ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

M.Sc. Five Year Integrated Programme (APPLIED GEOLOGY, CHEMISTRY & 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 of the 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. In the discharge tube emission of cathode rays requires

(A) Low potential and low pressure (B) Low potential and high pressure

(C) High potential and high pressure (D) High potential and low pressure

2. The rates of diffusion of O_2 and H_2 at same P and T in the ratio

(A) 1:4 (B) 1:8 (C) 1:16 (D) 4:1

3. Which particle is used to bombard $^{28}_{13}Al$ to give $_{15}^{31}P$ and a neutron?

(A) α-Particle (B) Deutron (C) Proton (D) Neutron

4. The hybridization of *p* in PO_4^{3-} is same as in

(A) I in ICl_4^- (B) S in SO_3^- (C) N in NO_3^- (D) S in SO_4^-

5. 0.7 g of $Na_2CO_3.x\ H_2O$ was dissolved in water and volume was made to 100 ml. 20 ml of this solution required 19.8 ml of N/10 HCl for complete neutralization. The value of x is

(A) 7 (B) 3 (C) 2 (D) 5

6. The cell reaction for the given cell is

$Pt(H_2)\ _PH=2 \mid {}_PH=3 \| Pt\ (H_2)$

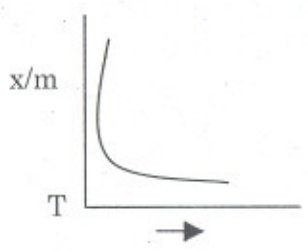
P_1=1 atm p_2=1 atm

(A) spontaneous (B) non - spontaneous

(C) in equilibrium (D) either of these

7. Which plot is the absorption isober for chemisorption, where x is the amount of gas absorbed on mass m (at constant pressure) at temperature T?

(A)



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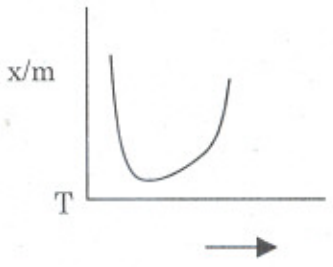

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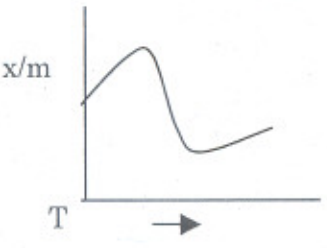

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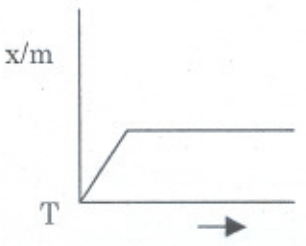


8. Which correctly represents the physical significance of free energy change?

(A) $-\Delta G = W_{Compression}$

(B) $\Delta G = W_{Expansion}$

(C) $\Delta G = -W_{Expansion} = W_{Non\text{-}expansion}$

(D) $-\Delta G = W_{Expansion}$

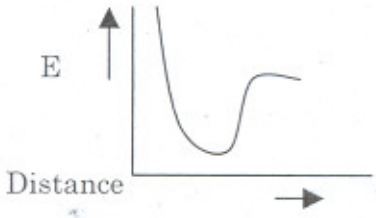
9. Under which circumstances would the free energy change for a reaction be relatively temperature independent?

(A) $\Delta H°$ is negative (B) $\Delta H°$ is positive

(C) $\Delta S°$ has large positive value (D) $\Delta S°$ has small value

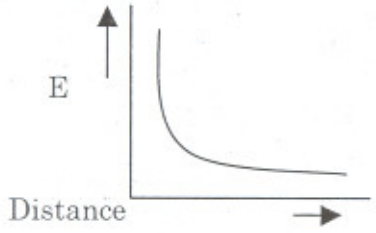
10. Which plot best represents the potential energy of two hydrogen atoms as they approach one another to form a hydrogen molecule, H_2?

(A)



(B)

(C)



(D)

11. Heating of carbonate ores to remove carbon is called

(A) Roasting (B) Calcination (C) Smelting (D) Fluxing

12. The main factor responsible for weak acidic nature of B-F bonds in BF_3 is

(A) Large electronegativity of F

(B) Three centered two electron bonds in BF_3

(C) $p\pi - d\pi$ back bonding

(D) $p\pi$-$p\pi$ back bonding

13. In graphite, electrons are

(A) Localized on each carbon atom

(B) Spread out between the sheets

(C) Localized on every third carbon atom

(D) Present in antibonding orbital

14. Dinitrogen tetroxide, N_2O_4, is a mixed anhydride because it

(A) is a mixture of N_2O_3 and N_2O_5

(B) decomposes into two oxides of nitrogen

(C) reacts with water to form nitric acid

(D) reacts with water to form two acids

15. Peroxy compound is

(A) $H_2S_2O_8$ (B) $H_2S_4O_8$ (C) $H_2S_2O_6$ (D) $H_2S_2O_3$

16. AgCl dissolves in ammonia solution giving

(A) Ag^+, NH_4^+ and Cl^- (B) $[Ag(NH_3)]^+$ and Cl^-

(C) $[Ag_2(NH_3)_2]^+$ and Cl^- (D) $[Ag(NH_3)_2]^+$ and Cl^-

17. In the equation

$4M + 8\ CN^- + 2H_2O + O_2 \longrightarrow 4[M(CN)_2]^- + 4OH^-$

Identify the metal M

(A) Copper (B) Iron (C) Gold (D) Zinc

18. The most probable formula of Prussian blue is

(A) $Fe_3[Fe(CN)_6]_2$ (B) $Fe_2[Fe(CN)_6]_3$

(C) $Fe_4[Fe(CN)_6]_3$ (D) $Fe_3[Fe(CN)_6]_4$

19. The IUPAC name of $[Cr(NH_3)_4Cl_2]NO_3$ is

(A) Tetra-aminodichlorochromium(II)nitrate

(B) Tetra-aminodichlorochromium(III)nitrate

(C) Dichlorotetra-amminechromium(III)nitrate

(D) Tetra-aminodichlorochromium(IV)nitrate

20. The geometry of the atoms in the species PCl_4^+ is best described as

(A) Tetrahedral (B) See-saw

(C) Square (D) Triagonal bipyramidal

21. Stereo isomers (geometrical or opticals) which are neither super imposable nor mirror images to each other are called

(A) Enantiomers (B) Mesomers

(C) Tautomers (D) Diastereomers

22. Which step is chain termination step in the following mechanism?

(i) $Cl_2 \xrightarrow{hv} Cl^{\bullet} + Cl^{\bullet}$

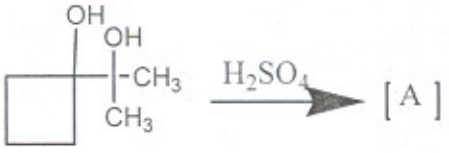
(ii) $Cl^{\bullet} + CH_4 \longrightarrow {}^{\bullet}CH_3 + HCl$

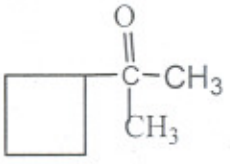
(iii) $Cl^{\bullet} + Cl^{\bullet} \longrightarrow Cl_2$

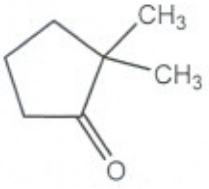
(iv) $CH_3 + Cl^{\bullet} \longrightarrow CH_3Cl$

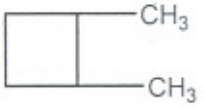
(A) (i) (B) (ii) (C) (iii) (D) (iv)

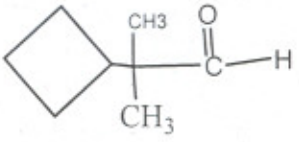
23. Product (A) in the reaction



(A) 

(B) 

(C) 

(D) 

24. Which of the following resonating structures of 1-methoxy-1,3-butadiene is the least stable?

(A) $CH_2^{\oplus}-CH=CH-CH=O^{\oplus}-CH$

(B) $CH_2=CH-CH^{\oplus}-CH=O^{\oplus}-CH_3$

(C) $CH_2-CH^{\oplus}-CH=CH-O^{\oplus}-CH_3$

(D) $CH_2=CH-CH^{\oplus}-CH-O^{\oplus}-CH_3$

25. Identify the Z in the following series:

$$CH_2=CH_2 \xrightarrow{HBr} X \xrightarrow{\text{Hydrolysis}} Y \xrightarrow[I_2 \text{ excess}]{Na_2CO_3} Z$$

(A) C_2H_5I (B) C_2H_5OH (C) CHI_3 (D) CH_3CHO

26. In the reaction the compound X is

(A) CH_3COOH (B) $Br.CH_2COOH$

(C) $(CH_3CO)_2O$ (D) CHO.COOH

27. Reimer –Tiemann reaction involves a

(A) carbonium ion intermediate (B) carbene intermediate

(C) carbanion intermediate (D) free-radical intermediate

28. Osazone formation involves only 2 carbon atoms of glucose because of

(A) Chelation (B) oxidation (C) Reduction (D) hydrolysis

29. Which of the following is the correct increasing order of acidic strength?

(A) $HOCl\ (aq) < H_2SeSO_4(aq) < H_3PO_4$

(B) $H_3PO_4(aq) < H_2SO_4(aq) < HOCl(aq)$

(C) $H_2SeO_4(aq) < HOCl(aq) < H_3PO_4(aq)$

(D) $HOCl(aq) < H_3PO_4(aq) < H_2SeO_4(aq)$

30. Addition polymers include

I. Polyamide II. Polyethylene III. Polyester

(A) I only (B) II only

(C) II and III only (D) I, II and III

31. Two bodies are thrown up with initial velocities in the ratio 2:3. The ratio of maximum height reached by them is

(A) 3:2 (B) 2:3 (C) 4:9 (D) $\sqrt{2}:\sqrt{3}$

32. If the angle between $A = 4\hat{i} + 4\hat{j} - 4\hat{k}$ and $B = 3\hat{i} + \hat{j} - x\hat{k}$ is 90° then $x = ?$

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

33. Bernoulli's theorem is based on

(A) conservation of momentum (B) conservation of energy

(C) mass-energy equivalence (D) conservation of mass

34. A photon is emitted when an electron jumped from the first excited state to the ground state of a hydrogen atom. The ground state energy of hydrogen atom is -13.6 eV. The energy of the emitted photon is _____

(A) 10.2 eV (B) 13.6 eV (C) 3.4 eV (D) –13.6 eV

35. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force ($\vec{F}$) between the two is

(A) $-k\frac{e^2}{r^2}\bar{r}$ (B) $k\frac{e^2}{r^2}\vec{r}$ (C) $-k\frac{e^2}{r^3}\bar{r}$ (D) $-k\frac{e^2}{r}\bar{r}$

36. As the temperature increases, the resistivity

(A) increases for metals and semiconductors but decrease for insulators.

(B) decreases for metals and semiconductors but increases for insulators.

(C) increases for metals but decreases for semiconductors and insulators.

(D) decreases for metals but increases for semiconductors and insulators.

37. A p-n diode is reverse biased then _____ flows through the diode.

(A) no current (B) only minority carrier current

(C) only majority carrier current (D) both (B) & (C)

38. The dimensional formula of magnetic moment is

(A) [L A] (B) $[L^2A]$ (C) $[LT^{-1}A]$ (D) ML^2T^{-1}

39. Which of the following are not electromagnetic waves?

(A) γ–rays (B) α–rays

(C) sound waves (D) both (B) and (C)

40. A metal foil of negligible thickness is introduced between the two plates of a capacitor at the centre. Then the capacitance of the capacitor will be

(A) same (B) double (C) half (D) squared

41. The refractive index of water is 1.33. The speed of light in water is ____ ms^{-1}

(A) 3×10^8 (B) 3.99×10^8 (C) 2.26×10^8 (D) 1.33×10^8

42. Which of the following rays contains negative particles?

(A) α–rays (B) β–rays

(C) cathode rays (D) both (B) and (C)

43. The unit of Poynting vectors is

(A) Watt per second
(B) Watt per square metre
(C) Watt per square metre per second
(D) Watt per metre cube per second

44. An ideal gas molecule at room temperature possesses:

(A) Potential energy
(B) Kinetic energy
(C) Electrical energy
(D) No energy

45. In Carnot's engine at the end of the cycle, the temperature of the working substance is

(A) less than initial temperature
(B) greater than initial temperature
(C) equal to initial temperature
(D) equal to final pressure

46. $01100111_{(2)}$ = _____

(A) $103_{(10)}$ (B) $67_{(10)}$ (C) $05_{(10)}$ (D) $27_{(10)}$

47. The value of $\left(\sin\frac{\pi}{3}+i\cos\frac{\pi}{3}\right)^3$ is

(A) 1 (B) -1 (C) i (D) $-i$

48. If a matrix A satisfies the equation $A^2-A+I=0$, then the inverse of A is

(A) A+I (B) A (C) A–I (D) I–A

49. Which one of the following forces is non-conservative?

(A) Electrostatic force
(B) Frictional force
(C) Elastic force
(D) Viscous force

50. A radioactive nucleus emitted a β particle then its

(A) mass number and atomic number remain same
(B) mass number increases by 1 but the atomic number remains same
(C) atomic number increases by 1 but the mass number remains same
(D) both mass number and atomic number increase by 1

51. The effective number of atoms that are there in the unit cell of a body centered cubic (BCC) lattice is

(A) 1 (B) 2 (C) 8 (D) 9

52. Trivalent impurity is added to silicon to obtain

(A) p-type silicon (B) boron (C) n-type silicon (D) insulator

53. A star is at 20 light years away from the surface of the earth. If we use convex lens of focal length 100 cm, then the image of the star is formed at

(A) 20 cm (B) 50 cm (C) 5 cm (D) 100 cm

54. The coefficients of thermal conductivity of a metal depends on

(A) temperature difference between the two sides

(B) thickness of the metal plate

(C) area of the plate

(D) number of free electrons

55. Curie temperature is the temperature above which

(A) a paramagnetic material becomes diamagnetic

(B) a ferromagnetic material becomes diamagnetic

(C) a paramagnetic material becomes ferromagnetic

(D) a ferromagnetic material becomes paramagnetic

56. Cathode rays, enter a magnetic field normal to the lines of force, then their path in the magnetic field is

(A) straight line (B) ellipse (C) circle (D) parabola

57. Hydrogen bond is found in

(A) H_2 (B) $NaHCO_3$ (C) H_2O (D) $HCCl_3$

58. Plane mirror always form

(A) Real and erect image (B) Real and inverted image

(C) Virtual and erect image (D) Virtual and inverted image

59. The electronic configuration of Cu^{29} in its ground state is _____

(A) [Ar] $4s^2\ 3d^9$ (B) [Ar] $4s^1\ 3d^{10}$

(C) [Ar] $4s^2\ 4p^6\ 4d^3$ (D) [Kr] $4s^2\ 4p^6\ 4d^3$

60. When a soap bubble is charged

(A) it contracts (B) it expands

(C) it does not under go any change (D) none of these

61. If the rank of the matrix $\begin{bmatrix} \lambda & -1 & 0 \\ 0 & \lambda & -1 \\ -1 & 0 & \lambda \end{bmatrix}$ is 2, then λ is

(A) 1 (B) 2

(C) 3 (D) any real number

62. Inverse of $\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$ is

(A) $\begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} -2 & 5 \\ 1 & -3 \end{bmatrix}$ (C) $\begin{bmatrix} 3 & -1 \\ -5 & -3 \end{bmatrix}$ (D) $\begin{bmatrix} -3 & 5 \\ 1 & -2 \end{bmatrix}$

63. The system of equations $ax + y + z = 0$, $x + by + z = 0$, $x + y + cz = 0$ has a non-trivial solution, then $a+b+c-abc =$

(A) 1 (B) 2 (C) –1 (D) 0

64. If $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$ then

(A) $\vec{a}$ is parallel to $\vec{b}$ (B) $\vec{a}$ is perpendicular to $\vec{b}$

(C) $|\vec{a}| = |\vec{b}|$ (D) $\vec{a}$ and $\vec{b}$ are unit vectors

65. If $[\vec{a}\times\vec{b},\ \vec{b}\times\vec{c},\ \vec{c}\times\vec{a}] = 64$, then $[\vec{a},\ \vec{b},\ \vec{c}]$ is

(A) 32 (B) 128 (C) 8 (D) 0

66. The point of intersection of the lines $\frac{x-6}{-6} = \frac{y+4}{4} = \frac{z-4}{-8}$ and $\frac{x+1}{2} = \frac{y+2}{4} = \frac{z+3}{-2}$ is

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

67. $\frac{1+e^{-i\theta}}{1+e^{i\theta}} =$

(A) $\cos\theta + i\sin\theta$ (B) $\cos\theta - i\sin\theta$

(C) $\sin\theta - i\cos\theta$ (D) $\sin\theta + i\cos\theta$

68. If $-i+2$ is one root of the equation $ax^2 - bx + c = 0$, then the another root is

(A) $-i-2$ (B) $i-2$ (C) $2+i$ (D) $2+2i$

69. The axis of the parabola $y^2 - 2y + 8x - 23 = 0$

(A) $y = -1$ (B) $x = -3$ (C) $x = 3$ (D) $y = 1$

70. The straight line $2x - y + c = 0$ is a tangent to the ellipse $4x^2 + 8y^2 = 32$ if c is

(A) $\pm 2\sqrt{3}$ (B) ± 6 (C) 36 (D) ± 4

71. The eccentricity of the hyperbola $12y^2 - 4x^2 - 24x - 48y - 127 = 0$ is

(A) 4 (B) 3 (C) 2 (D) 6

72. The length of the latus rectum of the rectangular hyperbola $xy = 32$ is

(A) $8\sqrt{2}$ (B) 32 (C) 8 (D) 16

73. The slope of the normal to the curve $y = 3x^2$ at the point $x = 2$ is

(A) $\frac{1}{13}$ (B) $\frac{1}{14}$ (C) $-\frac{1}{12}$ (D) $\frac{1}{12}$

74. If ω is a cube root of unity , then the value of $\left(1 - \omega + \omega^2\right)^4 + \left(1 + \omega - \omega^2\right)^4$ is

(A) 0 (B) 32 (C) –16 (D) –3

75. If $u = \log\left(\frac{x^2 + y^2}{xy}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is

(A) 0 (B) u (C) $3u$ (D) $\frac{1}{u}$

76. The value of $\int_0^1 \frac{1}{\sqrt{1 - x^2}} dx$ is

(A) π (B) $\frac{4\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

77. The value of $\int_0^{\pi} \sin^2 x \cos^3 x \, dx$ is

(A) π (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{4}$ (D) 0

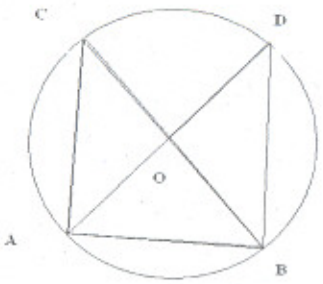
78. The differential equation $\left(\frac{dx}{dy}\right)^2 + 5y^{\frac{1}{3}} = x$ is

(A) of order 2 and degree 1 (B) of order 1 and degree 2

(C) of order 1 and degree 6 (D) of order 1 and degree 3

79. A particular integral of $(D^2 - 4D + 4)y = e^{2x}$ is

(A) $\frac{x^2}{2}e^{2x}$ (B) xe^{2x} (C) xe^{-2x} (D) $\frac{x^2}{2}e^{-2x}$

80. 

O is the centre of the circle passing through A, B, C and D and $\angle ABC = \theta$. Then $\angle ADB$ is

(A) θ (B) $\frac{\pi}{2} + \theta$ (C) $\frac{\pi}{2} - \theta$ (D) 2θ

81. In the set of integer under the operation * defined by $a * b = a + b - 1$, the identity element is

(A) 0 (B) 1 (C) a (D) b

82. A box contains 6 red and 4 white balls. If 3 balls are selected at random, the probability of getting 2 white balls is

(A) $\frac{1}{20}$ (B) $\frac{18}{125}$ (C) $\frac{4}{25}$ (D) $\frac{3}{10}$

83. In 5 throws of a die, getting 1 or 2 is a success. The mean number of successes is

(A) $\frac{5}{3}$ (B) $\frac{3}{5}$ (C) $\frac{5}{9}$ (D) $\frac{9}{5}$

84. In a Poisson distribution if $p(X=2) = p(X=3)$, then the variance of the distribution is

(A) 6 (B) 2 (C) 3 (D) 4

85. The value of the integral $\int_{-\pi}^{\pi} \sin(99\theta)\cos(87\theta)\,d\theta$ is

(A) 2π (B) 1 (C) 0 (D) π

86. Let $x = 6n+3 = 5m+4$, where n and m are positive integers. If $x \leq 100$, the number of solutions for the pair (n, m) is

(A) 6 (B) 4 (C) 2 (D) 3

87. If 5 men can finish a work in 3 days, the number of days needed for 3 men to finish the same work is

(A) 5 (B) 10 (C) 9 (D) 15

88. The centre of the circle, lying in the first quadrant, touching the lines $y = \sqrt{3}x$ and the X-axis and having radius 1 is

(A) $(\sqrt{3},1)$ (B) $(\frac{1}{\sqrt{3}},2)$ (C) $(\frac{1}{\sqrt{3}},1)$ (D) $(\sqrt{3},2)$

89. The value of $\int_{0}^{\frac{\pi}{2}} \frac{\sin x - \cos x}{1+\sin x \cos x}dx$ is

(A) $\frac{\pi}{2}$ (B) 0 (C) $\frac{\pi}{4}$ (D) π

90. The marks secured by 400 students in a Mathematics test were normally distributed with mean 65.

If 120 students got marks above 85, the number of students securing marks between 45 and 65 is

(A) 120 (B) 20 (C) 80 (D) 160

91. In the following sentence adjective is

"The driver was driving his beautiful Tata Indica at eighty kilometers per hour"

(A) driver (B) driving (C) beautiful (D) Tata Indica

92. Past tense for the verb teach is

(A) taught (B) teached (C) teaches (D) thought

93. "The reaction between hydrogen and oxygen produces water." This sentence is a statement of

(A) inference (B) observation (C) description (D) purpose

94. Fill up the blank in the following sentence:

"She ---- like foot ball."

(A) does not (B) has not (C) have not (D) do not

95. Fill up the blank in the following sentence:

"The lawyer gave ----- to his client."

(A) advise (B) advize (C) advice (D) adwise

96. The sentence "Motorbike is unstable on road than car." is a

(A) positive sentence (B) comparative sentence

(C) superlative sentence (D) negative sentence

97. "The student learned the poem by heart." Passive voice for this sentence is

(A) The student is learning the poem by heart.

(B) The poem was learnt by the student by heart.

(C) The poem was being learnt by the student by heart.

(D) The poem is learnt by the student by heart.

98. Fill up the blank in the following sentence:

"We are looking forward ---- going out this week end."

(A) for (B) if we are (C) till (D) to

99. Fill up the blank in the following sentence:

"Both teams played the game so well ---- it became difficult to predict the match winner."

(A) if (B) which (C) as (D) that

100. Fill up the blank in the following sentence:

"The dog was eating ---- biscuit."

(A) her (B) their (C) its (D) mine