

**SECTION A (Q. No 1-75)**  
**ENGLISH & GENERAL APTITUDE**

1. Read the sentence to find out whether there is any error in it. The error, if any, will be in one part of the sentence. Ignore errors of punctuation, if any. The king was aware (1)/ of his abilities, (2)/ and therefore made them (3)/ the administrator of the kingdom. (4)  
 A) 1                                      B) 2  
 C) 3                                      D) 4
2. Read the sentence to find out whether there is any error in it. The error, if any, will be in one part of the sentence. Ignore errors of punctuation, if any. Between you (1)/ and I (2)/ you are the (3)/ kinder one (4)  
 A) 1                                      B) 2  
 C) 3                                      D) 4
3. Fill in the blank with a suitable option.  
 I will visit the Grand Canyon \_\_\_\_\_ I go to Arizona.  
 A) once                                      B) whenever  
 C) wherever                                      D) Where
4. Fill in the blank with a suitable option.  
 This is the place \_\_\_\_\_ we stayed last time we visited.  
 A) Where                                      B) When  
 C) how                                      D) Once
5. Fill in the blank with a suitable option.  
 The cat and the dog have a \_\_\_\_\_ enemy in the rat.  
 A) Same                                      B) Common  
 C) Mutual                                      D) Similar
6. Choose the correct speech option.  
 Kiran asked me, "Did you see the Cricket match on television last night?"  
 A) Kiran asked me whether I saw the Cricket match on television the earlier night.  
 B) Kiran asked me whether I had seen the Cricket match on television the earlier night.  
 C) Kiran asked me did I see the Cricket match on television the last night.  
 D) Kiran asked me whether I had seen the Cricket match on television the last night.
7. Find the principle clause in the following sentence  
 I could not tolerate what he said because it was quite insulting.  
 A) I could not tolerate  
 B) what he said  
 C) because it was very insulting  
 D) none of these
8. Choose the correct sentence pattern.  
 I teach him English  
 A) SVA                                      B) SVOO  
 C) SVOC                                      D) SVO
9. Choose the correct sentence pattern.  
 India become independent in 1947  
 A) SVOA                                      B) SVA  
 C) SVOO                                      D) SVAC
10. Choose the correct option.  
 I was sure that I \_\_\_\_\_ her before.  
 A) Had saw                                      B) Seen  
 C) Had seen                                      D) saw
11. Choose the correct option.  
 I needed to know what \_\_\_\_\_ to my dog.  
 A) has happened                                      B) had happened  
 C) happened                                      D) happens
12. Choose the correct option.  
 I remember \_\_\_\_\_ the Queen in London.  
 A) meet                                      B) to meet  
 C) meeting                                      D) to meeting
13. Choose the correct option.  
 Did you remember \_\_\_\_\_ the letter?  
 A) post                                      B) to post  
 C) posting                                      D) to posting
14. Correct the following sentence by choosing the correct option.  
 The small child does whatever his father was done.  
 A) has done                                      B) did  
 C) does                                      D) had done
15. The men to who I sold my house was a cheat  
 A) to whom I sell                                      B) to who I sell  
 C) who was sold to                                      D) to whom I sold
16. Garampani sanctuary is located at  
 A) Gangtok, Sikkim                                      B) Kohima, Nagaland  
 C) Diphu, Assam                                      D) Junagarh, Gujarat

17. ESCAP stands for  
 A) European Society Council for Africa and Pacific  
 B) Economic and Social Commission for Asia and Pacific  
 C) Economic and Social Commission for Africa and Pacific  
 D) None of the above

18. Headquarters of UNO are situated at  
 A) Paris  
 B) Geneva  
 C) Haque (Netherlands)  
 D) New York, USA

19. Which one set of letters when sequentially placed at the gaps in the given letter series shall complete it? bca \_ b \_ aabc \_ a \_ caa  
 A) acab                                      B) bcbb  
 C) cbab                                      D) ccab

**Directions Question 20 to 22:**

20. In each of the following questions four possible answers are given. Find out the most suitable answer.

Which is the best statement to achieve success in life?

- A) the person should be well educated  
 B) The person should be rich and prosperous  
 C) The person should be sincere and hard working.  
 D) the person should be honest
21. If in a certain language PROSE is coded as PPOQE, how is LIGHT coded in that code?  
 A) LIGFT                                      B) LGGHT  
 C) LGGFT                                      D) LLGFE

22. Complete the series 1, 5, 13, 25, 41, ...?  
 A) 51                                              B) 57  
 C) 61                                              D) 63

23. How many medals in diving were won by India at the Indonesia Open Aquatic championship 2017?  
 A) 6                                                B) 7  
 C) 8                                                D) 10

24. On whom the Yerarignar Award for the year 2017 was conferred by the Vice-President of India M,Venkaiah Naidu  
 A) Prof. C.N. Rao  
 B) Prof. M.S.Swarminathan  
 C) Dr. Manmohan Singh  
 D) Dr. Bimal Jalan

25. Who is new Union Minister of Railways  
 A) Ms.Nirmala Sitharaman  
 B) Sh.Suresh Prabhu  
 C) Sh. Kalraj Mishra  
 D) Sh. Piyush Goyal

**PHYSICS**

26. The electric flux through a closed surface depends on the?  
 A) Magnitude of the charge enclosed by the surface  
 B) The shape of the surface  
 C) Position of the charge enclosed by the surface  
 D) None of these

27. In a parallel-plate capacitor, the region between the plates is filled by a dielectric slab. The capacitor is charged from a cell and then disconnected from it. The slab is now taken out.  
 A) No work is done by an external agent in taking the slab out  
 B) The potential difference across the capacitor is reduced  
 C) The potential difference across the capacitor is increased  
 D) The energy stored in the capacitor is reduced

28. Ohm's law is not applicable to  
 A) high currents                              B) DC circuits  
 C) small resistors                            D) semi-conductors

29. Kirchhoffs 2nd law deals with  
 A) current in circuit                        B) voltage in circuit  
 C) e.m.f in circuit                            D) both B and C

30. A current carrying conductor has a  
 A) magnetic field                            B) current capacity  
 C) voltage capacity                            D) resistance capacity

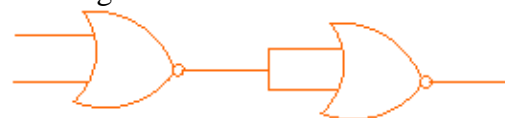
31. A galvanometer having a coil resistance of  $100\ \Omega$  gives a full scale deflection, when a current of  $1\ \text{mA}$  is passed through it. The value of the resistance, which can convert this galvanometer into ammeter giving a full scale deflection for a current of  $10\ \text{A}$ , is  
 A)  $2\ \Omega$                                         B)  $0.1\ \Omega$   
 C)  $3\ \Omega$                                         D)  $0.01\ \Omega$

32. According to Faraday's law, EMF stands for  
 A) Electromagnetic field  
 B) Electromagnetic force  
 C) Electromagnetic friction  
 D) Electromotive force

33. Wattles current is said to flow when phase angle between voltage and current is  
 A)  $90^\circ$                       B)  $0^\circ$   
 C)  $60^\circ$                       D)  $180^\circ$
34. Arrange the following electromagnetic radiations per quantum in the order of increasing energy:  
 (A) Blue light                      (B) Yellow light  
 (C) X-ray                      (D) Radiowave
- A) A, B, D, C                      B) C,A, B, D  
 C) B, A, D, C                      D) D, B, A, C
35. Electromagnetic waves travel  
 A) without medium  
 B) with medium  
 C) both with medium and without medium  
 D) in a disturbed path
36. Huygen's principle says that  
 A) when light passes through two narrow slits, it produces an interference pattern  
 B) each point on a wave front acts as a new source of wavelets  
 C) when the crests of waves overlap, their individual effects add together.  
 D) light waves bend slightly when passing through an opening
37. From double-slit experiment, quantities to be measured are  
 A) slit separation  
 B) fringe separation  
 C) slit-to-screen distance  
 D) all of above
38. In photoelectric effect, electrons should be removed from the  
 A) inner shells                      B) surface  
 C) from axe                      D) nucleus
39. Electrons show diffraction effects because their de Brogue wavelength is similar to  
 A) spacing between atomic layers  
 B) no. of atomic layers  
 C) nature of atomic layers  
 D) positioning of atomic layers
40. Isotopes have same number of protons but different number of  
 A) electrons                      B) neutrons  
 C) shells                      D) positrons

41. Release of energy from sun is due to  
 A) nuclear fission                      B) nuclear fusion  
 C) burning of gases                      D) chemical reaction
42. The diode \_\_\_\_\_.  
 A) is the simplest of semiconductor devices  
 B) has characteristics that closely match those of a simple switch  
 C) is a two terminal device  
 D) all of the above
43. The gate is either  
 A) A NAND or an EX-OR  
 B) An OR or an EX-NOR  
 C) An AND or an EX-OR  
 D) A NOR or an EX-NOR
44. Amplitude modulation is the process of  
 A) superimposing a low frequency on a high frequency  
 B) superimposing a high frequency on a low frequency  
 C) carrier interruption  
 D) frequency shift and phase shift

45. Identify the logic operation performed by the circuit given here.



- A) OR                      B) NOT  
 C) NAND                      D) NOR

46. A conducting wire of resistance R is stretched to increase its length by double. What will be its resistance in that case?  
 A) R                      B) 2R  
 C) R/2                      D) 4R
47. A blue object on a white background when seen through a blue filter will appear  
 A) Blue on a white background  
 B) Black on a blue background  
 C) Blue on a red background  
 D) Invisible
48. The process of combining audible frequency waves and radio waves is called:  
 A) Modulation                      B) Demodulation  
 C) Both A and B                      D) None of the above

49. FM broadcast transmitters have frequency range:

- A) 88 MHz to 108 MHz
- B) 10 KHz to 108 KHz
- C) 88 MHz to 100 MHz
- D) 88 MHz to 108 GHz

50. When arsenic is added as an impurity to silicon, the resulting material is?

- A) N-type semiconductor
- B) P-type semiconductor
- C) N-type conductor
- D) Insulator

### CHEMISTRY

51. The equation  $pV=RT$  is used for ideal gases. The right equation for real gases is van der Waals equation. What is the correct formula for the van der Waals equation? Where  $(a/v^2)$  = force of cohesion,

$b$  = coefficient related to volume of molecules

- A)  $(p + (a/v^2)(v + b)) = RT$
- B)  $(p - (a/v^2)(v - b)) = RT$
- C)  $(p + (a/v^2)(v - b)) = RT$
- D)  $(p - (a/v^2)(v + b)) = RT$

52. Which one of the following defects in the crystals lowers its density?

- A) F-centres
- B) Schottky defect
- C) Frenkel defect
- D) Interstitial defect

53. Which one is correct?

- A) Molality changes with temperature
- B) Molality does not change with temperature
- C) Molarity does not change with temperature
- D) Normality does not change with temperature

54. Colligative properties are the properties of

- A) dilute solutions which behave as nearly ideal solutions
- B) concentrated solutions which behave as nearly non—ideal solutions
- C) both (A) and (B)
- D) neither (A) nor (B)

55. An Oxidation number can be

- A) positive
- B) negative
- C) zero
- D) All of these

56. The standard emf of galvanic cell involving 3 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the reaction of the cell is

- A)  $10^{25}$
- B)  $10^{20}$
- C)  $10^{15}$
- D)  $10^{30}$

57. Rate of a reaction can be expressed by Arrhenius equation as:  $k = Ae^{-E/RT}$  In this equation, E represents

- A) the energy below which colliding molecules will not react
- B) the total energy of the reacting molecules at a temperature, T
- C) the fraction of molecules with energy greater than the activation energy
- D) the energy above which all the colliding molecules will react.

58. Consider the reaction,  $2A + B \rightarrow$  Products. When concentration of B alone was doubled, the half-life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is

- A) no unit
- B)  $\text{mol L}^{-1} \text{s}^{-1}$
- C)  $\text{s}^{-1}$
- D)  $\text{L mol}^{-1} \text{s}^{-1}$

59. In Freundlich Adsorption isotherm, the value of  $\ln \ln$  is

- A) 1 in case of physical adsorption
- B) 1 in case of chemisorptions
- C) Between 0 and 1 in all cases
- D) Between 2 and 4 in all cases

60. Which one of the following polymers is prepared by condensation polymerization?

- A) Teflon
- B) Styrene
- C) Rubber
- D) Nylon-6,6

61. The IUPAC name of  $\text{K}_2[\text{Ni}(\text{CN})_4]$  is

- A) Potassium tetracyanonickelate(II)
- B) Potassium tetracyanonickelate(II)
- C) Potassium tetracyanonickel(III)
- D) Potassium tetracyanonickel(II)

62. Which of the following is not a  $\pi$ -bonded complex

- A) Zeise's salt
- B) Ferrocene
- C) Dibenzene chromium
- D) Tetraethyl lead

63. Which one is Chloroform

- A)  $\text{CH}_2\text{Cl}_2$
- B)  $\text{CH}_3\text{Cl}$
- C)  $\text{CHCl}_3$
- D)  $\text{CCl}_4$

64. Chloro ethane reacts with X to form diethyl ether. What is X

- A) NaOH
- B)  $\text{H}_2\text{SO}_4$
- C)  $\text{C}_2\text{H}_5\text{ONa}$
- D)  $\text{Na}_2\text{S}_2\text{O}_3$

65. Catalytic dehydrogenation of a primary alcohol gives a  
 A) ketone                    B) Aldehyde  
 C) secondary alcohol      D) Ester
66. Hydrolysis of substituted amides will give product of  
 A) carboxylic acids      B) amines  
 C) both A and B                    D) alcohols
67. Classes of amines include  
 A) primary amines  
 B) secondary amines  
 C) tertiary amines  
 D) all of them
68. Vitamins A, D, E, and K are classified as  
 A) carbon-soluble vitamins  
 B) oxygen-soluble vitamins  
 C) ethyl-soluble vitamins  
 D) calcium-soluble vitamins
69. Greenhouse gases which is present in very high quantity is  
 A) propane                              B) ethane  
 C) carbon dioxide                    D) methane
70. The functional isomer of ethers are:  
 A) Ketone  
 B) Aldehyde  
 C) Alcohols  
 D) esters
71. The compound formed when 2-butene is treated with hot alkaline  $\text{KMnO}_4$  is:  
 A) Acetaldehyde  
 B) Acetic acid  
 C)  $\text{CH}_2\text{OH}-\text{CH}_2\text{OH}$   
 D)  $\text{CH}_3-\text{CH}_2-\text{CO}-\text{CH}_3$
72. The reaction of  $\text{C}_2\text{H}_5\text{MgI}$  with water produces  
 A) Acetaldehyde  
 B) Ethane  
 C) Ethanol  
 D) Acetic Acid
73. Ozone in the atmosphere is depleted by  
 A)  $\text{CF}_2\text{Cl}_2$   
 B)  $\text{C}_7\text{F}_{16}$   
 C)  $\text{C}_6\text{H}_6\text{Cl}_6$   
 D)  $\text{C}_6\text{H}_6$
74. Which of the following is not a property of solids?  
 A) Sharp melting point  
 B) Isotropic  
 C) Definite geometry  
 D) Strong intermolecular forces
75. Which of the following properties of liquids increases with the increase in temperature?  
 A) Vapour pressure  
 B) Surface tension  
 C) Viscosity  
 D) None of the above
- SECTION B (Q. No. 76-100 & 76A-100A)**  
**Candidates have to fill responses either from**  
**Biology or Mathematics on response sheet (OMR)**  
**S. No. 76-100**
- BIOLOGY**
76. In a fully developed male gametophyte, no of nuclei is:  
 A) 1      B) 2      C) 3      D) 4
77. Distance between stigma and anthers in same flower,  
 A) reduces chances of self pollination  
 B) enhances chances of self pollination  
 C) reduces chances of cross pollination  
 D) enhances chance of cross pollination
78. Which of the following Mendel's law has not been proved to be true in all cases?  
 A) Law of segregation  
 B) Mendel's second law of inheritance  
 C) Law of dominance  
 D) Law of purity of gametes
79. Process of genetic information flowing from DNA to RNA to proteins is called  
 A) gene annealing                    B) gene mutation  
 C) gene expression                    D) gene therapy
80. The genetic code translated the language of  
 A) Proteins into that of RNA  
 B) Amino acids into that of RNA  
 C) RNA into that of proteins  
 D) RNA into that of DNA
81. Interaction and interdependence of plants and animals in -a certain place is known as  
 A) ecological niche  
 B) ecological community  
 C) ecological habitat  
 D) both A and B

82. The type of biodiversity including all the different kinds of living things found in a certain habitat is called as:  
 A) Species diversity  
 B) Genetic diversity  
 C) Ecosystem diversity  
 D) Population diversity
83. Global warming alters distribution of  
 A) forests around the globe  
 B) heat around the globe  
 C) wind and moisture around the globe  
 D) water around the globe
84. Traditional breeding methods are  
 A) selective breeding                      B) cell fusion  
 C) mutation breeding                      D) all of above
85. Microbes/ microorganism also help in production of food like  
 A) bread                                      B) fruits and seeds  
 C) vegetables                                D) pulses
86. Budding is a method of asexual reproduction found in  
 A) hydra                                      B) honey bee  
 C) bacteria                                    D) virus
87. Which assisted reproductive technology places collected oocytes and sperm in the woman's fallopian tubes? -  
 A) artificial insemination  
 B) intracytoplasmic sperm injection  
 C) in vitro fertilization  
 D) gamete intrafallopian transfer
88. Symptoms of gonorrhoea include  
 A) painful urination  
 B) milky urethral discharge  
 C) Infected individuals may be asymptomatic  
 D) All of these are correct
89. Identify a Mendelian disorder from the following  
 A) Down's syndrome  
 B) Klinefelter's syndrome  
 C) Turner's syndrome  
 D) Phenyl ketonuria
90. Assumptions underlying Hardy- Weinberg equilibrium are  
 A) organisms are diploid  
 B) mating is random  
 C) population size is infinitely large  
 D) all of them
91. When HIV invades in an individual, it destroys its  
 A) nervous system  
 B) digestive system  
 C) circulatory system  
 D) immune system
92. The annual survey that assesses adolescent lifestyle issues including drug and alcohol use is called  
 A) Yearly Assessment of Lifestyle and Habits  
 B) National Progress toward a Better Tomorrow  
 C) Monitoring the Future  
 D) none of the above
93. Cloning has been used for desirable animals such as  
 A) race horses                                B) prize bulls  
 C) human                                      D) both A and B
94. A recombinant DNA molecule is produced by Recombinant DNA Technology by  
 A) joining of two DNA fragments  
 B) joining of two or more DNA fragments  
 C) joining of two or more DNA fragments originating from different organisms  
 D) joining of two or more DNA fragments originating from different organisms
95. Polyploid derived from two different species is called  
 A) Autopolyploid                            B) Triploid  
 C) Allopolyploid                            D) Monoploid
96. Ribosomal RNA is actively synthesized in:  
 A) Lysosomes                                B) Nucleolus  
 C) Nucleoplasm                                D) Ribosomes
97. Populations are said to be sympatric when \_\_\_\_\_.  
 A) two populations are physically isolated by natural barriers.  
 B) two populations live together and freely interbreed to produce sterile offspring.  
 C) two populations share the same environment but cannot interbreed.  
 D) two populations are isolated but occasionally come together to interbreed
98. The main difference between Gram positive and Gram negative bacteria is  
 A) Cell membrane                            B) Cell Wall  
 C) Ribosome                                    D) Mitochondria

99. Who wrote the famous book "Origin of Species"?

- A) Larmarck                                  B) Darwin  
C) De Vries                                  D) Mendel

100. Genes for cytoplasmic male sterility in plants are generally located in

- A) nuclear genome  
B) mitochondrial genome  
C) chloroplast genome  
D) cytosol

### MATHEMATICS

76A. Let A and B be two sets in the universal set.

Then  $A - B$  equals

- A)  $A \cap B^c$                                   B)  $A^c \cap B$   
C)  $A \cap B$                                   D) None of these

77A. The domain of definition of the function

$$y = f(x) = \sqrt{-x} \text{ is}$$

- A)  $(0, \alpha)$                                   B)  $[0, \alpha)$   
C)  $(-\alpha, 0)$                                   D)  $(-\alpha, 0]$

78A. Number of subsets of a set of order three is

- A) 2      B) 4      C) 6      D) 8

79A. Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey; 80 played cricket and basketball and 40 played cricket and hockey; 24 played all the three games. The number of boys who did not play any game is

- A) 128                                  B) 216  
C) 240                                  D) 160

80A. If y is expressed in terms of a variable x as  $Y = f(x)$ , then y is called

- A) explicit function                          B) implicit function  
C) Linear function                          D) identity function

81A. The derivative of  $\sin(x^2)$  is

- A)  $2x \sin(x^2)$                                   B)  $\cos(x^2)$   
C)  $2x \cos x^2$                                   D)  $-2x \cos x^2$

82A. Find the second derivative of  $e^x \cos x$

- A)  $2e^x \sin x$                                   B)  $-e^x \sin x$   
C)  $e^x(\sin x + \cos x)$                           D)  $2e^x \cos x$

83A.  $\int \sec^2 5x dx = ?$

- A)  $\tan x + c$                                   B)  $1/5 \tan x + c$   
C)  $1/5 \tan 5x + c$                                   D)  $1/5 \tan^2 5x + c$

84A. The point of a parabola which is closest to the focus is the \_\_\_\_\_ parabola.

- A) Vertex                                  B) Latusrectum  
C) Directrix                                  D) Eccentricity

85A. The solution of a differentiated equation which is not obtained from the general solution is known as

- A) Particular solution                          B) Singular solution  
C) Complete solution                          D) Auxiliary solution

86A. For a random experiment, all possible outcomes are called

- A) Numerical Space                          B) Event Space  
C) Sample Space                          D) Both B and C

87A. The probability on the basis of observations and collected data is called:

- A) Axiomatic approach of probability  
B) Empirical probability  
C) Statistical approach of probability  
D) Classical approach of probability

88A. Previous probabilities in Bayes Theorem that are changed with help of new available information are classified as

- A) independent probabilities  
B) posterior probabilities  
C) interior probabilities  
D) dependent probabilities

89A. In binomial distribution, formula of calculating standard deviation is

- A) square root of p                          B) square root of pq  
C) square root of npq                          D) square root of np

90A. A vector whose magnitude is zero is called a

- A) scalar                                  B) resultant  
C) unit vector                                  D) null vector

91A. In scalar multiplication of matrices, scalar is considered as

- A) real number                                  B) optimal number  
C) dimension number                          D) multiple number

92A. X-components of vectors are represented by the

- A) subtraction of x-components  
B) subtraction of y-components  
C) sum of x-components  
D) sum of y-components

93A. The point with position vector  $60\mathbf{i} + 3\mathbf{j}$ ,  $40\mathbf{i} - 8\mathbf{j}$  and  $a\mathbf{i} - 52\mathbf{j}$  are collinear if

- A)  $a = -40$       B)  $a = 40$   
 C)  $a = -20$       D) None of these

94A. There are 8 students in team A and 12 students in team B. What is the total number of students on the two teams if three students are on both teams?

- A) 20                      B) 17  
 C) 15                      D) 14

95A. Determine the total number of subsets of the following set:  $\{a, b, c, d, e, f, g\}$

- A) 64                      B) 128  
 C) 32                      D) 127

96A. The probabilities of each of getting the jack of hearts, when one card is picked from a well-shuffled deck of cards

- A)  $1/52$                       B)  $1/13$   
 C)  $1/4$                       D)  $1/26$

97A. The value of the integral  $\int \log x \, dx$  is

- A)  $e^x + C$                       B)  $\log x + x + C$   
 C)  $\log x + 1 + C$                       D)  $\log x - x + C$

98A. The solution of the differential equation

$$\frac{dy}{dx} = \frac{x+y}{x} \text{ satisfying the condition } y(1) = 1 \text{ is}$$

- A)  $y = xe^{(x-1)}$   
 B)  $y = x \log x + x$   
 C)  $y = x \log x + x^2$   
 D)  $y = \log x + x$

99A. The solution of the differential equation

$$\frac{dy}{dx} = xy + x + y + 1, \text{ is}$$

- A)  $\log(y+1) = \frac{1}{2}x^2 + x + c$   
 B)  $c(y+1) = e^{(x^2+2x)}$   
 C)  $\frac{1}{2}(x^2 + 2x) = e^{c(y+1)}$   
 D)  $(x^2 + 2x) = e^{\frac{1}{2}c(y+1)}$

100A. If  $\vec{a}$  and  $\vec{b}$  are two unit vectors and  $\theta$  is the angle between them then  $\vec{a} + \vec{b}$  is a unit vector if

- A)  $\theta = \frac{\pi}{3}$   
 B)  $\theta = \frac{\pi}{2}$   
 C)  $\theta = \frac{2\pi}{3}$   
 D)  $\theta = \frac{\pi}{4}$