*Choose the one lettered choice that is best in each case and then fill in the corresponding circle in the answer sheet provided.*

Each question carries equal mark.            Time: 2hrs

                              F.M. 1x100=100

## MATHEMATICS

1) If $A \cap B = \phi$

  A) $\overline{A} \subset B$                 B) $\overline{B} \subset A$

  C) $\overline{A} \cap \overline{B} = \phi$           D) $A \subset \overline{B}$

2) The inequality $2 \leq x \leq 4$ is same as

  A) $|x - 2| \leq 1$              B) $|x - 3| \leq 1$

  C) $|x - 3| \leq 2$              D) $|x - 3| \leq 4$

3) If $A = (-1, 3]$ and $B = [0, 4)$, then $A - B$ is

  A) $[-1, 0)$                 B) $(-1, 0]$

  C) $[-1, 0]$                 D) $(-1, 0)$

4) If $f^{-1}(x) = 2x - 1$, then $f(x)$ is

  A) $2x + 1$                 B) $\dfrac{1}{2x-1}$

  C) $\dfrac{x+1}{2}$              D) $\dfrac{x-1}{2}$

5) The value of $\log_{16} 64$ is

  A) $\dfrac{3}{2}$                 B) $\dfrac{2}{3}$

  C) $2$                  D) $3$

6) The parabola $y = ax^2$ is wider than $y = x^2$ if

  A) $a < 1$                  B) $|a| < 1$

  C) $a > 1$                  D) $|a| > 1$

7) If the three positive numbers a, b, c are in AP, then

  A) $b^2 = ac$              B) $b^2 < ac$

  C) $b = a + c$          D) $b^2 > ac$

8) If $|x| < 1$ and $y = x + x^2 + x^3 + \ldots \ldots \ldots$ to $\infty$, then x is equal to

  A) $\dfrac{1}{y}$                 B) $\dfrac{1}{1+y}$

  C) $\dfrac{y}{1+y}$            D) $\dfrac{1+y}{y}$

9) If A is a square matrix, then $A + A^T$ is a

  A) diagonal matrix          B) scalar matrix

  C) skew-symmetric matrix    D) symmetric matrix

10) The inverse of the matrix $\begin{pmatrix} 3 & -2 \\ 5 & 5 \end{pmatrix}$ is

A) $\dfrac{1}{5}\begin{pmatrix} 5 & 2 \\ -5 & 3 \end{pmatrix}$

B) $\dfrac{1}{10}\begin{pmatrix} 5 & -2 \\ -5 & 3 \end{pmatrix}$

C) $\dfrac{1}{25}\begin{pmatrix} 5 & 2 \\ -5 & 3 \end{pmatrix}$

D) $\dfrac{1}{15}\begin{pmatrix} 3 & -2 \\ 5 & 5 \end{pmatrix}$

11) If $\begin{vmatrix} -4 & x-4 \\ -2 & x+1 \end{vmatrix} = 0$, then the value of x is

A) 6

B) – 6

C) 3

D) – 3

12) If $z = \dfrac{-1+\sqrt{3}i}{2}$, then $z^3$ is equal to

A) i

B) 1

C) – i

D) – 1

13) The multiplicative inverse of $3 - 2i$ is

A) $\dfrac{3}{13} + \dfrac{2}{13}i$

B) $\dfrac{2}{13} + \dfrac{3}{13}i$

C) $\dfrac{3}{13} - \dfrac{2}{13}i$

D) $\dfrac{2}{13} - \dfrac{3}{13}i$

14) The amplitude of the complex number $-\sqrt{3} - i$ is

A) $\dfrac{\pi}{6}$

B) $\dfrac{2\pi}{3}$

C) $\dfrac{11\pi}{6}$

D) $\dfrac{7\pi}{6}$

15) The maximum value of $sin\ x + cos\ x$ is

A) 1

B) 2

C) √2

D) 1/√2

16) The general solution of the equation $4 \cos^2 x = 1$ is

A) $n\pi \pm \dfrac{\pi}{6}$

B) $n\pi + \dfrac{\pi}{6}$

C) $n\pi + \dfrac{\pi}{3}$

D) $n\pi \pm \dfrac{\pi}{3}$

17) The smallest angle of the triangle having sides 7cm, 4√3cm and √13cm is

A) 30º

B) 60º

C) 45º

D) 15º

18) The distance between the lines $4x - 3y = 22$ and $4x - 3y = 12$ is

A) 0

B) 2

C) 10

D) 5

19) The equation $3x^2 + xy - y^2 - 3x + 6y + k = 0$ represents a pair of straight line, then k is

A) 9

B) $-9$

C) 0

D) 1

20) The line $y = mx + c$ is normal to the circle $x^2 + y^2 = a^2$ if

A) $c = \pm a\sqrt{1 + m^2}$

B) $c = 0$

C) $m = 0$

D) $c = m = 0$

21) The equation of the tangent to the circle $x^2 + y^2 = 13$ at the point (2, 3) is

A) $2x + 3y = \sqrt{13}$

B) $2x - 3y = 13$

C) $2x - 3y = \sqrt{13}$

D) $2x + 3y = 13$

22) The equations $ax + by + c = 0$ and $\alpha x + \beta y + \gamma = 0$ represents the same line if and only if

A) $\dfrac{a}{\alpha} = \dfrac{b}{\beta}$

B) $a = \alpha, b = \beta, c = \gamma$

C) $\dfrac{a}{\alpha} = \dfrac{b}{\beta} = \dfrac{c}{\gamma}$

D) $c = \gamma$

23) The value of b for which the equations $9x + 4y = 9$ and $7x + by = 5$ have no solution is

A) 4

B) 7

C) $\dfrac{9}{28}$

D) $\dfrac{28}{9}$

24) $\lim\limits_{x \to 0} f(x)$ for the function $f(x) = \begin{cases} 2x - 1 & for\ x < 0 \\ 2x + 1 & for\ x \geq 0 \end{cases}$ is

A) 0

B) 1

C) $-1$

D) not exist

25) The value of k for which the function $f(x) = \begin{cases} x - k, & x < 1 \\ 5 - x, & x \geq 1 \end{cases}$ is continuous at x = 1 is

A) 4

B) 5

C) $-3$

D) 3

26) The derivative of $\dfrac{1}{x} + x$ with respect to x is

A) $1 - \dfrac{1}{x^2}$

B) $\ln x + \dfrac{x^2}{2}$

C) $\ln x + 1$

D) 0

27) If $y = ln\,(sin\ x)$, then $\dfrac{d^2 y}{dx^2}$ is equal to

A) $cot\ x$

B) $-cosec^2 x$

C) $sec^2 x$

D) $-cosec\ x\ cot\ x$

28) The derivative of $tan\ x$ with respect to $sec\ x$ is

A) $sec^2 x$

B) $cos\ x$

C) $sin\ x$

D) $cosec\ x$

29) The derivative of $5^x$ is

A) $5^x log\ 5$

B) $5^x$

C) $x\ 5^{x-1}$

D) $\dfrac{5^x}{log\ 5}$

30) The function $f(x) = \begin{cases} |x|, & x \neq 0 \\ 0, & x = 0 \end{cases}$ at the point x = 0 is

A) differentiable

B) continuous but not differentiable

C) not continuous

D) none of these

31) The interval in which the function f(x) is increasing is

A) $(2, \infty)$

B) $[-2, \infty)$

C) $(-2, \infty)$

D) $[2, \infty)$

32) The tangent to the parabola $x^2 = 2y$ at (1, 2) makes with x-axis an angle of

A) $0^o$

B) $45^o$

C) $30^o$

D) $60^o$

33) The minimum value of $x^2 + 1/x^2$ is

A) 1

B) 2

C) $-2$

D) 3

34) If the radius of the circular plate on heating is increasing at the rate of 1.2 cm/s, then the rate of increase of its circumference is

A) $1.2\pi$ cm/s

B) $2\pi$ cm/s

C) $\pi$ cm/s

D) $2.4\pi$ cm/s

35) $\int \dfrac{dx}{x \log x}$

A) $\log(\log x) + c$

B) $x \log x - x + c$

C) $x^x + c$

D) $(\log x)/x + c$

36) $\int \dfrac{x}{x+3} dx$ is equal to

A) $x + 3 \ln |x + 3| + c$

B) $x - 3 \ln |x + 3| + c$

C) $3 \ln |x + 3| + c$

D) $x + \ln |x + 3| + c$

37) $\int\limits_{1}^{e} \ln x\ dx$ is equal to

A) 0

B) e

C) $-1$

D) 1

38) $\int xe^{-x} dx$ is equal to

A) $x\ e^{-x} - e^{-x} + c$

B) $-x\ e^{-x} + e^{-x} + c$

C) $x\ e^{-x} + e^{-x} + c$

D) $-x\ e^{-x} - e^{-x} + c$

39) The area bounded by the curves $y^2 = 4x$ and x = 9 is

A) 12

B) 18

C) 24

D) 36

40)    The area bounded by y² = x − 1, y-axis between y = 0 to y = 3 is

A)   6                                    B)   12

C)   9                                    D)   10

## PHYSICS

41)    What are the dimensions of Van der wall's Constant 'a' in the formula:                    $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, Here, 'P' and 'V' and pressure and volume.

A)   [M L⁻¹ T⁻²]                         B)   [M L T⁻²]

C)   [M L⁵ T²]                           D)   [M L⁵ T⁻²]

42)    The maximum height (H) attained by a projectile launched with initial velocity 'u' and angle 'θ' is:

A)                $\dfrac{u\,sin^2\theta}{2g}$                    B)                $\dfrac{u^2\,sin2\theta}{2g}$

C)                $\dfrac{u^2\,sin^2\theta}{2g}$                    D)                $\dfrac{u^2\,sin^2\theta}{g^2}$

43)    A body of mass 5 kg is acted upon by two perpendicular forces 8N and 6N. What is the direction of acceleration?

A)                $Tan^{-1}(3/4)$                    B)                $sin^{-1}(3/4)$

C)                $Cot^{-1}(3/4)$                    D)                $Tan^{-1}(4/3)$

44)    The  mass of the Sun, if the mean radius of the Earth's orbit is 'R' and 'G' is gravitational constant, is

A)                $\dfrac{4\pi^2 R^3}{GT^2}$                    B)                $\dfrac{4\pi R^2}{3GT^2}$

C)                $\dfrac{4\pi R^3}{G^2 T}$                    D)                $\dfrac{3\pi^2 R^3}{4GT^2}$

45)    An electron revolves round a nucleus in an orbit of radius $0.5\times 10^{-10}m$. If its linear velocity in the orbit is $2.2\times 10^6 m/s$, what will be its angular momentum (in SI units)?

A)                $10^{-35}$                    B)                $10^{-34}$

C)                $10^{35}$                    D)                $10^{-36}$

46)    If two temperatures differ by 25 on Celsius scale, what is the difference on Fahrenheit scale?

A)   25                                   B)   45

C)   52                                   D)   54

47)    The efficiency of a Carnot engine depends upon :

A)   Nature and amount of working          B)   Temperature of sink only
       substance

C)   Temperature of source only            D)   Temperature of source and sink

48) Which of the following expresses the relationship between focal length (f) and radius of curvature (R) of a curved mirror?

A) $R = f/2$

B) $f = R/2$

C) $f = 2R$

D) $R = 2f$

49) The value of permittivity of free space (in unit Farad/meter) is:

A) $8.85 \times 10^{12}$

B) $8.85 \times 10^{-12}$

C) $9.1 \times 10^9$

D) $9.1 \times 10^{-9}$

50) Velocity of radio wave is $3.0 \times 10^8$ m/s. A radio station broadcasts on a wavelength of 2.0 m. It's frequency in MHz is:

A) $1.5 \times 10^8$

B) $1.5 \times 10^2$

C) $1.5 \times 10^6$

D) $1.5$

51) Truth Table:

| A | B | C |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 0 |

A and B are inputs and C is the output of a logic gate. The type of such gate is:

A) NOR

B) AND

C) OR

D) NAND

52) A physical constant that appears in de – Broglie equation is:

A) Planck's constant

B) Faraday's constant

C) Gravitational constant

D) Boltzmann's constant

53) Magnetic susceptibility of some materials is large and positive. Those materials are called:

A) Paramagnetic

B) Ferromagnetic

C) Antiferromagnetic

D) Diamagnetic

54) In which of the following materials, electrical conductivity increases with increase in temperature?

A) Cobalt

B) Germanium

C) Nichrome

D) Copper

55) A coil has 'N' turns, radius 'a' and carries current 'i'. Magnetic field at it's center is:

A) $\dfrac{\mu_0 Ni}{2\pi a}$

B) $\dfrac{\mu_0 Ni}{2a}$

C) $\dfrac{\mu_0 Ni}{2\pi}$

D) $\dfrac{\mu_0 Ni^2}{2\pi a}$

56) Which of the following phenomena is followed only by transverse waves?

A) Diffraction

B) Polarization

C) Interference

D) Refraction

57) The $\gamma$ − ray emitted by a radioactive nucleus, actually is:

A) Photon
B) Electron
C) Proton
D) Neutron

58) The atomic mass unit is used for unit of:

A) Mass only
B) Energy only
C) Both mass and energy
D) Neither mass nor energy

59) Mass of a proton (in Kg) is equal to:

A) $9.11 \times 10^{-31}$
B) $1.67 \times 10^{-27}$
C) $1.68 \times 10^{-27}$
D) $1.60 \times 10^{-19}$

60) In a simple harmonic motion, the K.E. of the body is maximum at which position?

A) Extreme
B) Between extreme and mean
C) Mean
D) K.E. is constant

61) The energy stored in a capacitor is given by:

A) $\dfrac{1}{2}\dfrac{q^2}{C}$
B) $\dfrac{1}{2}q^2C$
C) $\dfrac{1}{2}qC^2$
D) $\dfrac{1}{2}\dfrac{1}{q^2C}$

62) The prefix ' Pico' used in a unit represents:

A) $10^{15}$
B) $10^{-12}$
C) $10^{-15}$
D) $10^{12}$

63) Which of the parameters below does not change on refraction of wave?

A) Wavelength
B) Phase
C) Speed
D) Frequency

64) Which of the following is correct for X – ray:

A) Deflected by electric field
B) Does not possess charge
C) Deflected by magnetic field
D) Possess charge

65) In parallel combination of resistors with unequal resistances, the equivalent resistance:

A) Is less than minimum of that in combination
B) Is more than maximum of that in combination
C) Remains as that of minimum one of in combination
D) Remains as that of maximum one in combination

66) A lens of power -4D is placed in contact with a lens of power +2D.The power of lens combination will
.

A) +6D
B) +2D
C) -2D
D) -1D

67) If the normal reaction is doubled, keeping limiting friction same, the coefficient of friction is

A) not changed
B) halved
C) doubled
D) tripled

68) The amount of heat required to change the state of 1kg of substance at constant temperature is called

A) Kilocal

B) Calorie

C) Specific heat

D) Latent heat

69) Mechanical waves can be

A) longitudinal only

B) transverse only

C) both longitudinal and transverse

D) neither longitudinal nor transverse

70) The bending of light waves through the corners of the obstacle is called

A) refraction

B) diffraction

C) interference

D) beats

# ENGLISH

71) Dikendra got his servant_____ his house.

A) paint

B) to paint

C) painted

D) painting

72) Among the following words, _____has /æ/ sound.

A) mouth

B) moon

C) sound

D) add

73) The word 'Tabulate' has primary stress on_____ syllables.

A) 1st

B) 2nd

C) 3rd

D) 4th

74) The word _____has three syllables from the following.

A) absent

B) academy

C) department

D) beauty

75) The man has been working here_____ last Monday.

A) for

B) to

C) from

D) since

76) If you boil the water, it____ into vapour.

A) changes

B) will change

C) would change

D) will be changed

77) The passive form of the sentence, 'Everybody speaks English all over the world' is_____.

A) English was spoken all over the world

B) English is spoken all over the world

C) English is being spoken all over the world

D) English has been spoken all over the world

78) Question tag of the sentence, 'Let's prepare the minute', _____?

A) shall we

B) will you

C) do you

D) don't we

79) I explained that I was ____artist, but that I was sometimes _____ plumber as well.

A) an, the

B) a, a

C) an, a

D) an, an

80) The indirect speech of He says "I will meet you at the station" is_____.

A) he says that he would meet him at the station
B) he said that he would meet him at the station
C) he said that he will meet him at the station
D) he says that he will meet him at the station

## CHEMISTRY

81) Minimum energy required for the molecules to enter into the reaction is called

A) Potential energy
B) Kinetic energy
C) Activation energy
D) Nuclear energy

82) Le -Chatelier's principle is not applicable to

A) Homogenous reaction
B) Not homogenous reaction
C) System that is in equilibrium
D) System that is not in equilibrium

83) Why liquid ammonia is used in refrigerator? Because of its

A) High basicity
B) High heat of vaporization
C) High dipole moment
D) All the above

84) Tick the necessary conditions for Geometrical isomerism

A) There should be carbon - carbon double bond compound
B) First carbon must contain two different groups attached
C) Second carbon must contain same group as the first carbon
D) All the above

85) Which test is useful to distinguish formaldehyde with acetaldehyde?

A) Schiff's test
B) Fehling's test
C) Test with Iodine in basic condition
D) Tollen's test

86) Bromomethane can be converted into methanol in suitable chemical environment, the reaction involved is

A) Nucleophilic substitution
B) Electrophilic substitution
C) Elimination
D) Addition

87) Markovnikoff's rule is applicable to

A) Free radical addition reaction
B) Electrophilic addition reaction
C) Substitution reaction
D) Elimination reaction

88) In which type of reaction, the number of pi bonds in the product increases?

A) Elimination reaction
B) Addition reaction
C) Substitution reaction
D) Electrophilic addition reaction

89) A sample of drinking water was found to be severely contaminated with chloroform ($CHCl_3$) supposed to be a carcinogen. The level of contamination was 20 ppm (by mass), express this in % by mass.

A) $20 \times 10^5 \times 100$
B) $20/10^6 \times 100$
C) $20/10^5 \times 100$
D) $20 \times 10^6 \times 100$

90) Which of the following is optically active compound?

A) Formic acid
B) Acetic acid
C) Phenol
D) Lactic acid

91) Transition metal compounds are colorful because

    A)    it has unpaired electrons in d orbitals      B)    it has completely filled d orbitals

    C)    it has filled p orbitals      D)    All the above

92) Tick the correct order according to the size of ionic/atomic radii

    A)    $Cu^{++} > Ca > Cl^- > Al^{+3}$      B)    $Ca > Cu^{++} > Cl^- > Al^{+3}$

    C)    $Ca > Cl^- > Cu^{++} > Al^{+3}$      D)    $Ca > Cl^- > Al^{+3} > Cu^{++}$

93) Which of the following metals are used for manufacturing batteries of mobile phone

    A)    Cobalt and Zn      B)    Cobalt and Lithium

    C)    Nickel and Lithium      D)    Cadmium and lithium

94) The consequences of global warming is

    A)    Precipitation pattern changes      B)    Rise of temperature

    C)    Drought      D)    All the above

95) In the galvanic cell

    A)    Oxidation occurs at anode and reduction occurs at cathode      B)    Oxidation occurs at cathode and reduction occurs at anode

    C)    Only oxidation occurs at cathode      D)    Only reduction occurs at anode

96) If you titrate 1M H2SO4 solution against 50ml of 1M NaOH solution, what volume of H2SO4, in ........ will be needed for neutralization?

    A)    25      B)    10

    C)    75      D)    2

97) Which of the following pair of compounds can be used to illustrate the law of Multiple Proportions?

    A)    $NO$ & $NO_2$      B)    $ZnO_2$ & $ZnCl_2$

    C)    $H_2O$ & $HCl$      D)    $CH_4$ & $CO_2$

98) 4grams of hydrogen are ignited with 4 grams of oxygen. How many grams of water can be formed

    A)    0.5      B)    4.5

    C)    2.5      D)    36

99) Which of the following atom normally forms monoatomic molecule?

    A)    Oxygen      B)    Hydrogen

    C)    Nitrogen      D)    Helium

100) What is the approximate pH of a 0.005M solution of H2SO4 ?

    A)    5      B)    1

    C)    2      D)    13