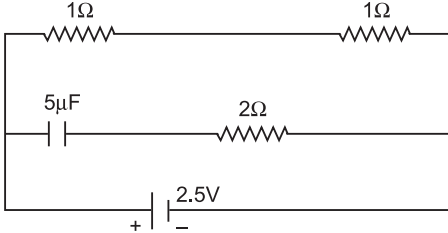
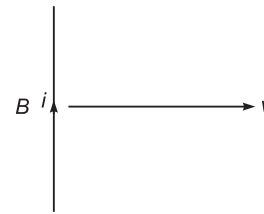


MET 2011 Memory Based Question Paper PDF

Physics

- Which of the following statements is wrong?
 - Voltmeter should have high resistance
 - Ammeter should have low resistance
 - Ammeter is placed in parallel across the conductor in a circuit
 - Voltmeter is placed in parallel across the conductor in a circuit
- As the temperature of hot junction increases, the thermo emf
 - always increases
 - always decreases
 - may increase or decrease
 - always remains constant
- A proton and an α -particle enter a uniform magnetic field perpendicularly with the same speed. If proton takes $25 \mu\text{s}$ to make 5 revolutions, then the periodic time for the α -particle would be
 - $50 \mu\text{s}$
 - $25 \mu\text{s}$
 - $10 \mu\text{s}$
 - $5 \mu\text{s}$
- Two parallel conductors A and B of equal length carry currents i and $10i$, respectively, in the same direction. Then
 - A and B will repel each other with same force
 - A and B will attract each other with same force
 - A will attract B , but B will repel A
 - A and B will attract each other with different forces
- An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is termed to be higher by 100 Hz than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is
 - 200 Hz
 - 150 Hz
 - 100 Hz
 - 250 Hz
- Two slits 4 mm apart, are illuminated by light of wavelength $6000 \text{ \AA}$. What will be the fringe width on a screen placed 2 m from the slits?
 - 0.12 mm
 - 0.3 mm
 - 3.0 mm
 - 4.0 mm
- A thin prism P_1 of angle 4° and refractive index 1.54 is combined with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation. The angle of P_2 is
 - 4°
 - 5.33°
 - 2.6°
 - 3°
- While viewing a distant object with a telescope suddenly a housefly sits on objective lens. The correct statement is that
 - housefly will be seen enlarged in image
 - housefly will be seen reduced in image
 - intensity of image will be decreased
 - intensity of image will be increased
- A capacitor of capacitance $5 \mu\text{F}$ is connected as shown in the figure. The internal resistance of the cell is 0.5Ω . The amount of charge on the capacitor plate is
 
 - $10 \mu\text{C}$
 - $5 \mu\text{C}$
 - $6 \mu\text{C}$
 - $10.2 \mu\text{C}$

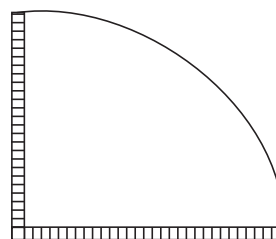
10. A charge of 10^{-9} C is placed on each of the 64 identical drops of radius 2 cm. They are then combined to form a bigger drop. Its potential will be
 (a) 7.2×10^3 V (b) 7.2×10^2 V
 (c) 1.44×10^2 V (d) 1.44×10^3 V
11. A particle moves in the xy -plane under the action of a force F such that the components of its linear momentum $\mathbf{p}$ at any time t are $p_x = 2 \cos t$, $p_y = \sin t$. The angle between F and $\mathbf{p}$ at time t is
 (a) 90° (b) 0°
 (c) 180° (d) 30°
12. A fighter plane is moving in a vertical circle of radius r . Its minimum velocity at the highest point A of the circle will be
 (a) $\sqrt{3gr}$ (b) $\sqrt{2gr}$
 (c) $\sqrt{gr}$ (d) $\sqrt{gr/2}$
13. In Millikan's oil drop experiment, a charged drop of mass 1.8×10^{-13} kg is stationary between its plates. The distance between its plates is 0.9 cm and potential difference is 2000 V. The number of electrons in the drop is
 (a) 500 (b) 50
 (c) 5 (d) 10
14. Decay constant of radium is λ . By a suitable process its compound radium bromide is obtained. The decay constant of radium bromide will be
 (a) λ (b) more than λ
 (c) less than λ (d) zero
15. Rn decays into Po by emitting an α -particle with half-life of 4 days. A sample contains 6.4×10^{10} atoms of Rn after 12 days, the number of atoms of Rn left in the sample will be
 (a) 3.2×10^{10} (b) 0.53×10^{10}
 (c) 2.1×10^{10} (d) 0.8×10^{10}
16. The energy gap between the valence and conduction bands of an insulator is about
 (a) 0.1 eV (b) 1.0 eV
 (c) 5.0 eV (d) zero
17. A conducting wire is moving towards right in a magnetic field B . The direction of induced current in the wire is shown in the figure. The direction of magnetic field will be



- (a) in the plane of paper pointing towards right
 (b) in the plane of paper pointing towards left
 (c) perpendicular to the plane of paper and downwards
 (d) perpendicular to the plane of paper and upwards
18. An electron moving with velocity 2×10^{-7} m/s, describes a circle in a magnetic field of strength 2×10^{-2} T. If $\frac{e}{m}$ of electron is 1.76×10^{11} C/kg. Then the diameter of the circle will be
 (a) 11 cm (b) 1.1 cm
 (c) 1.1 mm (d) 1.1 m
19. In an AC circuit the potential difference and current are represented respectively by $V = 100 \sin(100t)$ volt,
 $I = 100 \sin\left(100t + \frac{\pi}{3}\right)$ milliampere. The power in the circuit is
 (a) 2.5 W (b) 5 W
 (c) 10 W (d) 10^4 W
20. Escape velocity from earth's surface is 11 km/s. If radius of a planet is double than that of earth and density is same as that of earth, then the escape velocity from this planet will be
 (a) 5.5 km/s (b) 11 km/s
 (c) 16.5 km/s (d) 22 km/s
21. The orbital angular momentum of a satellite revolving at a distance r from the centre is L . If the distance is increased to $16r$, then the new angular momentum will be
 (a) $16L$ (b) $64L$
 (c) $\frac{L}{4}$ (d) $4L$
22. The acceleration of a particle performing SHM is 12 cm/s^2 at a distance of 3 cm from the mean position. Its time period is
 (a) 0.5 s (b) 1.0 s
 (c) 2.0 s (d) 3.14 s

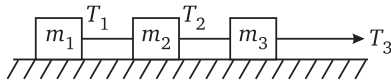
23. A soap bubble in vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4 cm. If the two bubbles coalesce under isothermal condition, then the radius of the new bubble is
 (a) 2.3 cm (b) 4.5 cm
 (c) 5 cm (d) 7 cm
24. A 10 cm^3 cube floats in water with a height of 4 cm^3 remaining above the surface. The density of the material from which the cube is made is
 (a) 0.6 g cm^{-3} (b) 1.0 g cm^{-3}
 (c) 0.4 g cm^{-3} (d) 0.24 g cm^{-3}
25. The heat flows through a rod of length 50 cm and area of cross-section 5 cm^2 . Its ends are respectively at 25°C and 125°C . The coefficient of thermal conductivity of the material rod is $0.092\text{ kcal/m}^\circ\text{C}$. The temperature gradient of the rod is
 (a) 2°C/cm (b) 2°C/m
 (c) 20°C/cm (d) 20°C/m
26. 5 mol of hydrogen gas is heated from 30°C to 60°C at constant pressure. Heat given to the gas is (given $R = 2\text{ cal/mol deg}$)
 (a) 750 cal (b) 630 cal
 (c) 1050 cal (d) 1470 cal
27. A fish at a depth of 12 cm in water is viewed by an observer on the bank of a lake. To what height the image of the fish is raised?
 (Refractive index of lake water $= \frac{4}{3}$)
 (a) 9 cm (b) 12 cm
 (c) 3.8 cm (d) 3 cm
28. The rest energy of an electron is 0.511 MeV. The electron is accelerated from rest to a velocity $0.5c$. The change in its energy will be
 (a) 0.026 MeV (b) 0.051 MeV
 (c) 0.079 MeV (d) 0.105 MeV
29. In Millikan's oil drop experiment, an oil drop carrying a charge Q is held stationary by a potential difference 2400 V between the plates. To keep a drop of half the radius stationary, the potential difference had to be made 600V. What is the charge on the second drop?
 (a) $\frac{Q}{4}$ (b) $\frac{Q}{2}$
 (c) Q (d) $\frac{3Q}{2}$
30. Band spectrum is characteristic of the
 (a) atoms
 (b) molecules
 (c) amorphous solids
 (d) crystalline solids
31. As a result of radioactive decay ${}_{92}\text{U}^{238}$ is converted into ${}_{91}\text{Pa}^{234}$. The particles emitted during this decay are
 (a) a proton and a neutron
 (b) a proton and two α -particles
 (c) an α -particle and a β -particle
 (d) two β -particles and a proton
32. A p -type semiconductor has acceptor levels 57 meV above the valence band. The maximum wavelength of light required to create a hole
 (a) $57\text{ \AA}$ (b) $57 \times 10^{-3}\text{ \AA}$
 (c) $217105\text{ \AA}$ (d) $11.61 \times 10^{-33}\text{ \AA}$
33. In an explosion a body breaks up into pieces of unequal masses. In this case
 (a) both parts will have numerically equal momentum
 (b) lighter part will have more momentum
 (c) heavier part will have more momentum
 (d) both parts will have equal kinetic energy
34. A force of 10 N acts on a body of mass 20 kg for 10 s. Change in its momentum is
 (a) 5 kg m/s (b) 100 kg m/s
 (c) 200 kg m/s (d) 1000 kg m/s
35. In which case does the potential energy decrease?
 (a) On compressing a spring
 (b) On stretching a spring
 (c) On moving a body against gravitational force
 (d) On the rising of an air bubble in water
36. A heavy mass is attached to a thin wire and is whirled in a vertical circle. The wire is most likely to break
 (a) when the mass is at the highest point of the circle
 (b) when the mass is at the lowest point of the circle
 (c) when the wire is horizontal
 (d) at an angle of $\cos^{-1}\left(\frac{1}{3}\right)$ from the upward vertical

37. The time taken by AC of 50 Hz in reaching from zero to the maximum value is
 (a) 50×10^{-3} s (b) 5×10^{-3} s
 (c) 1×10^{-3} s (d) 2×10^{-3} s
38. The molar heat capacity of rock salt at low temperature varies with temperature according to Debye's T^3 law
 Thus $C = k \frac{T^3}{\theta^3}$ where $k = 1940 \text{ Jmol}^{-1}\text{K}^{-1}$
 $\theta = 281 \text{ K}$
 Calculate how much heat is required to raise the temperature of 2 moles of rock salt from 10 K to 50 K
 (a) 800 J (b) 373 J
 (c) 273 J (d) None of these
39. The velocity of an electron in the second orbit of sodium atom (atomic number = 11) is v . The velocity of an electron in its fifth orbit will be
 (a) v (b) $\frac{22}{5}v$
 (c) $\frac{5}{2}v$ (d) $\frac{2}{5}v$
40. A charged particle enters a magnetic field H with its initial velocity making an angle of 45° with H . The path of the particle will be
 (a) a straight line (b) a circle
 (c) an ellipse (d) a helix
41. A $10 \mu\text{F}$ capacitor is charged to a potential difference of 50V and is connected to another uncharged capacitor in parallel. Now the common potential difference becomes 20V. The capacitance of second capacitor is
 (a) $10 \mu\text{F}$ (b) $20 \mu\text{F}$
 (c) $30 \mu\text{F}$ (d) $15 \mu\text{F}$
42. An alternating voltage $E = 200\sqrt{2} \sin(100t) \text{ V}$ is connected to a $1 \mu\text{F}$ capacitor through an AC ammeter. The reading of ammeter is
 (a) 10 mA (b) 20 mA
 (c) 40 mA (d) 80 mA
43. In a step-up transformer the turn ratio is 1 : 2. A Leclanche cell (emf 1.5 V) is connected across the primary. The voltage across the secondary is
 (a) 3.0 V (b) 0.75 V (c) zero (d) 1.5 V
44. If 10% of the current passes through a moving coil galvanometer of resistance 99Ω . Then the shunt resistance will be
 (a) 9.9Ω (b) 11Ω
 (c) 10Ω (d) 9Ω
45. How much energy will necessary for making a body of 500 kg escape from the earth?
 ($g = 9.8 \text{ m/s}^2$, radius of the earth = $6.4 \times 10^6 \text{ m}$)
 (a) about $9.8 \times 10^6 \text{ J}$ (b) about $6.4 \times 10^8 \text{ J}$
 (c) about $3.1 \times 10^{10} \text{ J}$ (d) about $27.4 \times 10^{12} \text{ J}$
46. In a neon discharge tube 2.9×10^{18} Ne^+ ions move to the right each second while 1.2×10^{18} electrons move to the left per second, electrons charge is $1.6 \times 10^{-19} \text{ C}$. The current in the discharge tube is
 (a) 1 A, towards right
 (b) 0.66 A, towards right
 (c) 0.66 A, towards left
 (d) zero
47. Water is falling on the blades of a turbine at a rate of 100 kg/s. If the height of the fall is 100 m, the power transferred to the turbine will be approximately
 (a) 100 kW (b) 10 kW (c) 1 kW (d) 100 W
48. A metre scale is standing vertically on the earth's surface on one of its end. It now falls on earth without slipping. Find the velocity with which the free end of the scale strikes the earth.
 ($g = 10 \text{ m/s}^2$)



- (a) 9.8 m/s (b) 5.47 m/s
 (c) 4.5 m/s (d) 1 m/s

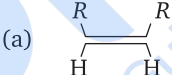
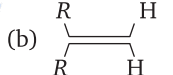
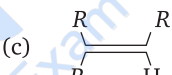
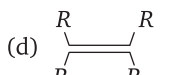
49. For germanium crystal, the forbidden energy gap in joule is
 (a) 1.216×10^{-19} (b) 1.76×10^{-19}
 (c) 1.6×10^{-19} (d) zero
50. An electron is accelerated through a potential difference of 200 V. If e/m for the electron be $1.6 \times 10^{11} \text{ C/kg}$, the velocity acquired by the electron will be
 (a) $8 \times 10^6 \text{ m/s}$ (b) $8 \times 10^5 \text{ m/s}$
 (c) $5.9 \times 10^6 \text{ m/s}$ (d) $5.9 \times 10^5 \text{ m/s}$

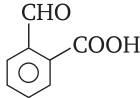
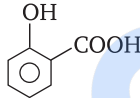
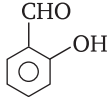
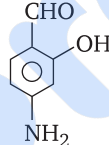
51. At what temperature will the resistance of a copper wire become three times its value at 0°C ? (temperature coefficient of resistance for copper $= 4 \times 10^{-3}/^{\circ}\text{C}$)
 (a) 400°C (b) 450°C
 (c) 500°C (d) 550°C
52. A coil having an area of 2m^2 is placed in a magnetic field which changes from 1Wb/m^2 to 4Wb/m^2 in 2 s. The emf induced in the coil will be
 (a) 4 V (b) 3 V
 (c) 2 V (d) 1 V
53. A 10 m long copper wire while remaining in the east-west horizontal direction is falling down with a speed of 5.0 m/s. If the horizontal component of the earth's magnetic field $= 0.3 \times 10^{-4}\text{Wb/m}^2$ the emf developed between the ends of the wires is
 (a) 0.15 V (b) 1.5 V
 (c) 0.15 mV (d) 1.5 mV
54. A current of 1.6 A is passed through a solution of CuSO_4 . How many Cu^{++} ions are liberated in one minute?
 (electronic charge $= 1.6 \times 10^{-19}\text{C}$)
 (a) 3×10^{20} (b) 3×10^{19}
 (c) 6×10^{20} (d) 6×10^{19}
55. A solenoid has an inductance of 60 H and a resistance of 30Ω . If it is connected to a 100 V battery, how long will it take for the current to reach $\frac{e-1}{e} = 63.2\%$ of its final value?
 (a) 1 s (b) 2 s
 (c) e second (d) 2e second
56. Three blocks of masses m_1, m_2 are connected by massless strings as shown on a frictionless table. They are pulled with a force $T_3 = 40\text{N}$. If $m_1 = 10\text{kg}$, $m_2 = 6\text{kg}$ and $m_3 = 4\text{kg}$, the tension T_2 will be
- 
- (a) 20 N (b) 40 N
 (c) 10 N (d) 32 N
57. The force constant of weightless spring is 16 N/m. A body of mass 1.0 kg suspended from it is pulled down through 5 cm and then released. The maximum kinetic energy of the system (spring + body) will be
 (a) $2 \times 10^{-2}\text{J}$ (b) $4 \times 10^{-2}\text{J}$
 (c) $8 \times 10^{-2}\text{J}$ (d) $16 \times 10^{-2}\text{J}$
58. A mass M is moving with a constant velocity on a line parallel to the x-axis. Its angular momentum with respect to the origin or z-axis
 (a) is zero
 (b) remains constant
 (c) goes on increasing
 (d) goes on decreasing
59. Which of the following pairs is an isobar?
 (a) ${}_1\text{H}^1$ and ${}_1\text{H}^2$ (b) ${}_1\text{H}^2$ and ${}_1\text{H}^3$
 (c) ${}_6\text{C}^{12}$ and ${}_6\text{C}^{13}$ (d) ${}_{15}\text{P}^{30}$ and ${}_{14}\text{Si}^{30}$
60. The half-life of the isotope ${}_{11}\text{Na}^{24}$ is 15 h. How much time does it take for $\frac{7}{8}$ th of a sample of this isotope to decay?
 (a) 75 h (b) 65 h
 (c) 55 h (d) 45 h

Chemistry

1. The largest number of molecules is in
 (a) 36 g of water
 (b) 28 g of CO_2
 (c) 46 g of CH_3OH
 (d) 58 g of N_2O_5
2. In the following reaction, which choice has value twice that of the equivalent weight of the oxidising agent?

$$\text{SO}_2 + 2\text{H}_2\text{O} \longrightarrow \text{S} + 2\text{H}_2\text{SO}_2$$
- (a) 16 (b) 48
 (c) 64 (d) 32
3. Orbital is
 (a) circular path around the nucleus in which electrons are revolves
 (b) space around the nucleus where the probability of finding the electron is maximum
 (c) amplitude of electrons wave
 (d) None of the above

4. Which of the following sets of quantum number is not permitted?
- (a) $n = 3, l = 3, m = 0, s = +\frac{1}{2}$
 (b) $n = 3, l = 2, m = +2, s = -\frac{1}{2}$
 (c) $n = 3, l = 2, m = -2, s = -\frac{1}{2}$
 (d) $n = 3, l = 0, m = 0, s = +\frac{1}{2}$
5. An element M has an atomic mass of 19 and atomic number 9, its ions is represented by
 (a) M^+ (b) M^{2+} (c) M^- (d) M^{2-}
6. In S_8 molecules, the type of hybridisation exhibited by sulphur is
 (a) sp^2 (b) sp^3
 (c) sp (d) sp^3d
7. In the oxyacids of chlorine, $Cl-O$ bond contains
 (a) $d\pi - d\pi$ bonding
 (b) $d\pi - p\pi$ bonding
 (c) $p\pi - p\pi$ bonding
 (d) None of the above
8. Anhydrous $AlCl_3$ fume in air due to
 (a) oxidation (b) hydrolysis
 (c) reduction (d) hydrogenation
9. The nature of Fe_2O_3 is
 (a) acidic (b) basic
 (c) amphoteric (d) None of these
10. Concentrated nitric acid (HNO_3) oxidises phosphorus to
 (a) H_3PO_4 (b) H_3PO_3
 (c) $H_4P_2O_7$ (d) H_3PO_2
11. Which of the following has the highest nucleophilicity?
 (a) F^- (b) OH^-
 (c) CH_3^- (d) NH_2^-
12. Number of isomeric primary amines obtained from $C_4H_{11}N$ are
 (a) 3 (b) 4
 (c) 5 (d) 6
13. Which of the following reaction doesn't support the acidic nature of alkyne?
 (a) Reaction with HBr
 (b) Reaction with Grignard reagent
 (c) Reaction with ammoniacal silver salt
 (d) Reaction with metallic sodium
14. $CH_3-CH_2-\underset{\substack{| \\ CH_3}}{N}-\overset{\overset{O}{||}}{C}-H$;
 The IUPAC name of the compound is
 (a) N-formyl-N-methyl ethanamide
 (b) N-ethyl-N-methyl methanamide
 (c) N-methyl-N-oxo ethanamine
 (d) None of the above
15. The product of the following reaction,
 $C_6H_5COCHBr_2 \xrightarrow{OH^-} ?$ is
 (a) C_6H_5COCHO (b) $C_6H_5COCOOH$
 (c) C_6H_5CHO (d) $C_6H_5CHOHCOOH$
16. Which of the following alkenes will react fastest with H_2 under catalytic hydrogenation conditions?
- (a)  (b) 
 (c)  (d) 
17. Glucose reacts with acetic anhydride to give pentaacetyl derivative. Which of the following is true about that?
 (a) that can reduce Fehling or Tollen's reagent
 (b) that's soluble in dil. $NaOH$ solution
 (c) that consumes one mole of HIO_4
 (d) Br_2/H_2O can oxidise
18. Complete hydrolysis of cellulose gives
 (a) D-fructose (b) D-ribose
 (c) D-glucose (d) L-glucose
19. The saponification value of an oil or fat is measured in terms of
 (a) NH_4OH (b) $NaOH$
 (c) C_6H_5OH (d) KOH
20. N_2 gas is liberated when $[HCl + NaNO_2]$ reacts with the following compounds;
 A. $CH_3CH_2NH_2$ B. urea
 C. CH_3CONH_2 D. $C_6H_5NH_2$
 The answer is
 (a) A, B, C (b) B, C, D
 (c) A, C, D (d) A, B, D

21. Benzaldehyde condenses with N,N-dimethyl aniline in presence of anhydrous ZnCl_2 to give
(a) azo dye (b) malachite
(c) michlers ketone (d) buffer yellow
22. Which of the following reactions is given by only primary amines?
(a) Reaction with HNO_2
(b) Reaction with chloroform and alcoholic KOH
(c) Reaction with acetyl chloride
(d) Reaction with Grignard reagent
23. $\text{CH}_3\text{COOH} \xrightarrow{\text{NH}_3} \xrightarrow{\Delta} ?$
The product of the reaction is isomeric with
(a) $\text{CH}_2=\text{CHO}$ (b) $\text{CH}_3\text{CH}=\text{NOH}$
|
 NH_2
(c) $\text{HCONH}-\text{CH}_3$ (d) All of these
24. Which one of the following compound gives aspirin on reacting with acetic anhydride in presence of H_2SO_4 ?
(a)  (b) 
(c)  (d) 
25. $\text{R}-\text{C} \begin{smallmatrix} \text{O} \\ // \\ \text{Z} \end{smallmatrix} + \text{Na}^+ \longrightarrow \text{R}-\text{C} \begin{smallmatrix} \text{O} \\ // \\ \text{Na} \end{smallmatrix} + \text{Z}^-$
is fastest when Z is
(a) Cl (b) NH_2
(c) OC_2H_5 (d) OCOCH_3
26. Aldehyde not showing cannizzaro's reaction is
(a) paraldehyde (b) chloral
(c) formaldehyde (d) acetaldehyde
27. Both HCHO and CH_3CHO gives similar reactions with all the reagents except
(a) Schiff reagent
(b) Fehling solution
(c) ammoniacal AgNO_3
(d) ammonia
28. Which of the following statements is not correct?
(a) All alcohols are miscible with water
(b) Only lower alcohols are miscible with water
(c) All alcohols are not poisonous
(d) Methanol is poisonous
29. Cyclohexanol is
(a) phenol (b) 1° alcohol
(c) 2° alcohol (d) 3° alcohol
30. In the manufacture of ethanol from sugar the enzymes are
(a) diastase and zymase
(b) maltase and zymase
(c) diastase and invertase
(d) invertase and zymase
31. The action of chloral on chlorobenzene gives
(a) BHC (b) DDT
(c) gammexene (d) lindane
32. Which halide will be least reactive in respect to hydrolysis?
(a) vinyl chloride (b) allyl chloride
(c) ethyl chloride (d) *t*-butyl chloride
33. By Wurtz reaction, a mixture of methyl iodide and ethyl iodide gives
(a) butane
(b) ethane
(c) propane
(d) a mixture of above three
34. The cyanide process is used for obtaining
(a) Cu (b) Na
(c) Zn (d) Ag
35. Which of the following ore does not represent the ores of iron?
(a) Cassiterite (b) Limonite
(c) Haematite (d) Magnetite
36. van-Arkel method of purification of metals involves converting the metal to a
(a) volatile stable compound
(b) non-volatile stable compound
(c) volatile unstable compound
(d) None of the above
37. The first element of rare earth metal is
(a) cerium (b) cesium
(c) lanthanide (d) actinide
38. Which of the following transitions involves maximum amount of energy?
(a) $M^-(g) \longrightarrow M(g)$
(b) $M^-(g) \longrightarrow M^+(g)$
(c) $M^+(g) \longrightarrow M^{2+}(g)$
(d) $M^{2+}(g) \longrightarrow M^{3+}(g)$

39. Transition metal with low oxidation number will act as
 (a) an oxidising agent (b) a base
 (c) an acid (d) None of these
40. Chloride of which of the following element is coloured?
 (a) Hg (b) Ag
 (c) Co (d) Zn
41. Spiegeleisen is an alloy of
 (a) Fe, Co and Cr (b) Fe, Co and Mg
 (c) Fe, Mg, and C (d) Fe, C and Mn
42. Which of the following ions form most stable complex compound?
 (a) Mn^{2+} (b) Ni^{2+}
 (c) Fe^{2+} (d) Cu^{2+}
43. Coordination number of Fe in the complexes $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{FeCl}_4]^-$ would be respectively
 (a) 6, 4, 6 (b) 6, 6, 4
 (c) 6, 3, 3 (d) 2, 3, 3
44. Which of the following is a wrong statement?
 (a) $\text{Ni}(\text{CO})_4$ has zero oxidation number for Ni
 (b) $\text{Ni}(\text{CO})_4$ has oxidation number +4 for Ni
 (c) Ni is metal
 (d) CO is gas
45. Rusting of iron is catalysed by which of the following?
 (a) Fe (b) Zn
 (c) O_2 (d) H^+
46. Standard electrode potential of NHE at 298 K is
 (a) 0.05 V (b) 0.10 V
 (c) 0.50 V (d) 0.00 V
47. For a cell reaction involving a two electron change, the standard emf of the cell is found to be 0.295 V at 25°C. The equilibrium constant of the reaction at 25°C will be
 (a) 10 (b) 1×10^{10}
 (c) 1×10^{-10} (d) 10×10^{-2}
48. The ionic conductance of Ba^{2+} and Cl^- are respectively 127 and 76 $\text{ohm}^{-1}\text{-cm}^2$ at infinite dilution. The equivalent conductance ($\text{inohm}^{-1}\text{ cm}^2$) of BaCl_2 at infinite dilution will be
 (a) 139.5 (b) 203
 (c) 279 (d) 101.5
49. Multimolecular colloids are present in
 (a) soap solution (b) sol of proteins
 (c) sol of gold (d) All of these
50. In physical adsorption, the gas molecules are held by solid surfaces through
 (a) strong chemical forces
 (b) van der waals' forces
 (c) metallic bonds
 (d) gravitational forces
51. The osmotic pressure of a 5% (wt./vol.) solution of cane sugar at 150°C is
 (a) 3.078 atm (b) 4.078 atm
 (c) 5.078 atm (d) 2.45 atm
52. The mole fraction of water in 20% aqueous solution of H_2O_2 is
 (a) $\frac{20}{80}$ (b) $\frac{80}{20}$
 (c) $\frac{34}{77}$ (d) $\frac{77}{68}$
53. The pH of a solution is increased from 3 to 6, its H^+ ion concentration will be
 (a) reduced to half
 (b) doubled
 (c) reduced by 1000 times
 (d) increased by 1000 times
54. Solubility product of BaCl_2 is 4×10^{-9} . Its solubility in mol/L would be
 (a) 1×10^{-3} (b) 1×10^{-9}
 (c) 4×10^{-27} (d) 1×10^{-27}
55. An example of a Lewis acid is
 (a) NaCl (b) MgCl_2
 (c) AlCl_3 (d) SnCl_4
56. Radioactive decay is a
 (a) first order reaction
 (b) zero order reaction
 (c) second order reaction
 (d) third order reaction
57. The rate constant for the first order reaction is 60 s^{-1} . How much time will it take to reduce the concentration of the reactant to $\frac{1}{16}$ th value?
 (a) $4.6 \times 10^{-2}\text{ s}$
 (b) $4.6 \times 10^4\text{ s}$
 (c) $4.6 \times 10^2\text{ s}$
 (d) $4.6 \times 10^{-4}\text{ s}$

58. $(\Delta H - \Delta U)$ for the formation of carbon monoxide (CO) from its elements at 298 K is ($R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)
- (a) $-1238.78 \text{ J mol}^{-1}$ (b) $1238.78 \text{ J mol}^{-1}$
 (c) $-2477.57 \text{ J mol}^{-1}$ (d) $2477.57 \text{ J mol}^{-1}$
59. An ideal gas at constant temperature and pressure expands, then its
- (a) internal energy remains same
 (b) internal energy decrease
 (c) internal energy increases
 (d) entropy first increases and then decreases
60. At which temperature nitrogen under 1.00 atm pressure has the same root mean square speed as that of CO_2 at STP
- (a) 0°C (b) 27°C (c) -99°C (d) -200°C

Mathematics

1. The value of $\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+1)^2 & (b+1)^2 & (c+1)^2 \\ (a-1)^2 & (b-1)^2 & (c-1)^2 \end{vmatrix}$ is
- (a) $3 \begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$ (b) $4 \begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$
 (c) $2 \begin{vmatrix} a^2 & b^2 & c^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$ (d) None of these
2. If $a_1x + b_1y + c_1z = 0$, $a_2x + b_2y + c_2z = 0$,
 $a_3x + b_3y + c_3z = 0$ and $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$, then the given system has
- (a) one trivial and one non-trivial solution
 (b) no solution
 (c) one solution
 (d) infinite solution
3. Let A be a square matrix all of whose entries are integers. Then, which one of the following is true?
- (a) If $\det(A) = \pm 1$, then A^{-1} exists but all its entries are not necessarily integers
 (b) If $\det(A) \neq \pm 1$, then A^{-1} exists and all its entries are non-integers
 (c) If $\det(A) = \pm 1$, then A^{-1} exists and all its entries are integers
 (d) If $\det(A) = \pm 1$, then A^{-1} need not exist
4. Which of the following statements is/are correct?
- I. Adjoint of a unit matrix is a unit matrix.
 II. $A(\text{adj } A) = (\text{adj } A)A = |A|I$
- III. Adjoint of a symmetric matrix is symmetric.
 IV. Adjoint of a diagonal matrix is a diagonal matrix.
- (a) I
 (b) II
 (c) I or II
 (d) All statements are correct
5. The value of $\int \frac{dx}{x\sqrt{1-(\log x)^2}}$ is
- (a) $\cos^{-1}(\log x + C)$
 (b) $x \log(1 - x^2) + C$
 (c) $\frac{1}{2} \cos^{-1}(\log x + C)$
 (d) $\sin^{-1}(\log x) + C$
6. $\int \frac{x^2}{(x^2 + 2)(x^2 + 3)} dx$ is equal to
- (a) $-\sqrt{2} \tan^{-1}\left(\frac{x}{\sqrt{2}}\right) + \sqrt{3} \tan^{-1}\left(\frac{x}{\sqrt{3}}\right) + C$
 (b) $\sqrt{2} \tan^{-1}\left(\frac{x}{\sqrt{2}}\right) + \sqrt{3} \tan^{-1}\left(\frac{x}{\sqrt{3}}\right) + C$
 (c) $-\sqrt{2} \tan^{-1} x + \sqrt{3} \tan^{-1} x + C$
 (d) None of the above
7. The degree and order of the differential equation of the family of all parabolas whose axis is x -axis, are respectively
- (a) 2, 1 (b) 1, 2
 (c) 3, 2 (d) 2, 3
8. The differential equation satisfied by the family of curve $y = ax \cos\left(\frac{1}{x} + b\right)$, where a, b are parameters, is

- (a) $x^2 y_2 + y = 0$ (b) $x^4 y_2 + y = 0$
 (c) $xy_2 - y = 0$ (d) $x^4 y_2 - y = 0$
9. Integrating factor of equation $(x^2 + 1) \frac{dy}{dx} + 2xy = x^2 - 1$ is
- (a) $\frac{2x}{x^2 + 1}$ (b) $\frac{x^2 - 1}{x^2 + 1}$
 (c) $x^2 + 1$ (d) None of these
10. The value of $\int_0^{\pi/2} |\sin x - \cos x| dx$ is
- (a) 0 (b) $2(\sqrt{2} - 1)$
 (c) $\sqrt{2} - 1$ (d) $2(\sqrt{2} + 1)$
11. The equation of the circle which passes through the points (2, 3) and (4, 5) and the centre lies on the straight line $y - 4x + 3 = 0$, is
- (a) $x^2 + y^2 + 4x - 10y + 25 = 0$
 (b) $x^2 + y^2 - 4x - 10y + 16 = 0$
 (c) $x^2 + y^2 - 4x - 10y + 25 = 0$
 (d) None of the above
12. The number of solutions of $\log_4 (x - 1) = \log_2 (x - 3)$ is/ are
- (a) 0 (b) 1
 (c) 2 (d) 3
13. If α, β are the roots of $x^2 - 3x + 1 = 0$, then the equation whose roots are $\frac{1}{\alpha - 2}, \frac{1}{\beta - 2}$, is
- (a) $x^2 + x + 1 = 0$ (b) $x^2 - x - 1 = 0$
 (c) $x^2 + x - 1 = 0$ (d) None of these
14. If x is real, then the value of $\frac{x^2 + 34x - 71}{x^2 + 2x - 7}$ does not lie between
- (a) 8 and -5 (b) -5 and 9
 (c) 0 and 9 (d) 5 and 9
15. The square root of $\sqrt{50} + \sqrt{48}$ is
- (a) $2^{1/4}(3 + \sqrt{2})$ (b) $2^{1/4}(\sqrt{3} + \sqrt{2})$
 (c) $2^{1/4}(2 + \sqrt{2})$ (d) $2^{1/4}(\sqrt{3} + 2)$
16. Let $I_1 = \int_{\alpha}^{\pi-\alpha} xf(\sin x) dx$, $I_2 = \int_{\alpha}^{\pi-\alpha} f(\sin x) dx$, then I_2 is equal to
- (a) $\frac{\pi}{2} I_1$ (b) πI_1
 (c) $\frac{2}{\pi} I_1$ (d) $2 I_1$
17. The area of figure bounded by $y = e^x, y = e^{-x}$ and the straight line $x = 1$ is
- (a) $\left(e + \frac{1}{e}\right)$ sq unit (b) $\left(e - \frac{1}{e}\right)$ sq unit
 (c) $\left(e + \frac{1}{e} - 2\right)$ sq unit (d) $\left(e + \frac{1}{e} + 2\right)$ sq unit
18. The domain and range of $f(x) = \sin^{-1}[x]$ are
- (a) $[0, 2), \left\{-\frac{\pi}{2}, \frac{\pi}{2}\right\}$
 (b) $[-1, 2), \left\{-\frac{\pi}{2}, 0, \frac{\pi}{2}\right\}$
 (c) $[-1, 2), \left\{-\pi, -\frac{\pi}{2}, 0, \frac{\pi}{2}, \pi\right\}$
 (d) None of the above
19. If **a**, **b** and **c** are non-collinear vectors such that for some scalars x, y, z , $xa + yb + zc = 0$, then
- (a) $x = 0, y = 0, z = 0$
 (b) $x \neq 0, y \neq 0, z = 0$
 (c) $x = 0, y \neq 0, z \neq 0$
 (d) $x \neq 0, y \neq 0, z \neq 0$
20. Let **a**, **b**, **c**, be three vectors such that $\mathbf{c} \neq 0$ and $\mathbf{a} \cdot \mathbf{b} = 2\mathbf{a} \cdot \mathbf{c}, |\mathbf{a}| = |\mathbf{c}| = 1, |\mathbf{b}| = 4$ and $|\mathbf{b} \times \mathbf{c}| = \sqrt{15}$, if $\mathbf{b} - 2\mathbf{c} = \lambda \mathbf{a}$, then, λ equals
- (a) -1 (b) 1
 (c) -4 (d) 2
21. The image of the point with position vector $\mathbf{i} + 3\mathbf{k}$ in the plane $r \cdot (\mathbf{i} + \mathbf{j} + \mathbf{k}) = 1$ is
- (a) $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ (b) $\mathbf{i} + 2\mathbf{j} - \mathbf{k}$
 (c) $-\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ (d) None of these
22. The vectors **c**, **a**, $= x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ and **b** $= \mathbf{j}$ are such that **a**, **b**, **c** form a right handed system, then **c** is
- (a) 0 (b) $y\mathbf{j}$
 (c) $-z\mathbf{i} + x\mathbf{k}$ (d) $z\mathbf{i} - x\mathbf{k}$
23. The equation of plane passing through a point A (2, -1, 3) and parallel to the vectors **a** $= (3, 0, -1)$ and **b** $= (-3, 2, 2)$ is
- (a) $2x - 3y + 6z + 25 = 0$
 (b) $3x - 2y + 6z + 25 = 0$
 (c) $2x - 3y + 6z - 25 = 0$
 (d) $3x - 2y + 6z - 25 = 0$
24. $\lim_{x \rightarrow 1} \frac{(2x - 3)(\sqrt{x} - 1)}{2x^2 + x - 3}$ is equal to
- (a) -1/10 (b) 1/10
 (c) -1/8 (d) None of these

25. Which is the correct order for a given number α in increasing order?
- (a) $\log_2 \alpha, \log_3 \alpha, \log_e \alpha, \log_{10} \alpha$
 (b) $\log_{10} \alpha, \log_3 \alpha, \log_e \alpha, \log_2 \alpha$
 (c) $\log_{10} \alpha, \log_e \alpha, \log_2 \alpha, \alpha \log_3 \alpha$
 (d) None of the above
26. If $x = \frac{\sqrt{5} + \sqrt{2}}{\sqrt{5} - \sqrt{2}}, y = \frac{\sqrt{5} - \sqrt{2}}{\sqrt{5} + \sqrt{2}}$, then $3x^2 + 4xy - 3y^2$ is equal to
- (a) $\frac{1}{3}(56\sqrt{10} + 12)$ (b) $\frac{1}{3}(56\sqrt{10} - 12)$
 (c) $\frac{1}{3}(56 + 12\sqrt{10})$ (d) None of these
27. If $x + y = 1$, then $\sum_{r=0}^n r^{2 \cdot n} C_r x^r y^{n-r}$ is equal to
- (a) nxy (b) $nx(x + yn)$
 (c) $nx(n x + y)$ (d) None of these
28. If $Z = f(x + ay) + \phi(x - ay)$, then
- (a) $Z_{xx} = Z_{yy}$ (b) $Z_{xx} = a^2 Z_{yy}$
 (c) $Z_{yy} = a^2 Z_{xx}$ (d) None of these
29. The existence of the unique solution of the system $x + y + z = \lambda, 5x - y + \mu z = 10, 2x + 3y - z = 6$ depends on
- (a) μ only (b) λ only
 (c) λ and μ both (d) neither λ nor μ
30. Let $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is the inverse of matrix A , then α is
- (a) -1 (b) -2
 (c) 2 (d) 5
31. The angle of intersection of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and circle $x^2 + y^2 = ab$ is
- (a) $\tan^{-1}\left(\frac{a+b}{ab}\right)$ (b) $\tan^{-1}\left(\frac{a-b}{\sqrt{ab}}\right)$
 (c) $\tan^{-1}\left(\frac{a+b}{\sqrt{ab}}\right)$ (d) $\tan^{-1}\left(\frac{a-b}{ab}\right)$
32. If $S = \sum_{n=0}^{\infty} \frac{(\log x)^{2n}}{(2n)!}$, then S is equal to
- (a) $x + x^{-1}$ (b) $x - x^{-1}$
 (c) $\frac{1}{2}(x + x^{-1})$ (d) None of these
33. The value of $\log 2 + 2\left(\frac{1}{5} + \frac{1}{3} \cdot \frac{1}{5^3} + \frac{1}{5} \cdot \frac{1}{5^5} + \dots\right)$, is
- (a) $\log 2 + \log 3$ (b) $\log 2 + 2$
 (c) $\frac{1}{2} \log 2$ (d) $\log 3$
34. The equation of parabola whose vertex and focus are (0,4) and (0,2) respectively, is
- (a) $y^2 - 8x = 32$ (b) $y^2 + 8x = 32$
 (c) $x^2 + 8y = 32$ (d) $x^2 - 8y = 32$
35. The line $x + 2y = 4$ is translated parallel to itself by 3 unit in the sense of increasing x and then rotated by 30° in the anti-clockwise direction about the point where the shifted line cuts the x -axis. The equation of the line in the new position is
- (a) $y = \tan(\theta - 30^\circ)(x - 4 - 3\sqrt{5})$
 (b) $y = \tan(30^\circ - \theta)(x - 4 - 3\sqrt{5})$
 (c) $y = \tan(\theta + 30^\circ)(x + 4 + 3\sqrt{5})$
 (d) $y = \tan(\theta - 30^\circ)(x + 4 + 3\sqrt{5})$
36. The distance between the foci of a hyperbola is double the distance between its vertices and the length of its conjugate axis is 6. The equation of the hyperbola referred to its axes as axes of coordinates are
- (a) $3x^2 - y^2 = 3$
 (b) $x^2 - 3y^2 = 3$
 (c) $3x^2 - y^2 = 9$
 (d) $x^2 - 3y^2 = 9$
37. If the equation $12x^2 + 7xy - py^2 - 18x + qy + 6 = 0$ represents a pair of perpendicular straight lines, then
- (a) $p = 12, q = -1$ (b) $p = -12, q = 1$
 (c) $p = 12, q = 1$ (d) $p = 1, q = 1$
38. If the roots of the equation $\frac{\alpha}{x - \alpha} + \frac{\beta}{x - \beta} = 1$ be equal in magnitude but opposite in sign, then $\alpha + \beta$ is equal to
- (a) 0 (b) 1
 (c) 2 (d) None of these
39. If $2a + 3b + 6c = 0$, then at least one root of the equation $ax^2 + bx + c = 0$ lies in the interval
- (a) (1, 2) (b) (0, 1)
 (c) (2, 3) (d) (3, 4)

40. The ratio in which the line $3x + 4y + 2 = 0$ divides the distance between $3x + 4y + 5 = 0$ and $3x + 4y - 5 = 0$, is
 (a) 7 : 3
 (b) 3 : 7
 (c) 2 : 3
 (d) None of the above
41. If the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ is touched by $y = x$ at P such that $OP = 6\sqrt{2}$, then the value of c is
 (a) 36
 (b) 72
 (c) 144
 (d) None of these
42. The coefficient of x^4 in the expansion of $(1 + x + x^2 + x^3)^n$ is
 (a) nC_4
 (b) ${}^nC_4 + {}^nC_2$
 (c) ${}^nC_4 + {}^nC_2 + {}^nC_4 \cdot {}^nC_2$
 (d) ${}^nC_4 + {}^nC_2 + {}^nC_1 \cdot {}^nC_2$
43. $1 + \frac{1+x}{2!} + \frac{1+x+x^2}{3!} + \frac{1+x+x^2+x^3}{4!} + \dots$ is equal to
 (a) $\frac{e^x + 1}{x - 1}$
 (b) $\frac{e^x + 1}{x + 1}$
 (c) $\frac{e^x - e}{x + 1}$
 (d) $\frac{e^x - e}{x - 1}$
44. The inequation $n! > 2^{n-1}$ is true for
 (a) for all $n \in \mathbb{N}$
 (b) for all $n > 1$
 (c) for all $n > 2$
 (d) None of the above
45. Let $A = \{(x, y) : y = e^x, x \in \mathbb{R}\}$ and $B = \{(x, y) : y = e^{-x}, x \in \mathbb{R}\}$. Then,
 (a) $A \cap B = \phi$
 (b) $A \cap B \neq \phi$
 (c) $A \cup B = \mathbb{R}^2$
 (d) None of these
46. In $\triangle ABC$, $\frac{b-c}{r_1} + \frac{c-a}{r_2} + \frac{a-b}{r_3}$ is equal to
 (a) 0
 (b) abc
 (c) $a + b + c$
 (d) $ab + bc + ca$
47. $ABCD$ is a rectangular field. A vertical lamp post of height 12 m stands at the corner A . If the angle of elevation of its top from B is 60° and from C is 45° , then the area of the field is
 (a) $48\sqrt{2} \text{ m}^2$
 (b) $12\sqrt{2} \text{ m}^2$
 (c) 48 m^2
 (d) $12\sqrt{3} \text{ m}^2$
48. The function $f(x) = \max\{(1-x), (1+x), 2\}$, $x \in (-\infty, \infty)$ is equivalent to
 (a) $f(x) = \begin{cases} 1+x, & x \leq -1 \\ 2, & -1 < x < 1 \\ 1-x, & x \geq 1 \end{cases}$
 (b) $f(x) = \begin{cases} 1-x, & x \leq -1 \\ 2, & -1 < x < 1 \\ 1+x, & x \geq 1 \end{cases}$
 (c) $f(x) = \begin{cases} 1-x, & x \leq -1 \\ 1, & -1 < x < 1 \\ 1+x, & x \geq 1 \end{cases}$
 (d) None of the above
49. The number of values of x in the interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is
 (a) 0
 (b) 5
 (c) 6
 (d) 10
50. $\left(1 + \cos \frac{\pi}{8}\right)\left(1 + \cos \frac{3\pi}{8}\right)\left(1 + \cos \frac{5\pi}{8}\right)\left(1 + \cos \frac{7\pi}{8}\right)$ is equal to
 (a) $\frac{1}{2}$
 (b) $\frac{1}{8}$
 (c) $\cos \frac{\pi}{8}$
 (d) $\frac{1 + \sqrt{2}}{2\sqrt{2}}$
51. The number of solutions of the equation $2\sin^{-1}\sqrt{x^2 - x} + 1 + \cos^{-1}\sqrt{x^2 - x} = \frac{3\pi}{2}$ is
 (a) 0
 (b) 2
 (c) 4
 (d) ∞
52. Each side of a square subtends an angle of 60° at the top of a tower h metre high standing in the centre of the square. If a is the length of each side of the square, then
 (a) $2a^2 = h^2$
 (b) $2h^2 = a^2$
 (c) $3a^2 = 2h^2$
 (d) $2h^2 = 3a^2$
53. The value of $\cos^{-1}\left(\cos \frac{7\pi}{6}\right)$ is
 (a) $\frac{7\pi}{6}$
 (b) $\frac{5\pi}{3}$
 (c) $\frac{5\pi}{6}$
 (d) $\frac{13\pi}{6}$
54. If $n \in \mathbb{N}$, then $|\sin nx|$
 (a) $\leq n|\sin x|$
 (b) $\geq n|\sin x|$
 (c) $= n|\sin x|$
 (d) None of these

55. In ΔABC , if $a = 30$, $b = 24$, $c = 18$, then r_3 is equal to
 (a) 15 (b) 18 (c) 36 (d) 12
56. The circumcentre of a triangle formed by the lines $xy + 2x + 2y + 4 = 0$ and $x + y + 2 = 0$, is
 (a) $(0, -1)$ (b) $(-1, 0)$
 (c) $(1, 1)$ (d) $(-1, -1)$
57. One diagonal of a square is along the line $8x - 15y = 0$ and one of its vertex is $(1, 2)$. Then, the equation of the sides of the square passing through this vertex are
 (a) $23x + 7y = 9$, $7x + 23y = 53$
 (b) $23x - 7y - 9 = 0$, $7x + 23y - 53 = 0$
 (c) $23x - 7y + 9 = 0$, $7x + 23y + 53 = 0$
 (d) None of the above
58. The two curves $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 = 2$
 (a) cut at right angles
 (b) touch each other
 (c) cut at an angle $\pi/3$
 (d) cut at an angle $\pi/4$
59. If $\frac{2x+3}{(x+1)(x-3)} = \frac{a}{x+1} + \frac{b}{x-3}$, then $a+b$ is equal to
 (a) 1 (b) 2
 (c) $9/4$ (d) $-1/4$
60. $\lim_{n \rightarrow \infty} \frac{1}{n} \left[\sec^2 \frac{\pi}{4n} + \sec^2 \frac{2\pi}{4n} + \dots + \sec^2 \frac{n\pi}{4n} \right]$ is equal to
 (a) $\frac{4}{\pi}$ (b) $\frac{2}{\pi}$
 (c) $\frac{3}{\pi}$ (d) $\frac{5}{\pi}$
61. If $f(x) = |\cos x|$ and $g(x) = [x]$, then $g \circ f(x)$ is equal to
 (a) $|\cos [x]|$ (b) $|\cos x|$
 (c) $[|\cos x|]$ (d) $[|\cos x|]$
62. If $\lim_{x \rightarrow \infty} \left(1 + \frac{a}{x} + \frac{b}{x^2} \right)^{2x} = e^2$, then
 (a) $a = 1$, $b = 2$ (b) $a = 2$, $b = 1$
 (c) $a = 1$, $b \in \mathbb{R}$ (d) None of these
63. The area bounded by the curve $y^2 = 2x + 1$ and the straight line $x - y - 1 = 0$ is given by
 (a) $\frac{9}{2}$ sq units (b) $\frac{43}{6}$ sq units
 (c) $\frac{35}{6}$ sq units (d) None of these
64. The value of $f(0)$, so that the function $f(x) = \frac{2 - (256 - 7x)^{1/8}}{(5x + 3x)^{1/5} - 2}$, $x \neq 0$ is continuous everywhere is given by
 (a) -1 (b) 1
 (c) 2^6 (d) None of these
65. The set of points where the function $f(x) = x|x|$ is differentiable, is
 (a) $(-\infty, \infty)$ (b) $(-\infty, 0) \cup (0, \infty)$
 (c) $(0, \infty)$ (d) $[0, \infty)$
66. If $f(x) = |x|^{\sin x}$, then $f'\left(-\frac{\pi}{4}\right)$ is equal to
 (a) $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \log \frac{4}{\pi} - \frac{2\sqrt{2}}{\pi}\right)$
 (b) $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \log \frac{4}{\pi} + \frac{2\sqrt{2}}{\pi}\right)$
 (c) $\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} \left(\frac{\sqrt{2}}{2} \log \frac{\pi}{4} - \frac{2\sqrt{2}}{\pi}\right)$
 (d) $\left(\frac{\sqrt{2}}{2} \log \frac{\pi}{4} + \frac{2\sqrt{2}}{\pi}\right)$
67. A circle touches the x -axis and also touches the circle which centre at $(0, 3)$ and radius 2. The locus of the centre of the circle is
 (a) a parabola (b) a circle
 (c) an ellipse (d) a hyperbola
68. The circle on focal radii of a parabola as diameter touches
 (a) the x -axis
 (b) the tangent at the vertex
 (c) the directrix
 (d) None of the above
69. The equation of the ellipse whose axes are parallel to the coordinate axes having its centre at the point $(2, -3)$ and focus at $(3, -3)$ and one vertex at $(4, -3)$ is
 (a) $\frac{(x-2)^2}{4} + \frac{(y+3)^2}{3} = 1$
 (b) $\frac{(x+2)^2}{3} + \frac{(y+3)^2}{4} = 1$
 (c) $\frac{(x+2)^2}{4} + \frac{(y+3)^2}{3} = 1$
 (d) None of the above

70. The diameter of $16x^2 - 9y^2 = 144$ which is conjugate to $x = 2y$ is
 (a) $y = \frac{32x}{9}$ (b) $x = \frac{16}{9}y$
 (c) $y = \frac{16}{9}x$ (d) None of these
71. If $\frac{2x+3}{(x+1)(x-3)} = \frac{a}{x+1} + \frac{b}{x-3}$, then $a+b$ is equal to
 (a) 1
 (b) 2
 (c) $9/4$
 (d) $-1/4$
72. If $\frac{e^x+2}{(e^x-1)(2e^x-3)} = -\frac{3}{e^x-1} + \frac{B}{2e^x-3}$, then B is equal to
 (a) 1 (b) 3
 (c) 5 (d) 7
73. $\frac{3\sqrt{2}}{\sqrt{6}+\sqrt{3}} - \frac{4\sqrt{3}}{\sqrt{6}+\sqrt{2}} + \frac{\sqrt{6}}{\sqrt{3}+\sqrt{2}}$ is equal to
 (a) $5\sqrt{2}$ (b) $3\sqrt{2}$
 (c) $2\sqrt{3}$ (d) 0
74. If $\log_3 2$, $\log_3 (2^x - 5)$ and $\log_3 \left(2^x - \frac{7}{2}\right)$ are in AP, then x is equal to
 (a) $1, \frac{1}{2}$ (b) $1, \frac{1}{3}$
 (c) $1, \frac{3}{2}$ (d) None of these
75. If the roots of the cubic equation $ax^3 + bx^2 + cx + d = 0$ are in GP, then
 (a) $c^3a = b^3d$ (b) $ca^3 = bd^3$
 (c) $a^3b = c^3d$ (d) $ab^3 = cd^3$
76. In the group $G = (\{1, 2, 3, 4\}, \times_5)$ the solution of $2^{-1} \times (3 \times_5 x) = 4$ is
 (a) 1 (b) 2
 (c) 3 (d) None of these
77. Negation of "Ram is in Class X or Rashmi is in Class XII" is
 (a) Ram is not in Class X but Rashmi is in Class XII
 (b) Ram is not in Class X but Rashmi is in Class XII
 (c) Either Ram is not in Class X or Rashmi is not in class XII
 (d) None of the above
78. The inverse of the proportion $(p \wedge \sim q) \Rightarrow r$ is
 (a) $\sim r \Rightarrow \sim p \vee q$ (b) $\sim p \vee q \Rightarrow \sim r$
 (c) $r \Rightarrow p \vee \sim q$ (d) None of these
79. The least remainder when 17^{30} is divided by 5, is
 (a) 2 (b) 1
 (c) 4 (d) 3
80. The solution of differential equation $dy - \sin x \sin y \, dx = 0$ is
 (a) $e^{\cos x} \cdot \tan \frac{y}{2} = C$ (b) $e^{\cos x} \cdot \tan y = C$
 (c) $\cos x \cdot \tan y = C$ (d) $\cos x \cdot \sin y = C$

General English and Aptitude

Directions (Q. Nos. 1-4) Choose the alternative which can be substituted for the given group of words.

- A person concerned with practical results and values
 (a) plagiarist (b) realist
 (c) pragmatist (d) fundamentalist
- Member of a band of robbers
 (a) dacoit (b) brigand
 (c) thief (d) pirate
- A person without manners or polish is
 (a) rustic (b) naive
 (c) boorish (d) barbarian

- A speech by an actor at the end of a play
 (a) epilogue (b) monologue
 (c) duologue (d) prologue

Directions (Q. Nos. 5-8) Choose the most suitable alternative to fill in the blank.

- The teacher ordered Kamal to leave the room and him to return.
 (a) stopped (b) refused
 (c) forbade (d) challenged
- I hope you must have by now that failures are the stepping stones to success.
 (a) known (b) felt
 (c) decided (d) realised

7. The tyrant anyone whom he regarded as a rival.
 (a) massacred (b) killed
 (c) exterminated (d) slaughtered
8. In a little publicised deal, Pepsi Cola has the entire soft drink market in Afghanistan.
 (a) conquered
 (b) swallowed
 (c) captured
 (d) occupied

Directions (Q. Nos. 9-12) Choose the alternative which is nearest in meaning to the word given in capital letters.

9. DILETTANTE
 (a) Opponent (b) Specialist
 (c) Amateur (d) Expert
10. FLAK
 (a) Adventure (b) Advice
 (c) Criticism (d) Praise
11. HOODLUM
 (a) Pioneer (b) Criminal
 (c) Devotee (d) Scholar
12. SPASMODIC
 (a) Continuous (b) Gradual
 (c) Intermittent (d) Spontaneous

Directions (Q. Nos. 13-16) Choose the alternative which is opposite in meaning of the word given in capital letters.

13. SHAME
 (a) Glorify (b) Exalt
 (c) Dignify (d) Enshrine
14. RESCUE
 (a) Extricate (b) Waver
 (c) Bind (d) Desert
15. AGONY
 (a) Pleasure (b) Bliss
 (c) Ecstasy (d) Fear
16. REQUISITE
 (a) Dispensable (b) Random
 (c) Inappropriate (d) Chaotic

Directions (Q. Nos. 17-20) In each of the following questions, a sentence is given with a part of it italicised. Choose the alternative which is an improvement upon this italicised part. If the sentence is correct as it is, choose (d) as your answer.

17. Old habits *die hardly*.
 (a) die much hardly
 (b) die hard
 (c) die too hard
 (d) No improvement
18. The teacher asked, "*Why you are late?*"
 (a) Why you were late
 (b) Why late you are
 (c) Why are you late
 (d) No improvement
19. It is ten years since I *have begun* living here.
 (a) begun (b) had begun
 (c) began (d) No improvement
20. The *various* practices and norms for bank's transactions *are laid down* by the Reserve Bank of India.
 (a) are laid up (b) are led down
 (c) are lead up (d) No improvement

Directions (Q. Nos. 21-25) In the following questions, choose the option which shows common feature in the relationship given in each question.

21. Knot : Watt : Fathom
 (a) The terms are connected with rope
 (b) They are units of measurement
 (c) The terms are used by sailors
 (d) The terms are used for installing electricity
22. Majlis : Diet : Knesset
 (a) These are parliaments of countries
 (b) These are old names of certain countries
 (c) These are foreign languages
 (d) These are the names of foods eaten in different countries
23. Kanha : Periyar : Dachigam
 (a) These are mountain peaks
 (b) These are famous lagoons
 (c) These are hill stations
 (d) These are animal sanctuaries
24. Stirrup : Anvil : Drum
 (a) These are used by folk artists
 (b) The items are used by riders
 (c) They are parts of ear
 (d) These are musical instruments
25. Kennedy : Indira : Palme
 (a) They were Prime Ministers
 (b) They were very popular among children
 (c) They were Presidents.
 (d) All of them were assassinated

- Directions (Q. Nos. 26-30)** In the following questions, choose the group of words that shows the same relationship as given in the question.
26. Chair : Door : Stick
 (a) Book : Pen : Notebook
 (b) Statue : Brick : Pitcher
 (c) Mason : Carpenter : Cobbler
 (d) Tomato : Potato : Brinjal
27. Music : Guitar : Performer
 (a) Trick : Rope : Acrobat
 (b) Dance : Tune : Instrument
 (c) Food : Recipe : Cook
 (d) Patient : Medicine : Doctor
28. Hair : Brush : Wig
 (a) Cement : Brick : Building
 (b) Paper : Pen : Pencil
 (c) Iron : Hammer : Axe
 (d) Bread : Butter : Milk
29. Village : City : Suburb
 (a) Footpath : Road : Highway
 (b) Pillow : Quilt : Bed
 (c) Flowers : Garden : Park
 (d) Pen : Pencil : Colour
30. Smile : Laugh : Cry
 (a) Frown : Anger : Temper
 (b) Sit : Sleep : Play
 (c) Touch : Catch : Release
 (d) Morning : Night : Day
31. Which river of India is called Vridha Ganga?
 (a) Krishna (b) Godavari
 (c) Cauveri (d) Narmada
32. The capital of Tanzania is
 (a) Nairobi (b) Lusaka
 (c) Kaupala (d) Dar-e-Salaam
33. During which decade did the population of India record a negative growth rate?
 (a) 1921-31 (b) 1911-21
 (c) 1941-51 (d) 1931-41
34. Marx belonged to
 (a) Germany (b) Holland
 (c) France (d) Britain
35. Who is the author of 'A River Sutra'?
 (a) VS Naipaul (b) Nirad C Chaudhri
 (c) Gita Mehta (d) Vikram Seth
36. Who is known as the 'Father of Indian Missile Technology'?
 (a) Dr UR Rao
 (b) Dr APJ Abdul Kalam
 (c) Dr Chidambaram
 (d) Dr Homi Bhabha
37. The art and science of map making is called
 (a) remote sensing
 (b) cartography
 (c) photogrammetry
 (d) mapping
38. WTO basically promotes
 (a) financial support
 (b) global peace
 (c) unilateral trade
 (d) multilateral trade
39. The forest in Sunderban is called
 (a) scrub jungle (b) mangrove
 (c) deciduous forest (d) tundra
40. Indian Standard Time relates to
 (a) 75.5° E longitude
 (b) 82.5° E longitude
 (c) 90.5° E longitude
 (d) 0° longitude