ENTRANCE EXAMINATION FOR ADMISSION, MAY 2010.

M.Sc. FIVE YEAR INTEGRATED PROGRAMME (APPLIED GEOLOGY, CHEMISTRY AND PHYSICS)

COURSE CODE : 380

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 380

Time : 2 Hours   Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.

2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.

3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.

4. Avoid blind guessing. A wrong answer will fetch you −1 mark and the correct answer will fetch 4 marks.

5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.

6. Do not open the question paper until the start signal is given.

7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.

8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.

9. Use of Calculators, Tables, etc. are prohibited.

1. The standard form (a+ib) of 3+2i+(-7-i) is

   (A) 4-i   (B) -4+i   (C) 4+i   (D) 4+4i

2. The work done in moving a particle from the point A, with position vector $2\vec{i} - 6\vec{j} + 7\vec{k}$, to the point B, with position vector $3\vec{i} - \vec{j} - 5\vec{k}$, by a force $\vec{F} = \vec{i} + 3\vec{j} - \vec{k}$ is

   (A) 25   (B) 26   (C) 27   (D) 28

3. L'Hospital's rule cannot be applied to $\dfrac{x+1}{x+3}$ as $x \to 0$ because f(x)=x+1 and g(x)=x+3 are

   (A) not continuous

   (B) not differentiable

   (C) not in the indeterminate form as $x \to 0$

   (D) in the indeterminate form as $x \to 0$

4. Two equal forces act at a point. The square of their resultant is three times their product. What is the angle between them?

   (A) 60°   (B) 30°   (C) 15°   (D) 50°

5. If a body posses velocities 3m/s, 6m/s, 9m/s, and 12m/s at the end of first, second, third and fourth seconds, then the body moves

   (A) with uniform velocity   (B) with uniform acceleration

   (C) with non-uniform acceleration   (D) all these

6. A particle starts moving from the position of rest under a constant acceleration. It travels a distance x in the first 10 seconds and a distance y in the next 10 seconds then

   (A) y=3x   (B) y=2x   (C) y=x   (D) y=4x

7. Real image can be located on the screen

   (A) true   (B) false

   (C) depends on the object   (D) depends on the screen

8. In a double slit interference experiment, the maximum intensity of light would be ——————— times that of the single slit experiment.

   (A) same   (B) twice   (C) four times   (D) half

9. Bending of light around a obstacle is known as

(A) diffraction
(B) reflection
(C) polarization
(D) none of the above

10. A convex lens focuses Sunlight on white paper and black paper kept at focus which would start burning first?

(A) Black paper
(B) White paper
(C) Both burn at the same time
(D) Depends on the material of the paper

11. The maximum number of electrons in the sub shells s,p,d and f can be

(A) 2, 8, 18, 32
(B) 2, 6, 14, 18
(C) 2, 6, 10, 14
(D) 2, 2, 6, 10

12. The de Broglie wave length of an electron of Kinetic energy 500 eV is

(A) 14.82 A°
(B) 24.82 A°
(C) 34.82 A°
(D) 44.82 A°

13. The Davisson and Germer's experiment proves the

(A) electromagnetic nature of light
(B) particle nature of electron
(C) wave nature of electron
(D) free motion of electron

14. The resistance of the coil is ——————— in tangent galvanometer in comparison with moving coil galvanometer.

(A) same
(B) low
(C) high
(D) none of the above

15. The masses of ions liberated at an electrode is proportional to the strength of the current and time of conduction of the current in electrolyte is

(A) Faraday's law
(B) Joule's law
(C) Thomson's law
(D) None of the above

16. How many p-n junctions are there in a transistor (BJT)?
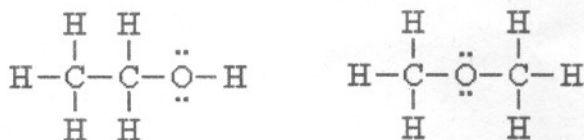
(A) 1
(B) 2
(C) 3
(D) none

17. The time required for 10% of a sample of thorium to disintegrate is (Thorium half-life is 1.4×10^{10} years)

    (A) 3.2×10^9 yrs
    (B) 2.1×10^9 yrs
    (C) 1.2×10^9 yrs
    (D) 4.2×10^9 yrs

18. Which of the following is not a moderator in an atomic pile?

    (A)   Heavy water
    (B)   Graphite
    (C)   Beryllium
    (D)   Boron

19. Two point charges +q and –q are held fixed at (-d,0) and (d,0) respectively of a x-y co-ordinate system, then

    (A)   the electric field E at all points on the x-axis has the same direction

    (B)   work has to be done in bringing at a test charge from infinity to the origin

    (C)   electric field at all point on y – axis is along the x-axis

    (D)   the dipole moment is 2qd along the x-axis

20. A current I flows along the length of an infinitely long straight, thin-walled pipe. Then

    (A)   the magnetic field at all points inside the pipe is the same, but not zero

    (B)   the magnetic field at any point inside the pipe is zero

    (C)   the magnetic field is zero only on the axis of the pipe

    (D)   the magnetic field is different at different points inside the pipe

21. A magnetic needle is kept in a non-uniform magnetic field. It experiences:

    (A)   a force and torque
    (B)   a force but not a torque
    (C)   a torque but not a force
    (D)   neither a force nor a torque

22. While measuring the thermal conductivity of a liquid, we keep the upper part hot and lower cool, so that

    (A)   convection may be stopped

    (B)   radiation may be stopped

    (C)   heat conduction is easier downwards

    (D)   it is easier and more convenient to do so

23. A gas expanded adiabatically and its temperature fell down to T_1. It then expanded isothermally and temperature now is T_2. Then

    (A) $T_1 > T_2$ (B) $T_1 = T_2$

    (C) $T_1 < T_2$ (D) T_1 is nearly equal to T_2

24. Two airplanes headed for the same destination leave an airport an hour apart. The one that leaves first travels at 300 km/hr and the other travels at 400 km/hr. The latter will overtake the former in

    (A) 45 min   (B) 80 min   (C) 3 hr   (D) 4 hr

25. A spring of force constant k cut into three equal parts. The force constant of each part is

    (A) k   (B) 2k   (C) 3k   (D) k/3

26. Two capillary tubes of different diameter are placed vertically in water. The rise of water is

    (A) greater in tube of smaller diameter   (B) greater in tube of larger diameter

    (C) same in both   (D) zero in both

27. Young's modulus of the material of wire length L and radius r is Y N/m². If the length is reduced to L/2 and radius to r/2, then the Young's modulus will be:

    (A) Y/4   (B) Y/2   (C) Y   (D) 2Y

28. The dimensional formula of angular momentum is

    (A) $M L^2 T^{-2}$ (B) $M L T^{-2}$ (C) $M L^{-1} T^{-2}$ (D) $M L^2 T^{-1}$

29. In SI system of unit of radioactivity is

    (A) Becquerel   (B) Curie   (C) Rutherford   (D) Rad

30. If two electrons are forced to come closer to each other, the P.E. of the system of 2 electrons will

    (A) becomes zero   (B) increases   (C) decreases   (D) becomes ∞

31. Which of the following compound is used as a substitute for diamond in making cutting tools?

    (A) Silicon carbide   (B) Sulphur hexafluoride

   (C) Borax   (D) Boron nitride

32. Which of the following statement is true of an element with atomic number 7?

    (A) It belongs to alkali metal series   (B) It a transition element

    (C) It belongs to the group VA   (D) It is a radioactive element

33. The correct order of oxides Al_2O_3, CO_2, BaO, B_2O_3, Cl_2O_7, SO_3 in order from the most acidic through amphoteric to the most basic is

    (A) $BaO>Al_2O_3>CO_2>SO_3>B_2O_3>Cl_2O_7$

    (B) $Cl_2O_7>Al_2O_3>SO_3>CO_2>B_2O_3>BaO$

    (C) $Cl_2O_7>SO_3>CO_2>B_2O_3>Al_2O_3>BaO$

    (D) $SO_3>Cl_2O_7>CO_2>B_2O_3>Al_2O_3>BaO$

34. The correct order of proton affinity of the ion HS^-, F^-, I^-, $NH2^-$ is

    (A) $NH_2^- > HS^- > F^- > I^-$ (B) $NH_2^- < HS^- < F^- < I^-$

    (C) $HS^- > I^- > F^- > NH_2^-$ (D) $F^- > NH_2^- > I^- > HS^-$

35. Which of the following will have an oxobridge between two central atoms?

    (i) N_2O_5 (ii) N_2O_4 (iii) $C_2O_4^{2-}$ (iv) $H_4P_2O_7$

    (A) (i) and (ii)   (B) (i) and (iii)

    (C) (ii) and (iv)   (D) (i) and (iv)

36. Which of the following is true for the element xenon?

    (A) It does not form chemical compounds

    (B) It exists as diatomic molecule

    (C) It has a lower first ionization energy than sodium

    (D) It forms compounds with some electronegative elements

37. Third ionization energy of titanium is required to carry out which of the following processes?

    (A) $Ti^{3+}(g) + e^- \rightarrow Ti^{2+}(g)$ (B) $Ti^{2+}(g) \rightarrow Ti^{3+}(g) + e^-$

    (C) $3Ti(g) \rightarrow Ti^+(g) + 3 e^-$ (D) $Ti(g) \rightarrow Ti^{3+}(g) + 3e^-$

38. Which of the following compound will act as oxidizing agent?

    (A) CO_2 (B) SiO_2 (C) SnO_2 (D) PbO_2

39. An element present in 6th period 3rd group has an atomic number 57. The atomic number of the element present in 6th period 4th group is

    (A) 58   (B) 72   (C) 71   (D) 56

40. The reduction step in extraction of sodium involves

    (A)   reduction with coke   (B)   reduction with aluminium

   (C)   electrolysis   (D)   reduction with hydrogen

41. How are the following compounds related?

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{..}{\underset{..}{O}}-H \qquad\qquad H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{..}{\underset{..}{O}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-H$$

    (A)   isoelectronic species

    (B)   isotopes

    (C)   isomers

    (D)   these compounds are not related at all. They are totally different.

42. What is the IUPAC name for the following compound?

$$CH_3-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-CH_2-\overset{\nearrow CH_3}{\underset{\searrow CH_3}{CH}}$$
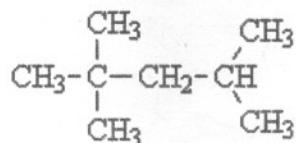
    (A)   2,2,2,3,3-pentamethylpropane   (B)   1,1,3,3-tetramethylbutane

    (C)   2,2,4-trimethylpentane   (D)   2,2,4,4-tetramethylbutane

43. Which of the following halides will react most rapidly in solvolysis reaction?

    (A) CH_3F (B) CH_3Cl (C) CH_3Br (D) CH_3I

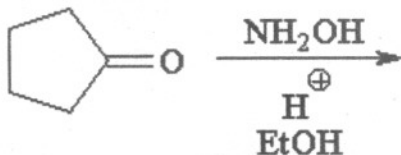44. What is the major product of the following reaction sequence?

$$HO \diagup COOH \quad \xrightarrow[\text{2. MeOH, Heat}]{\text{1. SOCl}_2,\ \text{heat}}$$
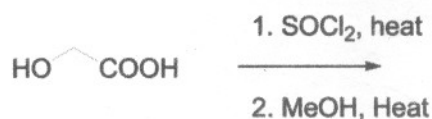
    (A) $HO \diagup COOMe$ (B) $HO \diagup COCl$

    (C) $MeO \diagup COOMe$ (D) $MeO \diagup COOH$

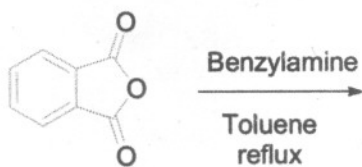45. What is the major product of the following reaction?
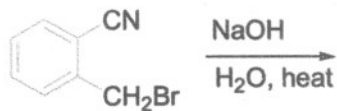
(A)

(B)

(C)

(D)

46. What is the major product of the following reaction?
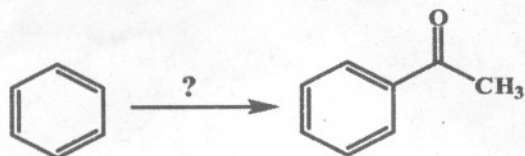

(A)

(B)

(C)

(D)

47. What is the major product of the following reaction?

(A)

(B)

(C)

(D)

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48. Which of the following reagents would be the best reactants for the following reaction?

| (A) | (B) | (C) | (D) |

49. What is the major product expected from the following reaction?

$HgSO_4$

dil H_2SO_4, rt

(A)

(B)

(C)

(D)

50. DDT is synthesized by reacting
   (A) chloral and chlorobenzene
   (B) chloral and 1,3-dichlorobenzene
   (C) chloral and 1,4-dichlorobenzene
   (D) chloral and 1,2-dichlorobenzene

51. According to dual behavior of matte
   (A) $PV = nRT$
   (B) $E = hc/\lambda$
   (C) $\lambda = h/mv$
   (D) $n\lambda = 2d \sin\theta$

52. According to Pauli exclusion principle
   (A) total energy is conserved
   (B) no two electrons in a molecule can have the same set of four quantum numbers
   (C) no two electrons in the universe can have the same set of four quantum numbers
   (D) no two electrons in an atom can have the same set of four quantum numbers

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53. A system is said to be closed if

    (A) it can exchange energy but not matter

    (B) it can exchange matter but not energy

    (C) it can exchange energy and matter

    (D) it cannot exchange energy or matter

54. In the presence of a catalyst, the equilibrium constant of a reaction

    (A) increases

    (B) does not change

    (C) decreases

    (D) depends upon the reaction

55. The pH of water at 90°C is

    (A) <7   (B) >7   (C) 7   (D) 9.0

56. Isotones have

    (A) same number of neutrons but different atomic number

    (B) same mass number and different atomic number

    (C) different mass number and same atomic number

    (D) same mass number and same number of neutrons

57. The order of disintegration process of a radio active nucleus

    (A) is zero order

    (B) is first order

    (C) is second order

    (D) depends upon the nucleus

58. A mixture of magnesium bromide and magnesium sulphate is known to contain 3 mol of magnesium and 4 mol of bromide ions. How many moles of sulphate ions are present?

    (A) 1   (B) 2   (C) 3   (D) 4

59. Carbon dating is used

    (A) as fuel

    (B) to prepare organic compounds

    (C) to determine the age of <u>carbonaceous</u> materials

    (D) as catalyst

60. According to first law of thermodynamics

   (A) total energy is constant
   (B) total entropy is constant
   (C) $E = mc^2$
   (D) $E = h\upsilon$

61. The equation $|z+i| - |z-i| = k$ represents a hyperbola if

   (A) $-2<k<2$
   (B) $k>2$
   (C) $0<k<2$
   (D) none of these

62. $\sqrt{1-c^2} = nc - 1$ and $z = e^{i\theta}$ then $\frac{c}{2n}(1+nz)\left(1+\frac{n}{z}\right) =$

   (A) $1-c\cos\theta$
   (B) $1+2c\cos\theta$
   (C) $1+c\cos\theta$
   (D) $1-2c\cos\theta$

63. $\dfrac{a^n + b^n}{a^{n-1} + b^{n-1}}$ is the H.M between a and b, if n is

   (A) 0
   (B) ½
   (C) -1/2
   (D) 1

64. If a, b and c are in G.P, then

   (A) $\dfrac{b-a}{b-c} = \dfrac{a}{c}$
   (B) $\dfrac{a-b}{b-c} = \dfrac{b}{a}$
   (C) $\dfrac{a-b}{b-c} = \dfrac{c}{b}$
   (D) $\dfrac{a-b}{b-c} = \dfrac{a}{b}$

65. The number of ways in which r letters can be posted in n letter boxes in a town is:

   (A) n^r
   (B) r^n
   (C) ^nP_r
   (D) ^nC_r

66. The normal to a given curve is parallel to x – axis if

   (A) $\dfrac{dy}{dx} = 0$
   (B) $\dfrac{dy}{dx} = 1$
   (C) $\dfrac{dx}{dy} = 0$
   (D) $\dfrac{dx}{dy} = 1$

67. Five distinct letters are to be transmitted through a communication channel. A total number of 15 blanks is to be inserted between the two letters with at least three between every two. The number of ways in which this can be done is

   (A) 1200
   (B) 1800
   (C) 2400
   (D) 3000

68. Sum of the series :

$$2C_0 + \frac{C_1}{2}.2^2 + \frac{C_2}{3}.2^3 + \frac{C_3}{4}.2^4 + \ldots\ldots + \frac{C_n}{n+1}.2^{n+1}$$ is equal to

(A) $\dfrac{3^{n+1}-1}{n-1}$ (B) $\dfrac{3^{n+1}-1}{n+1}$ (C) $\dfrac{3^{n+1}+1}{n+1}$ (D) $\dfrac{3^{n-1}-1}{n+1}$

69. In the binomial expansion of $(a-b)^n$, $n \geq 5$, the sum of the 5th and 6th terms is zero. Then $\dfrac{a}{b}$ equals

(A) $\dfrac{n-5}{6}$ (B) $\dfrac{n-4}{5}$ (C) $\dfrac{5}{n-4}$ (D) $\dfrac{6}{n-5}$

70. If $\begin{vmatrix} \alpha & -\beta & 0 \\ 0 & \alpha & \beta \\ \beta & 0 & \alpha \end{vmatrix} = 0$, then

(A) $\dfrac{\alpha}{\beta}$ is one of the cube roots of unity (B) α is one of the cube roots of unity

(C) β is one of the cube roots of unity (D) β is one of the fourth roots of unity

71. If $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$ and $|A^3| = 125$ then the value of α is

(A) ± 1 (B) ± 2 (C) ± 3 (D) ± 5

72. A box contains tickets numbered 1 to N. n tickets are drawn from the box with replacement. The probability that the largest number on the ticket is k,

(A) $\left(\dfrac{k}{N}\right)^n$ (B) $\left(\dfrac{k-1}{N}\right)^n$ (C) 0 (D) none of these

73. Two dice are thrown simultaneously. The probability that the sum of the points on two dice will be 7 is

(A) 5/36 (B) 6/36 (C) 7/36 (D) 8/36

74. Solution of equation $[\sin x] = [1+\sin x] + [1- \cos x]$, $0 \leq x \leq 2\pi$ is:

(A) $x = \dfrac{3\pi}{2}$ (B) no real solution

(C) $x = \dfrac{5\pi}{2}$ (D) none of the above

75. The number of ways in which two 10-paise, two 20-paise, three 25-paise, and one 50-paise coins can be distributed among 8 children so that each child gets only one coin, is

   (A) 1720   (B) 1680   (C) 1570   (D) infinity

76. If the tangent at the point P on the circle $x^2+y^2+6x+6y=2$ meets the straight line $5x-2y+6=0$ at a point Q on the Y-axis then the length of the PQ is

   (A) 4   (B) $2\sqrt{5}$ (C) 5   (D) $3\sqrt{5}$

77. A straight line through the point A (3, 4) is such that it intercepts between the axes is bisected at A. Its equation is

   (A) 3x-4y+7=0   (B) 4x+3y=24
   (C) 3x+4y=25   (D) x+y=7

78. Nishi has 5 coins each of the different denomination. The number different sums of money she can form, is

   (A) 32   (B) 25   (C) 31   (D) 35

79. $\lim_{m\to\infty}\left(\cos\dfrac{x}{m}\right)^m$ is equal to

   (A) 0   (B) e   (C) 1/e   (D) 1

80. 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) $f(x)$ is strictly decreasing function   (D) $f(x)$ is bounded

81. A particle is moving along the curve $x=at^2+bt+c$. If $ac=b^2$, then the particle would be moving with uniform

   (A) rotation   (B) velocity   (C) acceleration (D) retardation

82. The maximum value of $f(x)=\dfrac{x}{4+x+x^2}$ on [-1, 1] is

   (A) -1/4   (B) -1/3   (C) 1/6   (D) 1/5

83. $\int (Sin^4 x - Cos^4 x)\, dx$ is equal to

(A) $\dfrac{-Cos2x}{2} + C$

(B) $\dfrac{-Sin2x}{2} + C$

(C) $\dfrac{Sin2x}{2} + C$

(D) $\dfrac{Cos2x}{2} + C$

84. The maximum number of points of intersection of 8 circles is

(A) 56
(B) 28
(C) 24
(D) 16

85. If one of the diameter of the circle x²+y²–2x–6y+6=0 is a chord to the circle with centre (2, 1), then the radius of the circle is

(A) $\sqrt{3}$
(B) $\sqrt{2}$
(C) 3
(D) 2

86. The value of $\displaystyle\int_{-2}^{0}(x^3 + 3x^2 + 3x + x + (x+1)\cos(x+1))dx$ is

(A) 0
(B) 3
(C) 4
(D) 1

87. $\displaystyle\int_{-2}^{2}|x|\, dx$ is equal to

(A) 0
(B) 1
(C) 2
(D) 4

88. $\dfrac{d^3 y}{dx^3} + 2\left[1 + \dfrac{d^2 y}{dx^2}\right] = 1$ has the degree and order as

(A) 1,3
(B) 2,3
(C) 3,2
(D) 3,1

89. The solution of $x^2 + y^2 - 2xy\dfrac{dx}{dy} = 0$ is

(A) $x^2 - y^2 = cx$

(B) $x^2 + y^2 = cx$

(C) $2(x^2 - y^2) = cx$

(D) $2(x^2 - y^2) = c$

90. The derivative of $y = x^{\ln x}$ is

(A) $x^{\ln x}\ln x$
(B) $x^{\ln x - 1}\ln x$
(C) $2x^{\ln x - 1}\ln x$
(D) $x^{\ln x - 2}$

Fill in the blanks using a model verb:

91. A good teacher ——————— make even boring lessons interesting.
    (A) will/can   (B) should   (C) would   (D) shall

92. I ——————— like to know who she is.
    (A) should   (B) would   (C) may   (D) shall

93. The sky is overcast. It ——————— rain.
    (A) may/might   (B) must   (C) can   (D) will

94. If he misbehaves in the class he ——————— be punished.
    (A) is   (B) was   (C) can   (D) should

Choose the appropriate antonym of the underlined word from the options given:

95. Be patient till the last.
    (A) Restful   (B) impatient   (C) outpatient   (D) in-patient

96. Have respect to mine honour.
    (A) mishonour   (B) dishonor   (C) insult   (D) illtreat

97. Who is so vile?
    (A) Good   (B) Vulgar   (C) Wicked   (D) Filthy

Choose correct meaning of the word given in bold :

98. Vinod looked at the exam result with **bewilderment**.
    (A) fear   (B) happy   (C) smile   (D) confusion

Fill up the blank :

99. The road condition is so good ——————— I could drive my car fast.
    (A) that   (B) if   (C) which   (D) smoothly

100. I published my experimental results in a ———————.
    (A) text book   (B) news paper   (C) journal   (D) magazine

———————

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