श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकीसंस्थान, तिरुवनंतपुरम्-11

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY

THIRUVANANTHAPURAM—695 011

ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2018

PROGRAMME: Ph.D. BIOMATERIALS SCIENCE AND TECHNOLOGY

Time:120Minutes Max.Marks: 100

(Select the most appropriate answer)

(There are **no negative** marks for wrong answers)

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1) If 'a' is the smallest prime number greater than 39 and 'b' is the largest prime number less than 10, then ab =

a) 299 b) 287 c) 229 d) 261

2) Find the odd number from the series 8, 64, 99, 216, 343, 729, 1728

a) 64 b) 216 c) 729 d) 99

3) Which of the following options is the closest in meaning to the word 'ephemeral'?

a) short-lived b) effeminate c) oppose d) ghostly

4) A person has the capability of thinking 100 lines of code in five minutes and can type 100 lines of code in 10 minutes. He takes a break for five minutes after every ten minutes. How many lines of codes will he complete typing after an hour?

a) 100 b) 250 c) 350 d) 600

5) GENEALOGY: ANCESTRY, ETYMOLOGY:_____

a) Words b) Insects c) Fossils d) Inscriptions

6) Complete the equation by correctly identifying the incomplete number of the calculation from the list of options given below.

Equation: $(4.25 + 2.75)^2 +$ ___ $= 5^3 - (9 \times 8)$

a) 2 b) 4 c) 6 d) 8

7) Cobalt-60 is used in the radiation therapy of cancer and can be produced by bombardment of cobalt-59 with which of the following?

a) Neutrons b) Alpha particles c) Beta particles d) X-rays

8) When you reverse the age of the father you will get the age of the son. One year ago the age of the father was twice that of son's age. What are the current ages of son and father?

a) 37 and 73 b) 24 and 42 c) 13 and 31 d) 15 and 51

9) Which of the following microorganism does not cause disease in human beings?
a) *Vibrio cholerae* b) *Salmonella typhi* c) *Clostridumtitani* d) *Brevibacterium linens*

10) The anhydride of $Ba(OH)_2$ is
a) BaOH b) BaO c) BaO_2 d) Ba

11) Inheritance of acquired characteristics is called _____
a) Lamarckism b) Neo-Lamarckism c) Mendelism d) Darwinism

12) A buffer is made from equal concentrations of a weak acid and its conjugate base. Doubling the volume of the buffer solution by adding water has what effect on its pH?
a) It has little effect.
b) It significantly increases the pH
c) It significantly decreases the pH
d) It changes the pH asymptotically to the pKa of the acid.

13) All proteins absorb electromagnetic radiation of wavelength around 190 nm, which corresponds to an excitation in the protein molecule. In which region of the spectrum is this wavelength found?
a) X-ray b) Ultraviolet c) Microwave d) Infrared

14) What will be the pH of 10^{-8} M HCl?
a) 7.22 b) 7.14 c) 7.0 d) 6.98

15) Which of the following is not having an electromagnetic nature?
a) X-rays b) UV-rays c) β-rays d) Microwave

16) Which number comes next in this sequence? 1, 1.5, 2.5, 4,___?
a) 9 b) 8 c) 7 d) 6

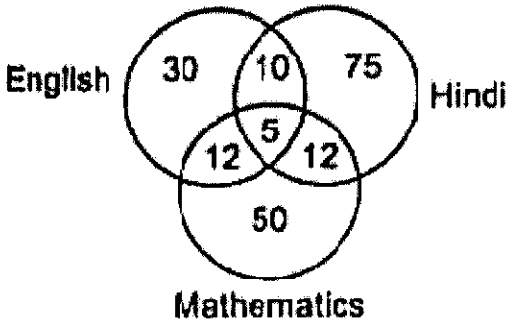
17) If 3 less than twice a certain number is equal to 2 more than 3 times the number, then 5 less than 5 times the number is
a) −30 b) −20 c) −5 d) 0

18). What is the greatest value of x for which $(3x-2)(x+1) = 0$?
a) −1 b) $-\frac{2}{3}$ c) $\frac{2}{3}$ d) 1

19) If the average of 5 numbers is 36 and the average of four of those numbers is 34, then what is the value of the fifth number?
a) 2 b) 34 c) 35 d) 44

20) The surface tension of a liquid vanishes at
a) triplet point
b) the boiling point
c) critical temperature
d) none of the above

21) Five hundred candidates appeared for the test conducted for English, Mathematics and Hindi. The below diagram gives the number of candidates failed at different tests. What is the percentage of students who failed for at least two tests?



a) 0.078% b)1.0% c) 6.8% d) 7.8%

22) A worker may claim Rs15 for each km he travelled in taxi and Rs 5 for each km he travelled in his own car. If in a month he is claiming Rs 500 for travelling 80km, how much does he travelled by taxi?

a) 10 b)20 c) 70 d) 40

23) At the end of a business conference ten people shook hands each other. Then how many handshakes were there altogether?

a) 100 b) 55 c) 10 d) 45

24) A number of people decided to go to picnic and spent Rs.96 on eatables. At the end, four people did not turn up. As a result, others had to contribute Rs. 4 each extra. The number of those who attended the meeting was

a) 12 b) 8 c) 10 d) 6

25) A bus starts from city X. The number of women in the bus is equal to half the number of men in the bus. When the bus reached city Y, 10 men left the bus and 5 women boarded it. Now, the number of women and men in the bus become equal. If so, how many passengers entered the bus in the beginning from city X.

a) 15 b) 30 c) 36 d) 45

26) Today is Wednesday, after 62 days it would be

a) Monday b) Tuesday c) Wednesday d) Saturday

Choose the appropriate word closest to meaning of word given in italics (questions 27 & 28)

27) A *baffling* problem

a) Simple b) Puzzling c) Difficult d) Fresh

28) *Posthumous* child

a) illegitimate b) Brilliant c) Born after death of father d) physically weak

Choose the appropriate word closest to meaning of word given in italics (questions 29 to 32)

29) *Hooligan*
a) Tin Whistle b) Thug c) Street gang d) commotion

30) *Modus vivendi*
a) Way of work b) Way of life c) Way of Operation d) Way of game

31) *Elucidate*
a) Clarify b) Interpret c) Confuse d) Contradict

32) *Claustrophobia*
a) Fear of spider b) Fear of computers c) Fear of being in enclosed area d) Fear of foreigners

33) The length of the side of a square is represented by x+2. The length of the side of an equilateral triangle is 2x. If the square and the equilateral triangle have equal perimeter, then the value of x is _____.
a) 3 b) 5 c) 6 d) 4

34) The area of the circle is increasing at the rate of 0.7 cm^2/sec. What is the rate of increase of its circumference?

a) 0.84 b) 1.4 c) 0.7 d) 1

35) The frequency of the second harmonic of 60 Hz is:

a) 60 Hz b) 180Hz c) 100Hz d) 120Hz

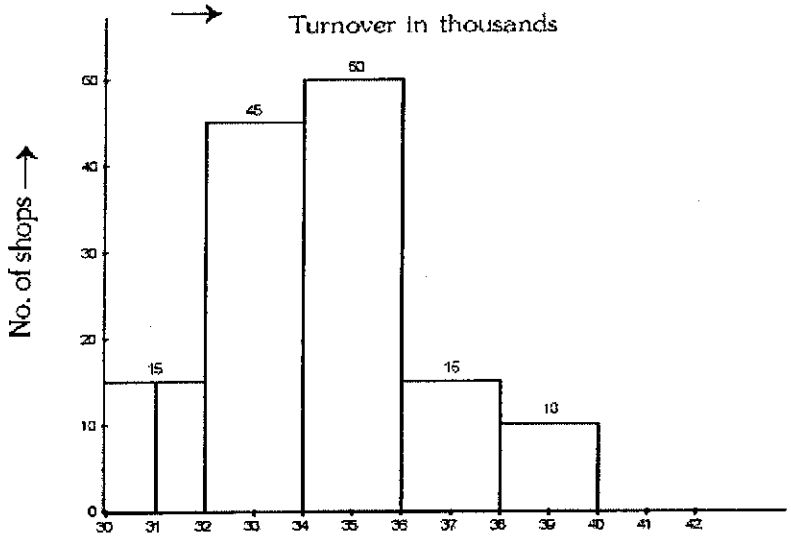
36) If a - b = 3 and $a^2 + b^2 = 29$. Find the value of ab.

a) 10 b) 12 c) 15 d) 18

37) An accurate clock shows o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?

a) 144^0 b) 160^0 c) 168^0 d) 180^0

The results of a survey done on the monthly turnover of some shops are represented as a bar diagram below. Study the chart carefully and answer the questions 38 & 39.



38) What percentage of shops has turnover of over Rs.36 thousands
a) 20% b) 25% c) 5% d) 23%

39) How many shops have turnover between Rs.32 thousand and Rs.38 thousand
a) 35 b) 95 c) 110 d) 55

40) Find the word which is nearly opposite in meaning for the word "Extrinsic"
a) Severe b) Shallow c) Incidental d) Inherent

41) A catalyst increases rate of reaction by _____
a) Decreasing enthalpy b) Decreasing internal energy
c) Decreasing activation energy d) Increasing activation energy

42) Amount of oxygen present in our atmosphere is
a) 78% b) 59% c) 46% d) 21%

43) Generally nanotechnology deals with structures sized between
a) 1 – 100 nm b) 100 - 500 nm c) 500 – 1000 nm d) 1 micron – 10 microns

44) Materials which can retain their strength above 550°C are known as
a) Ceramics b) refractories c) metals d) non-metals

45) The unit of intrinsic viscosity is
a) dL/g b) g/s c) g/dL d) dL/s

46) The weight average molecular weight of a polymer is given by the expression
   a) $\Sigma Ni\ Mi^2 / \Sigma\ Ni\ Mi$
   b) $\Sigma Ni\ Mi / \Sigma\ Ni$
   c) $\Sigma Ni\ Mi / \Sigma\ Ni\ Mi^2$
   d) $\Sigma Ni\ Mi^3 / \Sigma\ Ni\ Mi^2$

47) For a polydisperse polymer system –
   a) $Mw / Mn = 1$ b) $Mw / Mn < 1$ c) $Mw / Mn > 1$ d) $Mn / Mw > 1$

48) The most common means of fabricating a thermoplastic product is
   a) Compression molding b) Blow molding c) Extrusion d) Injection molding

49) Which of the following general behavior is shown by polymers
   a) Newtonian b) Viscous c) Elastic d) Viscoelastic

50) The IUPAC name of isoprene is
   a) 2-methyl-but-2,3 diene
   b) 2-methyl-but-1,4 diene
   c) 2-methyl-but-1,2 diene
   d) 2-methyl-but-1,3 diene

51) Which of the following has an ester linkage
   a) Nylon b) Bakelite c) Terylene d) PVC

52) Which compound form linear polymer due to H-bond?
   a) H_2O b) NH_3 c) HBr d) HCl

53) The following class of drugs blocks the release of substances in response to an allergen:
   a) Histamines
   b) Antihistamines
   c) Decongestants
   d) Bronchodilators

54) Substances that cause blood vessels to narrow or open to facilitate decrease or increase the flow of blood are known as:
   a) Embolism and effusion
   b) Vasoconstrictor and vasodilator
   c) Coagulant and anticoagulant
   d) Hemophilia and fibromyalgia

55) Burns that damage all layers of skin and blood vessels and nerves are known as:
   a) First-degree burn
   b) Second-degree burn

c) Third-degree burn
d) Superficial burn

56) Two examples of the main blood thinners -anticoagulants that lengthen the time to form a clot and antiplatelet drugs that prevent platelets from clumping together are:
a) Dextrin and coumarin
b) Cyanohydrin and ninhydrin
c) Heparin and aspirin
d) Tranexamic acid and norethisterone

57) At pH 7.2 and 10 Torr oxygen partial pressure, the extent of O_2binding is
a) high for both hemoglobin and myoglobin
b) high for hemoglobin and low for myoglobin
c) high for myoglobin and low for hemoglobin
d) low for both hemoglobin and myoglobin

58) Junctional diversity of antibody molecules results from
a) the addition of switch region nucleotides
b) the addition of N and P nucleotides
c) the joining of V, D and J segments
d) mutations in complementarity-determining regions

59) Which one of the following is NOT used for the measurement of cell viability in animal cell culture?
a) Trypan blue dye exclusion
b) Tetrazolium (MTT) assay
c) LDH activity in the culture medium
d) Coulter counter

60) Which one of the following techniques relies on the spin angular momentum of a photon?
a) CD spectroscopy
b) Fluorescence spectroscopy
c) IR spectroscopy
d) Raman spectroscopy

61) In animal cell culture, a CO_2 enriched atmosphere in the incubator chamber is used to maintain the culture pH between 6.9 and 7.4. Which one of the following statements is correct?
a) Higher the bicarbonate concentration in the medium, higher should be the requirement of gaseous CO_2
b) Lower the bicarbonate concentration in the medium, higher should be the requirement of gaseous CO_2
c) Higher the bicarbonate concentration in the medium, lower should be the requirement of gaseous CO_2
d) CO_2 requirement is independent of bicarbonate concentration in the medium

62) Analysis of a hexapeptide using enzymatic cleavage reveals the following result:

- Amino acid composition of the peptide is: 2R, A,V, S, Y
- Trypsin digestion yields two fragments and the compositions are: (R, A, V) and (R, S, Y)
- Chymotrypsin digestion yields two fragments and the compositions are: (A, R, V, Y) and (R, S)
- Digestion with carboxypeptidase A yields no cleavage product.

Given:
Trypsin cleaves at carboxyl side of R.
Chymotrypsin cleaves at carboxyl side of Y.
Carboxypeptidase A cleaves at amino side of the C-terminal amino acid (except R and K) of the peptide.

The correct amino acid sequence of the peptide is:
a) RSYRVA b) AVRYSR c) SRYVAR d) SVRRYA

63) The order of glass transition temperature for the given polymers is [NR=natural rubber; PP=polypropylene; PE=polyethylene; PMMA=poly(methyl methacrylate)]
a) NR < PE < PP < PMMA
b) PE < NR < PP < PMMA
c) PE < PP < NR < PMMA
d) NR < PP < PE < PMMA

64) Polyethylene and polypropylene form an immiscible blend mainly due to
a) entropy factor b) enthalpy factor c) crystallinity d) solubility

65) Which of the following polymers are currently in use for the development of synthetic vascular grafts?
a) expanded polytetrafluoroethylene
b) polyethylene terephthalate
c) polyurethane
d) all the above

66) Which of the following hormones initiates biological actions by crossing the plasma membrane and then binding to an intracellular receptor?
a) Insulin b) Calcitonin c) Estradiol d) Angiotensin II

67) Which of the following best predicts the direction of a chemical reaction?
a) G (Gibbs free energy change)
b) H (enthalpy change)
c) E (internal energy change)
d) S (entropy change)

68) Infrared (IR) spectroscopy is useful for determining certain aspects of the structure of organic molecules because

a) all molecular bonds absorb IR radiation

b) IR peak intensities are related to molecular mass

c) most organic functional groups absorb in a characteristic region of the IR spectrum

d) vibrational transitions are correlated to spin-spin coupling

69) Ions coagulate blood. This shows that blood contains colloidal particles bearing _____

a) +ve charge b) No charge (c)-ve charge (d) Either +ve or –ve Charge

70) Electromagnetic radiation emitted from a nucleus is most likely to be in the form of

a) gamma rays b) microwaves c) ultraviolet radiation d) infrared radiation

71) Which molecules are involved in the anchoring of cells to an extracellular matrix?

a) Integrins b) Interleukins c) Cyclic peptides d) Collagen

72) What is the term used to indicate the growth of new blood vessels?

a) Biosynthesis

b) Angiognesis

c) Vascularization

d) None of the above

73) What sort of therapy involves administration of an antibody linked to an enzyme, such that the enzyme activates a prodrug?

a) ADAPT b) GDAPT c) ADEPT d) GDEPT

74) The main glucose transporter in the cells of skeletal muscle, cardiac muscle and adipose tissue is

a) GLUT 1 b) GLUT 2 c) GLUT 3 d) GLUT 4

75) A class of drugs called statins is used to treat patients with hypercholesterolemia. The statins are competitive inhibitors of

a) β-hydroxyβ methyl glutaryl CoA synthase

b) β-hydroxyβ methyl glutaryl CoA reductase

c) Lecithin cholesterol acyl transferase

d) Squalene monooxygenase

76) Which of the following macromolecules will yield only one type of monomer following complete hydrolysis?

a) DNA b) RNA c) Liporotein d) Glycogen

77) Calculate the actual physiological ΔG for the reaction,

Phosphocreatine + ADP $\rightarrow$Creatine+ ATP

at 37° C, as it occurs in the cytosol of the neurons with phopshocreatine at 4.7 mM, creatine at 1.0 mM, ADP at 0.73 mM and ATP at 2.6 mM

a) 13 kJ/mol b) -13 kJ/mol c) 6.5 kJ/mol d) -6.5 kJ/mol

78) Which is the major site of immune response for blood borne antigens
a) Liver b) Thyroid c) Spleen d) Peyer's patches

79) What is the cost (in ATP equivalents) of transforming glucose to pyruvate via glycolysis and back again to gluycose via gluconeogenesis?
a) 2 ATP equivalents/glucose
b) 3 ATP equivalents/glucose
c) 4 ATP equivalents/glucose
d) 6 ATP equivalents/glucose

80) The amino acid glycine is used as a main ingredient of buffer in biochemical experiments. In what pH range can glycine be used as an effective buffer due to its amino group?
a) pH 8.6 to 10.6 b) pH 7.6 to 9.6 c) pH 4.2 to 6.2 d) pH 1.2 to 3.4

81) The nature of probe-surface interaction in contact mode AFM
a) Strong attractive force
b) weak attractive force
c) strong repulsive force
d) weak repulsive force

82) Which of the following is a procoagulant lipid?
a) Phosphatidyl serine
b) phosphatidyl ethanolamine
c) phosphatidyl choline
d) phosphatidylinositiol

83) Which of the following is a natural non-fouling surface composition?
a) ornithine b) chitosan c) Poly-Lysine d) Phospholipid bilayer

84) Polymer that undergoes a sharp thermally induced phase separation
a) Polyacrylic acid
b) Polymethacrylic acid
c) Polyacrylamide
d) Poly N-Isopropylacrylamide

85) Match the depth of the surface analyzed by following methods

A) Contact angle	1) 1-5 μm
B) FTIR-ATR	2) 3-20 A°
C) SEM	3) 10-250 A°
D) ESCA	4) 5 A°

a) A-2, B-1, C-4, D-3
b) A-1, B-2,C-3, D-4
c) A-4, B-3,C-4, D-2
d) A-3, B-1,C-2,D-4

86) The intrinsic pathway of blood coagulation is initiated when ---------- is activated
a) Factor IX b) Factor X c) Factor XII d) Factor II

87) A common mechanism of failure of ceramics is:
a) movement of dislocations
b) propagation of cracks
c) ductile failure
d) creep

88) Which of these is not used to build the ball section of a hip joint?
a) chromium b) cobalt c) silicon d) Titanium

89) Which of the following is not a desirable property of artificial arteries?
a) bioactive b) biocompatible c) Non-biodegradable d) Probiotic

90) Why is Teflon used as a coating on mechanical heart valves
a) To prevent wear resistance
b) Enhanced rigidity
c) Increased strength
d) For very low friction

91) Which of the following protein in plasma is not an adhesive for platelets?
a) fibrinogen b) albumin c) vitronectin d) von Willebrand factor

92) Molecular formula of hydroxyapatite
a) $Ca_{10}(PO_4)_6(OH)_2$ b) $Ca_3(PO_4)_2$ c) $CaSO_4$ d) $MgSO_4$

93) Which property of the polymeric suture materials helps them keep the wound closed?
a) low coefficient of friction
b) high tensile strength
c) low melting point
d) high thermoplasticity

94) The release of intra platelet_____ promotes secondary platelet aggregation and creation of adherent thrombus
a) AMP
b) ADP
c) ATP
d) none of the above

95) At what substrate concentration would an enzyme with a kcat of 30.0 s-1 and a Km of 0.0050 M operate at one quarter of its maximum rate

a) 1.7×10^{-3} M b) 1.7×10^{-4} M (c) 1.7×10^{-5} M (d) 1.7×10^{-6} M

96) A graft transplanted between two genetically identical individuals is called

a) Autologous graft b) Syngenic graft c) Xenogeneic graft d) Allograft

97) The phases of wound healing include

a) Inflammatory phase
b) Proliferation phase
c) Inflammatory and proliferation phase
d) Inflammatory, proliferation and maturation phase

98) Two sugars that differ only in the configuration around one carbon atom are called

a) anomers
b) epimers
c) enantiomers
d) none of the above

99) Which immunoglobulin protects against a local infection?

a) IgM b) IgA c)IgG d) IgE

100) The length of the α-helix composed of 72 amino acid residues is

a) 10A° b) 27A° c) 54A° d) 108A°