2$ group
(c) $-R$ -effect of $-NH_2$ group
(d) hyperconjugation effect
- A distinctive and characteristic functional group of fats is
(a) a peptide group
(b) an ester group
(c) an alcoholic group
(d) a ketonic group
- Which of the following compound is expected to be optically active ?
(a) $(CH_3)_2CHCHO$
(b) $CH_3CH_2CH_2CHO$
(c) $CH_3CH_2CHBrCHO$
(d) $CH_3CH_2CBr_2CHO$
- Which cycloalkane has the lowest heat of combustion per CH_2 group ?
(a) Cyclopropane (b) Cyclobutane
(c) Cyclopentane (d) Cyclohexane
- The physical states of dispersing phase and dispersion medium in colloid like pesticide spray respectively, are
(a) gas, liquid (b) solid, gas
(c) liquid, solid (d) liquid, gas

13. Potassium dichromate is used
 (a) in electroplating
 (b) as a reducing agent
 (c) it oxidises ferrous ions into ferric ions in acidic media as an oxidising agent
 (d) as an insecticide
14. Which one of the following statements is incorrect for the sucrose ?
 (a) It is obtained from cane sugar
 (b) It is not reducing sugar
 (c) On hydrolysis, it gives equal quantities of D-glucose and D-fructose
 (d) It gives aspartame when it is heated at 210°C
15. Inductive effect involves
 (a) displacement of σ -electrons
 (b) delocalisation of π -electrons
 (c) delocalisation of σ -electrons
 (d) displacement of π -electrons
16. The atomic number of Ni and Cu are 28 and 29 respectively. The electronic configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}$ represents
 (a) Cu^+ (b) Cu^{2+}
 (c) Ni^{2+} (d) Ni
17. In which of the following complex ion, the central metal ion is in a state of sp^3d^2 hybridisation ?
 (a) $[\text{CoF}_6]^{3-}$
 (b) $[\text{Co}(\text{NH}_3)_6]^{3+}$
 (c) $[\text{Fe}(\text{CN})_6]^{3-}$
 (d) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
18. The formation of $\text{O}_2^+[\text{PtF}_6]^-$ is the basis for the formation of xenon fluorides. This is because
 (a) O_2 and Xe have comparable sizes
 (b) Both O_2 and Xe are gases
 (c) O_2 and Xe have comparable ionisation energies
 (d) Both (a) and (c)
19. The density of a gas is 1.964 g dm^{-3} at 273 K and 76 cm Hg. The gas is
 (a) CH_4 (b) C_2H_6
 (c) CO_2 (d) Xe
20. ΔG° vs T plot in the Ellingham's diagram slopes downwards for the reactions
 (a) $\text{Mg} + \frac{1}{2} \text{O}_2 \longrightarrow \text{MgO}$
 (b) $2\text{Ag} + \frac{1}{2} \text{O}_2 \longrightarrow \text{Ag}_2\text{O}$
 (c) $\text{CO} + \frac{1}{2} \text{O}_2 \longrightarrow \text{CO}_2$
 (d) All of the above
21. When a mixture of calcium benzoate and calcium acetate is dry distilled, the resulting compound is
 (a) acetophenone (b) benzaldehyde
 (c) benzophenone (d) acetaldehyde
22. In a metallic crystal
 (a) the valence electrons constitute a sea of mobile electrons
 (b) the valence electrons are localised in between the kernels
 (c) the valence electrons remain within the field of influence of their own kernels
 (d) None of the above
23. Which of the following is correct, based on molecular orbital theory for peroxide ion ?
 (a) Its bond order is one and it is paramagnetic
 (b) Its bond order is two and it is diamagnetic
 (c) Its bond order is one and it is diamagnetic
 (d) Its bond order is two and it is paramagnetic
24. Insulin regulates the metabolism of
 (a) minerals (b) amino acids
 (c) glucose (d) vitamins
25. Which of the following electrolyte will have maximum flocculation value for $\text{Fe}(\text{OH})_3$ sol ?
 (a) NaCl (b) Na_2S
 (c) $(\text{NH}_4)_3\text{PO}_4$ (d) K_2SO_4
26. The concentration of a reactant X decreases from 0.1 M to 0.005 M in 40 min. If the reaction follows first order kinetics, the rate of the reaction when the concentration of X is 0.01 M will be
 (a) $1.73 \times 10^{-4} \text{ M min}^{-1}$
 (b) $3.47 \times 10^{-4} \text{ M min}^{-1}$
 (c) $3.47 \times 10^{-5} \text{ M min}^{-1}$
 (d) $7.5 \times 10^{-4} \text{ M min}^{-1}$

27. At pH = 4, glycine exists as
 (a) $\text{H}_3\text{N}^+ - \text{CH}_2 - \text{COO}^-$
 (b) $\text{H}_3\text{N}^+ - \text{CH}_2 - \text{COOH}$
 (c) $\text{H}_2\text{N} - \text{CH}_2 - \text{COOH}$
 (d) $\text{H}_2\text{N} - \text{CH}_2 - \text{COO}^-$
28. Which of the following taking place in the blast furnace is endothermic ?
 (a) $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$
 (b) $2\text{C} + \text{O}_2 \longrightarrow 2\text{CO}$
 (c) $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
 (d) $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$
29. The emf E° of the following cells are :
 $\text{Ag} | \text{Ag}^+ (1\text{M}) || \text{Cu}^{2+} (1\text{M}) | \text{Cu}; E^\circ = -0.46\text{ V}$
 $\text{Zn} | \text{Zn}^{2+} (1\text{M}) || \text{Cu}^{2+} (1\text{M}) | \text{Cu}; E^\circ = 1.10\text{ V}$
 emf of the following cell is
 $\text{Zn} | \text{Zn}^{2+} (1\text{M}) || \text{Ag}^+ (1\text{M}) | \text{Ag}$
 (a) 0.64 V (b) 1.10 V
 (c) 1.56 V (d) -0.64 V
30. The formation of cyanohydrin from acetone is which type of reaction ?
 (a) Electrophilic substitution reaction
 (b) Electrophilic addition reaction
 (c) Nucleophilic addition reaction
 (d) Nucleophilic substitution reaction
31. Name the end product in the following series of reactions
 $\text{CH}_3\text{COOH} \xrightarrow{\text{NH}_3} \text{A} \xrightarrow{\text{Heat}} \text{B} \xrightarrow[\Delta]{\text{P}_4\text{O}_{10}} \text{C}$
 (a) CH_3OH (b) CH_4
 (c) $\text{CH}_3\text{COONH}_4$ (d) CH_3CN
32. The presence of unpaired electron in phosphorous atom is explained by which principle ?
 (a) Aufbau principle
 (b) Pauli's exclusion principle
 (c) Hund's rule
 (d) Heisenberg's principle
33. If a cricket ball having mass of 200 g is thrown with a speed of $3 \times 10^3\text{ cm/s}$, then calculate the wavelength related to it.
 (a) $2.2 \times 10^{-27}\text{ cm}$
 (b) $1.104 \times 10^{-32}\text{ cm}$
 (c) $1.104 \times 10^{-27}\text{ cm}$
 (d) $1.104 \times 10^{-33}\text{ cm}$
34. Which type of stacking pattern is found in sodium chloride crystal lattice ?
 (a) a-b-a-b (b) a-a-a
 (c) a-b-c-a-b-c (d) None of these
35. Equivalent weight of a bivalent metal is 37.2. The molecular weight of its chloride is
 (a) 412.2 (b) 216
 (c) 145.4 (d) 108.2
36. Phenolphthalein is obtained by heating phthalic anhydride with conc. H_2SO_4 and
 (a) benzyl alcohol (b) benzene
 (c) phenol (d) benzoic acid
37. Freezing point of urea solution is -0.6°C . How much urea (m.wt. = 60 g/mol) will be required to dissolve in 3 kg water ?
 ($k_f = 1.5^\circ\text{C kg mol}^{-1}$)
 (a) 24 g (b) 36 g
 (c) 60 g (d) 72 g
38. If $K < 1.0$, what will be the value of ΔG° of the following ?
 (a) Zero (b) 1.0
 (c) Positive (d) Negative
39. The normality of a solution containing 32.5 g of $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$ per 0.5 L is
 (a) 10 N (b) 1 N
 (c) 2 N (d) 0.1 N
40. For the titration of KOH vs $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$, the suitable indicator is
 (a) methyl orange
 (b) phenolphthalein
 (c) methyl red
 (d) All can be used
41. The radius of Na^+ is 95 pm and that of Cl^- ion is 181 pm. The coordination number of Na^+ is
 (a) 8 (b) 6
 (c) 4 (d) unpredictable
42. In van der Waals' equation of state of the gas law, the constant 'b' is a measure of
 (a) intermolecular repulsion
 (b) intermolecular attraction
 (c) volume occupied by the molecules
 (d) intermolecular collisions per unit volume

43. Which reaction intermediate is formed during the condensation reaction between acetaldehyde and formaldehyde ?
 (a) $\text{:}\bar{\text{C}}\text{H}_2\text{CHO}$ (b) CH_2^+CHO
 (c) CH_2^+OH (d) $\text{:}\bar{\text{C}}\text{HCHO}$
44. 2, 2-dichloro propane on hydrolysis yields
 (a) acetone
 (b) 2, 2-propane diol
 (c) *iso*-propyl alcohol
 (d) acetaldehyde
45. Phenols are more acidic than alcohols because
 (a) phenoxide ion is stabilised by resonance
 (b) phenols are more soluble in polar solvents
 (c) phenoxide ions do not exhibit resonance
 (d) alcohols do not lose H atoms at all
46. Lemon gives sour taste because of
 (a) citric acid (b) tartaric acid
 (c) oxalic acid (d) acetic acid
47. When ammonium chloride is added to ammonia solution, the pH of the resulting solution will be
 (a) increased (b) seven
 (c) decreased (d) unchanged
48. Which of the following has highest second ionisation energy ?
 (a) Calcium (b) Chromium
 (c) Iron (d) Cobalt
49. The standard reduction potentials at 298 K for the following half-cell reactions are given below

$$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Zn}(\text{s}) - 0.762$$

$$\text{Cr}^{3+}(\text{aq}) + 3\text{e}^- \rightleftharpoons \text{Cr}(\text{s}) - 0.74$$

$$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2(\text{g}) 0.00$$

$$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightleftharpoons \text{Fe}^{2+}(\text{aq}) + 0.77$$

 Which one of the following is the strongest reducing agent ?
 (a) Zn(s) (b) Cr(s)
 (c) H₂(g) (d) Fe²⁺(aq)
50. Following reaction,
 $(\text{CH}_3)_3\text{CBr} + \text{H}_2\text{O} \longrightarrow (\text{CH}_3)_3\text{COH} + \text{HBr}$
 is an example of
 (a) elimination reaction
 (b) free radical substitution
 (c) nucleophilic substitution
 (d) electrophilic substitution
51. The unit of rate for a first order reaction is
 (a) L s⁻¹
 (b) mol⁻¹ L s⁻¹
 (c) mol L⁻¹ s⁻¹
 (d) mol s⁻¹
52. *Iso*-propyl amine with excess of acetyl chloride will give
 (a) $(\text{CH}_3\text{CO})_2\text{N} - \text{C} - (\text{CH}_3)_3$
 (b) $(\text{CH}_3)_2\text{CH} - \underset{\text{H}}{\text{N}} - \text{COCH}_3$
 (c) $(\text{CH}_3)_2\text{CHN}(\text{COCH}_3)_2$
 (d) $\text{CH}_3\text{CH}_2\text{CH}_2 - \underset{\text{H}}{\text{N}} - \text{COCH}_3$
53. C₂H₅CHO and (CH₃)₂CO can be distinguished by testing with
 (a) phenyl hydrazine
 (b) hydroxyl amine
 (c) Fehling solution
 (d) sodium bisulphite
54. Glucose molecule reacts with 'X' number of molecules of phenylhydrazine to yield osazone. The value of 'X' is
 (a) four (b) one
 (c) two (d) three
55. The oxidation number of chromium in CrO₅ is
 (a) + 3 (b) + 5
 (c) + 10 (d) + 6
56. Liquor ammonia bottles are opened only after cooling. This is because
 (a) it is a mild explosive
 (b) it generates high vapour pressure
 (c) both (a) and (b)
 (d) it is lachrymatory
57. What will be the proportion of moles of metal (Cu : Ni : Ag) at cathode according to the second law of Faraday ?
 (a) 1 : 2 : 1 (b) 2 : 2 : 1
 (c) 1 : 2 : 2 (d) 1 : 1 : 2

58. Which equation is true to calculate the energy of activation, if the rate of reaction is doubled by increasing temperature from T_1 K to T_2 K ?

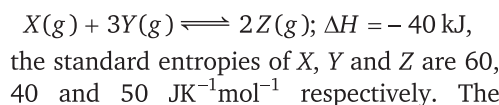
(a) $\log_{10} \frac{k_1}{k_2} = \frac{E_a}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$

(b) $\log_{10} \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left[\frac{1}{T_2} - \frac{1}{T_1} \right]$

(c) $\log_{10} \frac{1}{2} = \frac{E_a}{2.303R} \left[\frac{1}{T_2} - \frac{1}{T_1} \right]$

(d) $\log_{10} 2 = \frac{E_a}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$

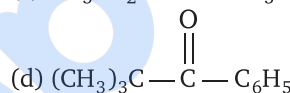
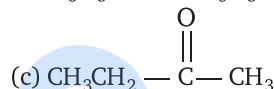
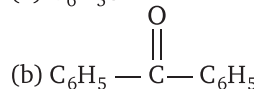
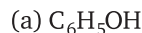
59. For a reversible reaction :



temperature at which the above reaction attains equilibrium is about

- (a) 400 K
(b) 500 K
(c) 273 K
(d) 373 K

60. Which of the following gives aldol condensation reaction ?



Mathematics

1. The range of the function $f(x) = x^2 + \frac{1}{x^2 + 1}$

is

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

2. If $f(x) = \begin{cases} ax^2 + b, & b \neq 0, x \leq 1 \\ bx^2 + ax + c, & x > 1 \end{cases}$, then

$f(x)$ is continuous and differentiable at $x = 1$, if

- (a) $c = 0, a = 2b$ (b) $a = b, c \in \mathbb{R}$
(c) $a = b, c = 0$ (d) $a = b, c \neq 0$

3. If a circle passes through the point (1, 2) and cuts the circle $x^2 + y^2 = 4$ orthogonally, then

the equation of the locus of its centre is

- (a) $x^2 + y^2 - 3x - 8y + 1 = 0$
(b) $x^2 + y^2 - 2x - 6y - 7 = 0$
(c) $2x + 4y - 9 = 0$
(d) $2x + 4y - 1 = 0$

4. If $\int f(x) \sin x \cos x \, dx$

$$= \frac{1}{2(b^2 - a^2)} \log[f(x)] + c,$$

then $f(x)$ is equal to

(a) $\frac{1}{a^2 \sin^2 x + b^2 \cos^2 x}$

(b) $\frac{1}{a^2 \sin^2 x - b^2 \cos^2 x}$

(c) $\frac{1}{a^2 \cos^2 x - b^2 \sin^2 x}$

(d) $\frac{1}{a^2 \cos^2 x + b^2 \sin^2 x}$

5. The points representing complex number z for which $|z - 3| = |z - 5|$ lie on the locus given by

- (a) an ellipse
(b) a circle
(c) a straight line
(d) None of the above

6. The value of α , for which the equation $x^2 - (\sin \alpha - 2)x - (1 + \sin \alpha) = 0$ has roots whose sum of square is least, is

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

7. For $n \in \mathbb{N}$, $10^{n-2} \geq 81n$, if

- (a) $n > 5$ (b) $n \geq 5$
(c) $n < 5$ (d) $n > 8$

8. The two consecutive terms in the expansion of $(3 + 2x)^{74}$ whose coefficients are equal, are
 (a) 11, 12 (b) 7, 8
 (c) 30, 31 (d) None of these
9. The value of $2.35\overline{7}$ is
 (a) $\frac{2355}{999}$ (b) $\frac{2355}{1000}$
 (c) $\frac{2355}{1111}$ (d) None of these
10. Let $S_n = \frac{1}{1^3} + \frac{1+2}{1^3+2^3} + \dots + \frac{1+2+\dots+n}{1^3+2^3+\dots+n^3}$
 $n = 1, 2, 3, \dots$. Then, S_n is not greater than
 (a) $\frac{1}{2}$ (b) 1
 (c) 2 (d) 4
11. If $E(\theta) = \begin{bmatrix} \cos^2 \theta & \cos \theta \sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta \end{bmatrix}$ and θ and ϕ differ by an odd multiple of $\frac{\pi}{2}$, then $E(\theta)E(\phi)$ is a
 (a) unit matrix
 (b) null matrix
 (c) diagonal matrix
 (d) None of the above
12. A parabola is drawn with its focus at (3, 4) and vertex at the focus of the parabola $y^2 - 12x - 4y + 4 = 0$. The equation of the parabola is
 (a) $y^2 - 8x - 6y + 25 = 0$
 (b) $y^2 - 6x + 8y - 25 = 0$
 (c) $x^2 - 6x - 8y + 25 = 0$
 (d) $x^2 + 6x - 8y - 25 = 0$
13. If p, p' denote the lengths of the perpendiculars from the focus and the centre of an ellipse with semi major axis of length a respectively on a tangent to the ellipse and r denotes the focal distance of the point, then
 (a) $ap' = rp + 1$ (b) $rp = ap'$
 (c) $ap = rp' + 1$ (d) $ap = rp'$
14. The equation of perpendicular bisectors of sides AB and AC of a $\triangle ABC$ are $x - y + 5 = 0$ and $x + 2y = 0$ respectively. If the coordinates of vertex A are (1, -2), the equation of BC is
 (a) $14x + 23y - 40 = 0$
 (b) $14x - 23y + 40 = 0$
 (c) $23x + 14y - 40 = 0$
 (d) $23x - 14y + 40 = 0$
15. If $\cos \theta = -\frac{\sqrt{3}}{2}$ and $\sin \alpha = -\frac{3}{5}$, where θ does not lie in the third quadrant, then $\frac{2 \tan \alpha + \sqrt{3} \tan \theta}{\cot^2 \theta + \cos \alpha}$ is equal to
 (a) $\frac{7}{22}$ (b) $\frac{5}{22}$ (c) $\frac{9}{22}$ (d) $\frac{22}{5}$
16. A parallelogram is constructed on the vectors $\vec{a} = 3\vec{\alpha} - \vec{\beta}$, $\vec{b} = \vec{\alpha} + 3\vec{\beta}$, if $|\vec{\alpha}| = |\vec{\beta}| = 2$ and angle between $\vec{\alpha}$ and $\vec{\beta}$ is $\frac{\pi}{3}$, then length of a diagonal of the parallelogram is
 (a) $4\sqrt{5}$ (b) $4\sqrt{3}$
 (c) $4\sqrt{17}$ (d) None of these
17. The value of c , so that for all real x , the vectors $c x \hat{i} - 6 \hat{j} + 3 \hat{k}$, $x \hat{i} + 2 \hat{j} + 2 c x \hat{k}$ make an obtuse angle, are
 (a) $c < 0$ (b) $0 < c < \frac{4}{3}$
 (c) $-\frac{4}{3} < c < 0$ (d) $c > 0$
18. The solution of the equation $y - x \frac{dy}{dx} = a \left(y^2 + \frac{dy}{dx} \right)$ is
 (a) $y = c(x + a)(1 - ay)$
 (b) $y = c(x + a)(1 + ay)$
 (c) $y = c(x - a)(1 + ay)$
 (d) None of the above
19. The order of the differential equation whose general solution is given by $y = (c_1 + c_2) \cos(x + c_3) - c_4 e^{x+c_5}$, where c_1, c_2, c_3, c_4, c_5 are arbitrary constants, is
 (a) 4 (b) 3 (c) 2 (d) 5
20. If $f(x) = x^3 + bx^2 + cx + d$ and $0 < b^2 < c$, then in $(-\infty, \infty)$
 (a) $f(x)$ is strictly increasing function
 (b) $f(x)$ has a local maxima
 (c) $f(x)$ strictly decreasing function
 (d) $f(x)$ is bounded

21. $\frac{d}{dx} \sin^{-1}(x\sqrt{1-x} + \sqrt{x}\sqrt{1-x^2})$
- (a) $-\frac{1}{2x\sqrt{1-x}} - \frac{1}{\sqrt{1-x^2}}$
- (b) $\frac{1}{2\sqrt{x}\sqrt{1-x^2}} - \frac{1}{\sqrt{1-x^2}}$
- (c) $\frac{1}{2\sqrt{x}\sqrt{1-x}} + \frac{1}{\sqrt{1-x^2}}$
- (d) $-\frac{1}{2\sqrt{x}\sqrt{1-x}} + \frac{1}{\sqrt{1-x^2}}$
22. $\int \frac{x \tan^{-1} x}{\sqrt{(1+x^2)^3}} dx$ is equal to
- (a) $\frac{x - \tan^{-1} x}{1-x^2} + c$ (b) $\frac{x + \tan^{-1} x}{\sqrt{1-x^2}} + c$
- (c) $\frac{x - \tan^{-1} x}{\sqrt{1+x^2}} + c$ (d) $\frac{x + \sqrt{1-x^2}}{\sqrt{1+x^2}} + c$
23. Let $A = \begin{bmatrix} 1 & \sin \theta & 1 \\ -\sin \theta & 1 & \sin \theta \\ -1 & -\sin \theta & 1 \end{bmatrix}$, where $0 \leq \theta \leq 2\pi$. Then, the range of $|A|$ is
- (a) 0
- (b) {2, 4}
- (c) [2, 4]
- (d) None of the above
24. If $y = |\cos x| + |\sin x|$, then $\frac{dy}{dx}$ at $x = \frac{2\pi}{3}$ is
- (a) 0
- (b) 1
- (c) $\frac{1-\sqrt{3}}{2}$
- (d) $\frac{\sqrt{3}-1}{2}$
25. $\lim_{n \rightarrow \infty} \left(\frac{1}{1-n^2} + \frac{2}{1-n^2} + \dots + \frac{n}{1-n^2} \right)$ is equal to
- (a) 0
- (b) $-\frac{1}{2}$
- (c) $\frac{1}{2}$
- (d) None of these
26. Let $f(x) = \begin{cases} \sin x, & x \neq n\pi \\ 2, & x = n\pi \end{cases}$, where $n \in I$ and $g(x) = \begin{cases} x^2 + 1, & x \neq 2 \\ 3, & x = 2 \end{cases}$, then $\lim_{x \rightarrow 0} g[f(x)]$ is
- (a) 1
- (b) 0
- (c) 3
- (d) does not exist
27. The intercept made by the tangent to the curve $y = \int_0^x |t| dt$, which is parallel to the line $y = 2x$, on x-axis is equal to
- (a) 1
- (b) -2
- (c) 2
- (d) None of these
28. If $P = x^3 - \frac{1}{x^3}$ and $Q = x - \frac{1}{x}$, $x \in (0, \infty)$, then minimum value of $\frac{P}{Q^2}$ is
- (a) $2\sqrt{3}$
- (b) $-2\sqrt{3}$
- (c) does not exist
- (d) None of these
29. Locus of the point which divides double ordinate of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ in the ratio 1:2 internally, is
- (a) $\frac{x^2}{a^2} - \frac{9y^2}{b^2} = \frac{1}{9}$
- (b) $\frac{x^2}{a^2} + \frac{9y^2}{b^2} = 1$
- (c) $\frac{9y^2}{a^2} + \frac{9y^2}{b^2} = 1$
- (d) None of these
30. From any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ tangents are drawn to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 2$. The area cut-off by the chord of contact on the asymptotes is equal to
- (a) $\frac{ab}{2}$
- (b) ab
- (c) $2ab$
- (d) $4ab$
31. The value of the sum of the series $3 \cdot {}^nC_0 - 8 \cdot {}^nC_1 + 13 \cdot {}^nC_2 - 18 \cdot {}^nC_3 + \dots$ upto $(n+1)$ terms is
- (a) 0
- (b) 3^n
- (c) 5^n
- (d) None of these
32. If A is a skew-symmetric matrix, then trace of A is
- (a) 1
- (b) -1
- (c) 0
- (d) None of these
33. The arbitrary constant on which the value of the determinant
- $$\begin{vmatrix} 1 & \alpha & \alpha^2 \\ \cos(p-d)a & \cos pa & \cos(p-d)a \\ \sin(p-d)a & \sin pa & \sin(p-d)a \end{vmatrix}$$
- does not depend, is
- (a) α
- (b) p
- (c) d
- (d) a

34. The sum of the first n terms of the series $\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{16} + \dots$ is equal to
 (a) $2^n - n + 1$ (b) $1 - 2^{-n}$
 (c) $n + 2^{-n} - 1$ (d) $2^n - 1$
35. The base of a cliff is circular. From the extremities of a diameter of the base angles of elevation of the top of the cliff are 30° and 60° . If the height of the cliff be 500 m, then the diameter of the base of the cliff is
 (a) $\frac{2000}{\sqrt{3}}$ m (b) $\frac{1000}{\sqrt{3}}$ m
 (c) $\frac{2000}{\sqrt{2}}$ m (d) $1000\sqrt{3}$ m
36. The most general solutions of the equation $\sec x - 1 = (\sqrt{2} - 1) \tan x$ are given by
 (a) $n\pi + \frac{\pi}{8}$ (b) $2n\pi, 2n\pi + \frac{\pi}{4}$
 (c) $2n\pi$ (d) None of these
37. 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 at
 (a) $x = \frac{\pi}{12}$ (b) $x = \frac{\pi}{6}$
 (c) $x = \frac{\pi}{3}$ (d) $x = \frac{\pi}{2}$
38. If $z_r = \cos \frac{r\alpha}{n^2} + i \sin \frac{r\alpha}{n^2}$, where $r = 1, 2, 3, \dots, n$, then $\lim_{n \rightarrow \infty} z_1 z_2 \dots z_n$ is equal to
 (a) $\cos \alpha + i \sin \alpha$
 (b) $\cos\left(\frac{\alpha}{2}\right) - i \sin\left(\frac{\alpha}{2}\right)$
 (c) $e^{i\alpha/2}$
 (d) $\sqrt[3]{e^{i\alpha}}$
39. Negation of "Paris is in France and London is in England" is
 (a) Paris is in England and London is in France
 (b) Paris is not in France or London is not in England
 (c) Paris is in England or London is in France
 (d) None of the above
40. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is
 (a) $\frac{5}{3}$ sq unit (b) $\frac{5}{4}$ sq unit
 (c) $\frac{5}{12}$ sq unit (d) $\frac{12}{5}$ sq unit
41. Find the equation of the bisector of the obtuse angle between the lines $3x - 4y + 7 = 0$ and $-12x - 5y + 2 = 0$,
 (a) $21x + 77y - 101 = 0$
 (b) $99x - 27y + 81 = 0$
 (c) $21x - 77y + 101 = 0$
 (d) None of the above
42. The equation of curve passing through the point $\left(1, \frac{\pi}{4}\right)$ and having slope of tangent at any point (x, y) as $\frac{y}{x} - \cos^2\left(\frac{y}{x}\right)$, is
 (a) $x = e^{1 + \tan\left(\frac{y}{x}\right)}$ (b) $x = e^{1 - \tan\left(\frac{y}{x}\right)}$
 (c) $x = e^{1 + \tan\left(\frac{x}{y}\right)}$ (d) $x = e^{1 - \tan\left(\frac{x}{y}\right)}$
43. If $P(n) : 2 + 4 + 6 + \dots + (2n), n \in N$, then $P(k) = k(k+1) + 2$ implies $P(k+1) = (k+1)(k+2) + 2$ is true for all $k \in N$. So, statement $P(n) = n(n+1) + 2$ is true for
 (a) $n \geq 1$ (b) $n \geq 2$
 (c) $n \geq 3$ (d) None of these
44. The differential equation of all non-vertical lines in a plane is
 (a) $\frac{d^2y}{dx^2} = 0$ (b) $\frac{d^2x}{dy^2} = 0$
 (c) $\frac{dy}{dx} = 0$ (d) $\frac{dx}{dy} = 0$
45. The unit vector in ZOY plane and making angle 45° and 60° respectively with $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = 0\hat{i} + \hat{j} - \hat{k}$, is
 (a) $-\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{k}$
 (b) $\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{k}$
 (c) $\frac{1}{3\sqrt{2}}\hat{i} + \frac{4}{3\sqrt{2}}\hat{j} + \frac{1}{3\sqrt{2}}\hat{k}$
 (d) None of the above

46. If $\int_2^e \left(\frac{1}{\log x} - \frac{1}{(\log x)^2} \right) dx = a + \frac{b}{\log 2}$, then
 (a) $a = e, b = -2$ (b) $a = e, b = 2$
 (c) $a = -e, b = 2$ (d) None of these
47. The circle $x^2 + y^2 - 4x - 4y + 4 = 0$ is inscribed in a triangle which has two of its sides along the coordinate axes. If the locus of the circumcentre of the triangle is $x + y - xy + k\sqrt{x^2 + y^2} = 0$, then the value of k is equal to
 (a) 2 (b) 1 (c) -2 (d) 3
48. The points of discontinuity of $\tan x$ are
 (a) $n\pi, n \in I$
 (b) $2n\pi, n \in I$
 (c) $(2n + 1)\frac{\pi}{2}, n \in I$
 (d) None of the above
49. The two curves $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 - 2 = 0$
 (a) cut at right angles
 (b) touch each other
 (c) cut at an angle $\frac{\pi}{3}$
 (d) cut at an angle $\frac{\pi}{4}$
50. The period of the function $f(x) = \frac{\sin 8x \cos x - \sin 6x \cos 3x}{\cos 2x \cos x - \sin 3x \sin 4x}$ is
 (a) π (b) 2π
 (c) $\frac{\pi}{2}$ (d) None of these
51. The derivative of $f(\tan x)$ w.r.t. $g(\sec x)$ at $x = \frac{\pi}{4}$, where $f'(1) = 2$ and $g'(\sqrt{2}) = 4$, is
 (a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$
 (c) 1 (d) None of these
52. If $a > 0, b > 0$ the maximum area of the triangle formed by the points $O(0, 0)$, $A(a \cos \theta, b \sin \theta)$ and $B(a \cos \theta, -b \sin \theta)$ is (in sq unit)
 (a) $\frac{ab}{2}$ when $\theta = \frac{\pi}{4}$
 (b) $\frac{3ab}{4}$ when $\theta = \frac{\pi}{4}$
 (c) $\frac{ab}{2}$ when $\theta = -\frac{\pi}{2}$
 (d) a^2b^2
53. If the two curves $y = a^x$ and $y = b^x$ intersect at an angle α , then $\tan \alpha$ equals
 (a) $\frac{\log a - \log b}{1 + \log a \log b}$ (b) $\frac{\log a + \log b}{1 - \log a \log b}$
 (c) $\frac{\log a - \log b}{1 - \log a \log b}$ (d) None of these
54. The number of roots of the equation $x - \frac{2}{x-1} = 1 - \frac{2}{x-1}$ is
 (a) 1 (b) 2
 (c) 0 (d) infinitely many
55. The vector $z = -4 + 5i$ is turned counterclockwise through an angle of 180° and stretched $1\frac{1}{2}$ times. The complex number corresponding to newly obtained vector is
 (a) $-6 + \frac{15}{2}i$ (b) $6 + \frac{15}{2}i$
 (c) $6 - \frac{15}{2}i$ (d) None of these
56. If $A = [a_{ij}]$ is a 4×4 matrix C_{ij} is the cofactor of the element a_{ij} in $|A|$, then the expression $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13} + a_{14}C_{14}$ is equal to
 (a) 0 (b) -1
 (c) 1 (d) $|A|$
57. If $A = \left\{ x : \frac{\pi}{6} \leq x \leq \frac{\pi}{3} \right\}$ and $f(x) = \cos x - x(1+x)$, then $f(A)$ is equal to
 (a) $\left[-\frac{\pi}{3}, -\frac{\pi}{6} \right]$
 (b) $\left[\frac{\pi}{6}, \frac{\pi}{3} \right]$
 (c) $\left[\frac{1}{2} - \frac{\pi}{3} \left(1 + \frac{\pi}{3} \right), \frac{\sqrt{3}}{2} - \frac{\pi}{6} \left(1 + \frac{\pi}{6} \right) \right]$
 (d) $\left[\frac{1}{2} + \frac{\pi}{3} \left(1 - \frac{\pi}{3} \right), \frac{\sqrt{3}}{2} + \frac{\pi}{6} \left(1 - \frac{\pi}{6} \right) \right]$

58. The contrapositive of $(p \vee q) \Rightarrow r$ is

- (a) $\sim r \Rightarrow (p \vee q)$
 (b) $r \Rightarrow (p \vee q)$
 (c) $\sim r \Rightarrow (\sim p \wedge \sim q)$
 (d) $p \Rightarrow (q \vee r)$

59. If the function $f(x) = ax^3 + bx^2 + 11x - 6$ satisfies the condition of Rolle's theorem in $[1, 3]$ and $f'\left(2 + \frac{1}{\sqrt{3}}\right) = 0$, then the values of

a, b are respectively

- (a) $-1, 6$ (b) $-2, 1$
 (c) $1, -6$ (d) $-1, \frac{1}{2}$

60. If $f(x) = \cos(\log x)$, then

$$f\left(\frac{1}{x}\right)f\left(\frac{1}{y}\right) - \frac{1}{2}\left[f\left(\frac{x}{y}\right) + f(xy)\right]$$

is equal to

- (a) $\cos(x - y)$ (b) $\log(x - y)$
 (c) $\cos(x + y)$ (d) None of these

61. If $\alpha = \sin^{-1} \frac{\sqrt{3}}{2} + \sin^{-1} \frac{1}{3}$ and

$$\beta = \cos^{-1} \frac{\sqrt{3}}{2} + \cos^{-1} \frac{1}{3}, \text{ then}$$

- (a) $\alpha > \beta$ (b) $\alpha = \beta$
 (c) $\alpha < \beta$ (d) $\alpha + \beta = 2\pi$

62. If $1 + \sin \theta + \sin^2 \theta + \dots \infty = 4 + 2\sqrt{3}, 0 < \theta < \pi$, $\theta \neq \frac{\pi}{2}$, then

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

63. A round balloon of radius r subtends an angle α at the eye of the observer, while the angle of elevation of its centre is β . The height of the centre of balloon is

- (a) $r \operatorname{cosec} \alpha \sin \frac{\beta}{2}$ (b) $r \sin \alpha \operatorname{cosec} \frac{\beta}{2}$
 (c) $r \sin \frac{\alpha}{2} \operatorname{cosec} \beta$ (d) $r \operatorname{cosec} \frac{\alpha}{2} \sin \beta$

64. In $\triangle ABC$, $(a - b)^2 \cos^2 \frac{C}{2} + (a + b)^2 \sin^2 \frac{C}{2}$ is

- equal to
 (a) a^2 (b) b^2
 (c) c^2 (d) None of these

65. In a triangle $\left(1 - \frac{r_1}{r_2}\right)\left(1 - \frac{r_1}{r_3}\right) = 2$, then the

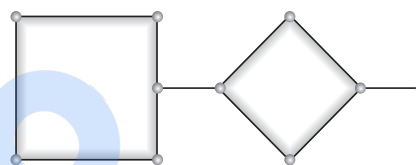
triangle is

- (a) right angled (b) isosceles
 (c) equilateral (d) None of these

66. If $a + b + c = 0$, then the roots of the equation $4ax^2 + 3bx + 2c = 0$ are

- (a) equal (b) imaginary
 (c) real (d) None of these

67. The adjoining graph



- (a) connected
 (b) disconnected
 (c) Neither connected nor disconnected
 (d) None of the above

68. The solution of $\tan^{-1} x + 2 \cot^{-1} x = \frac{2\pi}{3}$ is

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

69. The conjugate of the complex number $\frac{(1+i)^2}{1-i}$ is

- (a) $1 - i$ (b) $1 + i$
 (c) $-1 + i$ (d) $-1 - i$

70. A graph G has ' m ' vertices of odd degree and ' n ' vertices of even degree. Then which of the following statements is necessarily true?

- (a) $m + n$ is an odd number
 (b) $m + n$ is an even number
 (c) $n + 1$ is an even number
 (d) $m + 1$ is an odd number

71. The value of $\sin \left[2 \cos^{-1} \frac{\sqrt{5}}{3} \right]$ is

- (a) $\frac{\sqrt{5}}{3}$ (b) $\frac{2\sqrt{5}}{3}$
 (c) $\frac{4\sqrt{5}}{9}$ (d) $\frac{2\sqrt{5}}{9}$

72. In the group $(G, \otimes_{15})$, where $G = \{3, 6, 9, 12\}$, $\otimes_{15}$ is multiplication modulo 15, the identity element is
(a) 3 (b) 6 (c) 12 (d) 9
73. A group $(G, *)$ has 10 elements. The minimum number of elements of G , which are their own inverses is
(a) 2 (b) 1 (c) 9 (d) 0
74. $\frac{3x^2 + 1}{x^2 - 6x + 8}$ is equal to
(a) $3 + \frac{49}{2(x-4)} - \frac{13}{2(x-2)}$
(b) $\frac{49}{2(x-4)} - \frac{13}{2(x-2)}$
(c) $\frac{-49}{2(x-4)} + \frac{13}{2(x-2)}$
(d) $\frac{49}{2(x-4)} + \frac{13}{2(x-2)}$
75. The orthocentre of the triangle with vertices $O(0, 0)$, $A\left(0, \frac{3}{2}\right)$, $B(-5, 0)$ is
(a) $\left(\frac{5}{2}, \frac{3}{4}\right)$ (b) $\left(-\frac{5}{2}, \frac{3}{4}\right)$
(c) $\left(-5, \frac{3}{2}\right)$ (d) $(0, 0)$
76. The range in which $y = -x^2 + 6x - 3$ is increasing, is
(a) $x < 3$ (b) $x > 3$
(c) $7 < x < 8$ (d) $5 < x < 6$
77. The area bounded by the curve $x = 4 - y^2$ and the y-axis is
(a) 16 sq unit
(b) 32 sq unit
(c) $\frac{32}{3}$ sq unit
(d) $\frac{16}{3}$ sq unit
78. The number of positive divisors of 252 is
(a) 9 (b) 5 (c) 18 (d) 10
79. The remainder obtained when 5^{124} is divided by 124 is
(a) 5 (b) 0
(c) 2 (d) 1
80. Which of the following is not a group with respect to the given operation?
(a) The set of even integers including zero under addition
(b) The set of odd integers under addition
(c) $\{0\}$ under addition
(d) $\{1, -1\}$ under multiplication

General English and Aptitude

Directions (Q. 1-4) : In each of the following questions, choose the most suitable alternative to fill in the blank.

- He is so of his own idea that he will not entertain any suggestion from others.
(a) hopeful (b) enamoured
(c) jealous (d) possessed
- Undoubtedly, English is the most spoken language in the world today.
(a) broadly
(b) widely
(c) greatly
(d) beautifully
- I will be leaving for Delhi tonight and to return by this weekend.
(a) waiting (b) plan
(c) going (d) making

- The vacancy by the dismissal of the superintendent is expected to be filled up by the promotion of a U.D.C.
(a) made (b) created
(c) caused (d) generated

Directions (Q. 5-8) : In each of the following questions, choose the alternative which best expresses the meaning of the word given in capital letters.

- HAGGLE
(a) Postpone (b) Accept
(c) Bargain (d) Reject
- ABSTRUSE
(a) Awful (b) Irrelevant
(c) Shallow (d) Profound
- PENCHANT
(a) Like (b) Eagerness
(c) Disability (d) Dislike

8. BARTER

- (a) Deal (b) Return
(c) Lend (d) Exchange

Directions (Q. 9-12) : In each of the following questions, choose the alternative which can be substituted for the given words/sentence.

9. Bringing about gentle and painless death from incurable disease

- (a) Gallows (b) Suicide
(c) Euphoria (d) Euthanasia

10. The act of killing one's wife

- (a) Avicide
(b) Canicide
(c) Uxoricide
(d) Genocide

11. Stage between boyhood and youth

- (a) Infancy (b) Adolescence
(c) Puberty (d) Maturity

12. Lack of enough blood

- (a) Amnesia
(b) Insomnia
(c) Anaemia
(d) Allergy

Directions (Q. 13-16) : In each of the following questions, choose the alternative which best expresses the meaning of the given idiom/phrase.

13. To set the people by ears

- (a) To box the people
(b) To insult and disgrace the people
(c) To punish heavily
(d) To excite people to a quarrel

14. To give chapter and verse for a thing

- (a) To produce the proof of something
(b) To eulogise the qualities of a thing
(c) To make publicity of a thing
(d) To attach artificial value to a thing

15. Dog in the manger

- (a) An undersized bull almost the shape of a dog
(b) A dog that has no kennel of its own
(c) A person who puts himself in difficulties on account of other people
(d) A person who prevents others from enjoying something useless to himself

16. To blow hot and cold

- (a) Changing weather
(b) To be untrustworthy
(c) To change opinion often
(d) To be rich and poor frequently

Directions (Q. 17-20) : In each of the following questions, choose the alternative which is opposite in meaning to the word given in capital letters.

17. SAGACIOUS

- (a) Casual (b) Cunning
(c) Foolish (d) False

18. EPILOGUE

- (a) Conversation (b) Dialogue
(c) Dramatic (d) Prologue

19. AUSPICIOUS

- (a) Spicy
(b) Unfavourable
(c) Conspicuous
(d) Condemnatory

20. ENGULFED

- (a) Encircled (b) Groped
(c) Disfigured (d) Detached

21. Four of the following five are alike in a certain way and so form a group. Which is the one that does not belong to that group?

- (a) Hill (b) Valley
(c) Dam (d) River

22. In a certain code 'CREAM' is written as 'NBDBQ'. How in 'BREAD' written in that code?

- (a) EBFAQ
(b) EBDAQ
(c) BEDQA
(d) BEFQA

23. If black means white, white means red, red means yellow, yellow means blue, blue means green, green means purple and purple means orange, then what is the colour of lemon?

- (a) Green (b) Purple
(c) Orange (d) Blue

Directions (Q. 24-25) : In the following questions, find the word which holds the same relation with the third word as there is between the first two word.

24. Hot : Oven :: Cold : ?
 (a) Ice cream
 (b) Air conditioner
 (c) Snow
 (d) Refrigerator
25. Push : Pull :: Throw : ?
 (a) Jump
 (b) Collect
 (c) Pick
 (d) Game
- Directions (Q. 26-27)** In each of the following questions, one letter or a set of letter is missing, you have to understand the pattern of the series and insert the appropriate letter?
26. R, M, ?, F, D, ?
 (a) C, B (b) J, H
 (c) H, C (d) I, C
27. - bcc - ac - aabb - ab - cc
 (a) aab ca (b) aba ca
 (c) ba cab (d) bca ca.
28. How many 9's are there in the following number series which are immediately preceded by 3 and followed by 6?
 3 9 6 9 3 9 3 9 3 9 6 3 9 3 6 3 9 5 6 9 5 6 9 3 9 6 3 9
 (a) 0 (b) 3
 (c) 2 (d) 4
29. Some boys are sitting in a row, P is sitting fourteenth from the left and Q is seventh from the right. If there are four boys between P and Q, how many boys are there in the row?
 (a) 25 (b) 23
 (c) 21 (d) 19
30. Pointing to a photograph, a woman says, "this man's son's sister in my mother-in-law." How is the woman's husband related to the man in the photograph?
 (a) Grandson
 (b) Son
 (c) Son-in-law
 (d) Nephew.
31. The longest canal in the world is
 (a) Volga Baltic
 (b) Belye-more Baltic
 (c) Suez Canal
 (d) Grand China Canal
32. The oldest Hindu epic is
 (a) Mahabhashya (b) Ramayan
 (c) Mahabharata (d) Ashtadhyayi
33. Who among the following is not associated with the Swaraj Party?
 (a) C.R. Das
 (b) M.L. Kelkar
 (c) Motilal Nehru
 (d) Mahatma Gandhi
34. Where is the 'City of palaces'?
 (a) London (b) Kolkata
 (c) Patiala (d) Lucknow
35. Our National Song is
 (a) Sare Jahan Se Achcha
 (b) Jana Gana Mana
 (c) Vande Mataram
 (d) All of the above
36. The Constitution of India was adopted by the Constituent Assembly on
 (a) Dec 11, 1946 (b) Aug 15, 1957
 (c) Nov 26, 1949 (d) Jan 26, 1949
37. Gandhiji's Dandi March started from
 (a) Bardoli (b) Ahmedabad
 (c) Surat (d) Bombay
38. Who was the viceroy of India at the time of formation of the Indian National Congress?
 (a) Lord Canning (b) Lord Dufferin
 (c) Lord Mayo (d) Lord Elgin
39. Which country was a major donor in financing the 'SAARC'?
 (a) Pakistan (b) Sri Lanka
 (c) India (d) Bangladesh
40. Where in the H. Q. of the European Economic Community?
 (a) Bonn (b) Rome
 (c) Brussels (d) Hague