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FOR KUET EXAM PREPARATION

KUET 2021 Question Paper · M.Sc. Nanotechnology

EXAM	YEAR	TYPE	SUBJECT
KUET	2021	Question Paper	M.Sc. Nanotechnology

Sr. No. .....

ENTRANCE TEST-2021

SCHOOL OF BIOLOGICAL SCIENCES

NANOTECHNOLOGY

Question Booklet Series **A**

Total Questions : 60
Time Allowed : 70 Minutes

Roll No. : | | | | | | |

Instructions for Candidates :

1. Write your Entrance Test Roll Number in the space provided at the top of this page of Question Booklet and fill up the necessary information in the spaces provided on the OMR Answer Sheet.
2. OMR Answer Sheet has an Original Copy and a Candidate's Copy glued beneath it at the top. While making entries in the Original Copy, candidate should ensure that the two copies are aligned properly so that the entries made in the Original Copy against each item are exactly copied in the Candidate's Copy.
3. All entries in the OMR Answer Sheet, including answers to questions, are to be recorded in the Original Copy only.
4. Choose the correct / most appropriate response for each question among the options A, B, C and D and darken the circle of the appropriate response completely. The incomplete darkened circle is not correctly read by the OMR Scanner and no complaint to this effect shall be entertained.
5. Use only blue/black ball point pen to darken the circle of correct/most appropriate response. In no case gel/ink pen or pencil should be used.
6. Do not darken more than one circle of options for any question. A question with more than one darkened response shall be considered wrong.
7. There will be **'Negative Marking'** for wrong answers. Each wrong answer will lead to the deduction of 0.25 marks from the total score of the candidate.
8. Only those candidates who would obtain positive score in Entrance Test Examination shall be eligible for admission.
9. Do not make any stray mark on the OMR sheet.
10. Calculators and mobiles shall not be permitted inside the examination hall.
11. Rough work, if any, should be done on the blank sheets provided with the question booklet.
12. OMR Answer Sheet must be handled carefully and it should not be folded or mutilated in which case it will not be evaluated.
13. Ensure that your OMR Answer Sheet has been signed by the Invigilator and the candidate himself/herself.
14. At the end of the examination, hand over the OMR Answer Sheet to the invigilator who will first tear off the original OMR sheet in presence of the Candidate and hand over the Candidate's Copy to the candidate.

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Part—A : Chemistry

1. At NTP (293.15K, 1atm), 10 g of a gas occupies 2 litre. At what temperature will the volume become double, at the same pressure and for the same quantity of gas ?

   (A) 293.15 K

   (B) -293.15°C

   (C) 586.30 K

   (D) 586.30 °C

2. If the mean free path of a gas at 760 torr is λ, what will be its value at 5 atm pressure ?

   (A) λ/5

   (B) 5λ

   (C) 5λ/760

   (D) λ^2

3. The temperature at which the second virial coefficient of a real gas is zero is called :

   (A) Critical temperature

   (B) Boiling point

   (C) Boyle temperature

   (D) Eutectic point

4. Which of the following is correct ?

   (A) Coefficient of Viscosity of liquids increases with increasing temperature, while that of gases decreases with temperature

   (B) Coefficient of Viscosity of liquids decreases with increasing temperature, while that of gases increases with temperature

   (C) Coefficient of Viscosity of both, liquids and gases, decreases with increasing temperature

   (D) Coefficient of Viscosity of both, liquids and gases, increases with increasing temperature

5. The rise of a liquid in a capillary tube is due to :

   (A) Surface Tension

   (B) Osmosis

   (C) Diffusion

   (D) Viscosity

6. For the ideal gas, the maximum work produced in the reversible isothermal expansion from volume V_1 to volume V_f is given by :

   (A) $nRT \ln (V_f/V_1)$

   (B) $-Cv\ (T2-T1)$

   (C) $-\Delta U-Q$

   (D) $-nRT \ln (V_f/V_1)$

7. In which of the following cases the reaction is not spontaneous ?

   (A) ΔH is positive and ΔS is also positive ($T\Delta S > \Delta H$)

   (B) ΔH is negative and ΔS is also negative ($-T\Delta S < -\Delta H$)

   (C) ΔH is positive and ΔS is negative

   (D) ΔH is negative and ΔS is positive

8. Helmholtz Free energy A is expressed as :

   (A) A = U+TS

   (B) A= H+TS

   (C) A= H–TS

   (D) A = U–TS

9. ΔG° is related to equilibrium constant by :

   (A) $\Delta G° = -RT \ln K$

   (B) $\Delta G° = -RT \ln (1/K)$

   (C) $\Delta G° = RT \log K$

   (D) $\Delta G° = -RT (1/\ln K)$

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10. For a system of water and water vapor co-existing in equilibrium the number of degree of freedom is :

(A) 1

(B) 2

(C) 3

(D) 4

11. The ratio of the ionic mobilities of M^+ and X^- ions is 0.75. If the speed of M^+ ions is found to be 3.0 $\mu m\ s^{-1}$; the speed of X^- ions is ?

(A) 1.3 $\mu m\ s^{-1}$

(B) 2.3 $\mu m\ s^{-1}$

(C) 2.5 $\mu m\ s^{-1}$

(D) 4.0 $\mu m\ s^{-1}$

12. If for a solution of an electrolyte, t_+ is the transport number of the cation, then the transport number of the anion t_- is equal to :

(A) $t_+/2$

(B) $1+t_+$

(C) $1-t_+$

(D) $(1-t_+)/2$

13. The transference number of an ion :

(A) Is always positive

(B) Is always negative

(C) Can be positive as well as negative

(D) Is always zero

14. Free energy change (ΔG) is related to the e.m.f of a cell (E) as :

(A) $\Delta G = -(RT/nF) \ln E$

(B) $\Delta G = -nFE/RT$

(C) $\Delta G = -nFEd$

(D) $E = -nFE$

15. Zinc is coated over iron to prevent rusting of iron because :

(A) It is cheaper than iron

(B) $E°(Zn^{2+}, Zn) = E°(Fe^{2+}, Fe)$

(C) $E°(Zn^{2+}, Zn) > E°(Fe^{2+}, Fe)$

(D) $E°(Zn^{2+}, Zn) < E°(Fe^{2+}, Fe)$

16. The molecular geometry of BF_3 and SF_6 is :

(A) Both trigonal planar

(B) Both trigonal pyramidal

(C) Trigonal planar and Octahedral, respectively

(D) Trigonal pyramidal and trigonal planar, respectively

17. Lattice Energy of ionic compound is calculated by using :

(A) Hess's Law

(B) Kirchoff's equation

(C) Born-Haber cycle

(D) Carnot cycle

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18. Which one of the atoms listed below has the largest value for its electron affinity ?

(A) O

(B) He

(C) Cr

(D) F

19. For which one of the processes below is ΔH largest in magnitude ?

(A) $Be^{+}(g) \rightarrow Be^{2+}(g) + e-$

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

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

(D) $C(g) \rightarrow C+(g) + e-$

20. In accordance with Fajan's rules, the covalent character in ionic compounds will be :

(A) Large in case of small charge on the cation, large size of cation and small size on anion

(B) Small in case of high charge on the cation, small size of cation and large size on anion

(C) Large in case of high charge on the cation, small size of cation and large size on anion

(D) Cannot be predicted

21. The systematic name of $[Co(en)_2Cl_2]NO_3$ is :

(A) Dichlorobis(ethylenediamine)cobaltate(II) nitrate

(B) Bis(ethylenediamine) dichlorocobalt(III) nitrate

(C) Bis(ethylenediamine) dichlorocobalt(II) nitrate

(D) Dichlorobis(ethylenediamine)cobalt(III) nitrate

22. The CFSE of $[Co(NH_3)_6]^{3+}$:

(A) $-0.4\Delta_0$

(B) $-1.2\Delta_0$

(C) $-2.4\Delta_O$ (+2P)

(D) $-1.8\Delta_0$ (+3P)

23. The value of the spin-only magnetic moment (μ_{eff}) for $[Cr(NH_3)_6]^{3+}$ is :

(A) 0

(B) 3.87 BM

(C) 4.90 BM

(D) 5.92 BM

24. The ligand field strength is in order of $CN^- > NH_3 > H_2O$. So the relative size of CFSE (Δ) and energy of light absorbed will be :

(A) $[Ti(NH_3)_6]^{3+} > [Ti(H_2O)_6]^{3+} > [Ti(CN)_6]^{3-}$

(B) $[Ti(CN)_6]^{3-} > [Ti(NH_3)_6]^{3+} > [Ti(H_2O)_6]^{3+}$

(C) $[Ti(CN)_6]^{3-} > [Ti(H_2O)_6]^{3+} > [Ti(NH_3)_6]^{3+}$

(D) $[Ti(H_2O)_6]^{3+} > [Ti(NH_3)_6]^{3+} > [Ti(CN)_6]^{3-}$

25. Which of the carbocations will be most stable ?

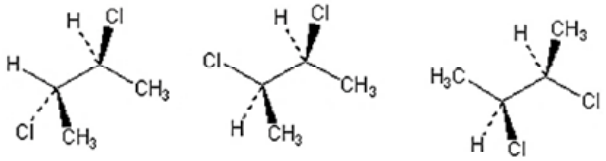
(A) Vinyl carbocation

(B) Cyclopropyl carbocation

(C) Trimethyl carbocation

(D) Phenyl carbocation

26. Which of the following structures represent the same stereoisomer ?



(A) A and B

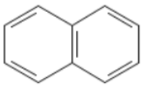
(B) B and C

(C) A, B and C

(D) A and C

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27. Which of the following compounds is not aromatic?

(A) 

(B) 

(C) 

(D) 

28. What type of reaction do alkynes undergo across the triple bond ?

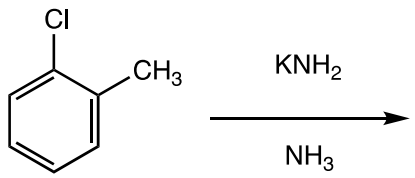
(A) Elimination reaction

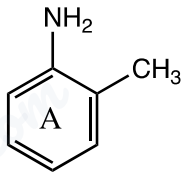
(B) Substitution reaction

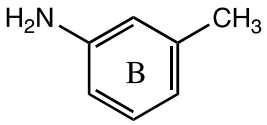
(C) Addition reaction

(D) Halogenation

29. Identify the correct product(s) formed :







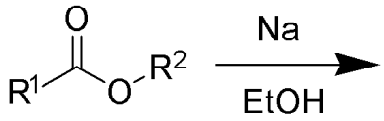
(A) A

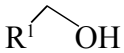
(B) B

(C) A and B

(D) None of these

30. Identify the product(s) formed in the following reaction :



(A) 

(B) $R^2 - OH$

(C) Both (A) and (B)

(D) None of these

31. Which of these compounds is most reactive towards electrophilic aromatic substitution ?

(A) Benzene

(B) Phenol

(C) Toluene

(D) Nitrobenzene

32. What reagents would you use to complete Nitration of benzene ?

(A) Conc. HNO_3 + conc. H_2SO_4

(B) Conc. HNO_3

(C) Anhydrous $AlCl_3$ + Ph-NO_2

(D) Conc. H_2SO_4 + Oleum

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Part—B: Biology

33. Which of the following proteins contains quaternary structure ?

(A) Myoglobin

(B) Insulin

(C) Chymotrypsin

(D) Hemoglobin

34. Which one of the following substance represents carbohydrate ?

(A) Glycerol

(B) Sucrose

(C) Waxes

(D) Sphingomyelin

35. Vitamin, that prevents rupturing of the blood vessels and bleeding is called as :

(A) Vitamin E

(B) Vitamin C

(C) Vitamin K

(D) Vitamin B_2

36. The hyperchromic effect refers to :

(A) An increase in the absorbance of light at 260 nm upon denaturation of DNA

(B) A change in the optical rotator dispersion of DNA solution upon heating

(C) An increase in the absorbance of light at 260 nm upon denaturation of RNA

(D) An increase in the absorbance of light at 260 nm when DNA-RNA hybrids are annealed

37. Which cell organelle reduces the number of other organelles ?

(A) Oxysome

(B) Lysosome

(C) Mitochondria

(D) None of the above

38. Which has a single membrane covering ?

(A) Mesosomes

(B) Golgi apparatus

(C) Mitochondria

(D) Centrosomes

39. Which of the following characteristic feature resembles in bacteria and viruses ?

(A) Binary fission

(B) Ribosomes in cytoplasm

(C) Conjugation

(D) Nucleic acid as genetic material

40. Which of the following special class of proteins is responsible for import of Vitamin B_{12} into gram negative bacteria ?

(A) Tubulins

(B) Porins

(C) Integrins

(D) Adhesins

41. The minimum length of cistron in base pairs which synthesizes a polypeptide of 50 amino acids is :

(A) 50 bp

(B) 100 bp

(C) 150 bp

(D) 190 bp

42. The process of coding of the message from DNA to RNA is :

(A) Replication

(B) Translation

(C) Transcription

(D) Transformation

43. Gene which is responsible for the synthesis of polypeptide chain is called as :

(A) Promoter gene

(B) Structural gene

(C) Operator gene

(D) Regulator gene

44. How many promoters control the transcription in lac operon of E. Coli ?

(A) One

(B) Two

(C) Three

(D) Four

45. Which one of the following would not be used in preparing recombinant DNA ?

(A) Plasmids

(B) Phages

(C) Restriction enzymes

(D) DNA polymerase III

46. Which one of the following DNA polymerase of prokaryotes have both 3-5' and 5-3' exonuclease activity ?

(A) DNA Pol II

(B) DNA Pol III

(C) DNA Pol I

(D) Both (B) and (C)

47. Which polymerase made widespread use of PCR possible ?

(A) DNA polymerase I

(B) Taq polymerase

(C) DNA polymerase

(D) Reverse transcriptase

48. In PCR deoxyoligonucleotide :

(A) Serves as primer

(B) Serves as denaturant

(C) Helping polymerization

(D) Activate Taq polymerase

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49. The electrophoresis technique used for the separation of charged molecules was developed by :

(A) Tiselius

(B) Tswell

(C) Alexander Reuss

(D) Oliver Smithies

50. The force with which the particles must displace the liquid media into which they sediment is called as :

(A) Fractional force

(B) Buoyant force

(C) Gravitational forces

(D) Drag force

51. Which one of the following technique does not involve electrophoresis for the separation of biomolecules ?

(A) Dot blotting

(B) Southern blotting

(C) Northern blotting

(D) Western blotting

52. The Southern blotting is the technique used for the detection of :

(A) Protein

(B) DNA

(C) RNA

(D) Both Protein & DNA

53. Which of the following amino acids are not suitable for gluconeogenesis ?

(A) Arginine and lysine

(B) Leucine and isoleucine

(C) Lysine and valine

(D) Lysine and leucine

54. DiGeorge syndrome (DS) occurs sporadically due to the deletion in chromosome at position :

(A) 22q11.2

(B) 22q15.5

(C) 22q111.2

(D) 22q119.2

55. Which of the following substance inhibits the function of enolase enzyme during glycolysis ?

(A) Iodoacetate

(B) Fluoride

(C) Fluoroacetate

(D) Chloride

56. Which of the following enzyme involved at substrate level phosphorylation during Krebs cycle ?

(A) Pyruvate kinase

(B) Phosphofructokinase

(C) Succinyl-CoA synthetase

(D) Acetyl-CoA synthetase

57. In higher organisms the cell known for antigen processing is :

(A) Eosinophil

(B) Megakaryocyte

(C) T-cell

(D) Macrophage

58. How many disulfide bound are present in a typical immunoglobulin molecule ?

(A) 2-5

(B) 6-9

(C) 10-20

(D) 25-28

59. Primary lymphoid organs include :

(A) Thymus and spleen

(B) Thymus and bone marrow

(C) Thymus, bone marrow and spleen

(D) Thymus, bone marrow, spleen and lymph nodes

60. In response to allergens, the cells that release histamine and other vasoactive substances are :

(A) NK cells

(B) Mast cells

(C) Macrophages

(D) Neutrophils

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OR

Part—B: Physics

33. According to Einstein's special theory of relativity, laws of physics can be formulated based on :

(A) Inertial frame of reference

(B) Non inertial frame of reference

(C) Both non and inertial frame of reference

(D) Quantum state

34. When a particle is moving with a velocity of light c relative to S, its velocity as observed by an observer in the frame S' is :

(A) Zero

(B) 0.5 c

(C) 0.75 c

(D) C

35. If A = 2i + 3j and B = –3i + 2j, the cross product of A and B is :

(A) 5j

(B) 5i

(C) 13k

(D) –5k

36. A stone of mass m tied to a string of length L is rotating along a circular path with constant speed v. The torque on the stone is :

(A) $\frac{mv^2}{L}$

(B) Zero

(C) $\frac{mv}{L}$

(D) $\frac{m}{L}$

37. The magnetic field due to current elements depends upon which of the following factors ?

(A) Current flowing through it

(B) Distance from it

(C) Its length

(D) All of the above

38. "Total electric flux through any closed surface is equal to the charge enclosed by that surface." This is :

(A) Gauss's law

(B) Lenz's law

(C) Maxwell's law

(D) Faraday's law

39. The power in an electromagnetic wave with electric field and magnetic field intensities 12 and 6 respectively is :

(A) 48

(B) 12

(C) 36

(D) 8

40. The Biot-Savart's law is a general modification of :

(A) Kirchoff's law

(B) Ampere's law

(C) Lenz's law

(D) Faraday's law

41. One kg of ice at 0°c is melted and converted to water at 0°c. The change in entropy is :

(A) 29.3 cal/k

(B) 2.93 cal/k

(C) 2930 cal/k

(D) 293 cal/k

42. In an ideal diatomic gas at an absolute temperature T, the internal energy per mole is equal to :

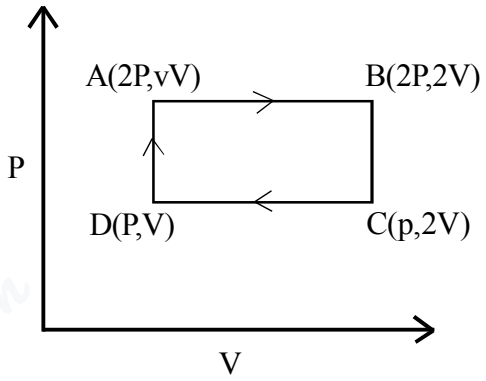
(A) $\frac{5}{2}RT$

(B) $\frac{3}{2}$ RT

(C) $\frac{3}{4}RT$

(D) $\frac{1}{2}RT$

43. A thermodynamical system undergoes a cyclic process as shown in figure. Work done in one complete cycle is :



(A) 2PV

(B) PV/2

(C) PV

(D) Zero

44. According to Stefan-Boltzman law a thermal radiation for perfect radiator, the rate of radiant energy per unit area is proportional to :

(A) The temperature of that radiator

(B) The fourth power of the temperature of that radiator

(C) The square of the temperature of the radiator

(D) The cube of the temperature of that radiator

45. If two SHMs (with same frequency) acting simultaneously on a particle are given by the equations $y_1 = 2\sin\left(\omega t + \frac{\pi}{6}\right)$, $y_2 = 3\sin\left(\omega t + \frac{\pi}{3}\right)$ then the resultant amplitude will be equal to :

(A) 4.939

(B) 4.859

(C) 4.975

(D) 4.639

46. When two or more notes are sounded simultaneously, the combined note, producing a pleasant effect on the ear is called :

(A) Melody

(B) Discord

(C) Harmony

(D) Diatonic

47. The monochromatic source of light in Young's double-slit experiment is replaced by a white-light source, now :

(A) No fringes will be formed

(B) There will be central white fringe only

(C) There will be a coloured central fringe only

(D) There will be central white fringe flanked on either side by a few coloured fringes

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48. The overlapping of waves into the regions of geometrical shadow is :

(A) Dispersion

(B) Polarization

(C) Interference

(D) Diffraction

49. Photoelectric current is of the order of :

(A) 10^{6}A

(B) 10^{-6}A

(C) 10^{3}A

(D) 10^{-3}A

50. Let uncertainty be $\Delta x\, \Delta p = h$. If the size of nucleus is 10^{-15} m, the uncertainty in the momentum of proton remaining within the nucleus is of the order of ($h = 6.62 \times 10^{-34}$ J.sec) :

(A) 6.62×10^{-19} kg m/s

(B) 6.62×10^{-49} kg m/s

(C) 10^{-23} kg m/s

(D) 6.62×10^{-29} kg m/s

51. The energies of a particle in box are given by :

(A) Continuous spectrum

(B) $\frac{n^2h^2}{8ml^2}$

(C) $\frac{\pi^2h^2}{8ml^2}$

(D) $\frac{nh}{4l\pi^2}$

52. According to Schrodinger a particle is equivalent to a :

(A) A single-wave

(B) Light wave

(C) A wave-packet

(D) Cannot behave as wave

53. If U is an up quark and D a down quark then the composition of a neutron is :

(A) UUD

(B) UUU

(C) DDD

(D) UDD

54. The Beta-decay is a process where a nucleus alters its ..... ratio to achieve greater stability.

(A) $\frac{A}{Z}$

(B) $\frac{N}{Z}$

(C) $\frac{Z}{A}$

(D) $\frac{Z}{N}$

55. The threshold energy of gamma rays for Pair Production to take place is :

(A) > 1.02 Mev

(B) ≥ 1.02 Mev

(C) $= 1.02$ Mev

(D) < 1.02 Mev

56. During a negative Beta-decay :

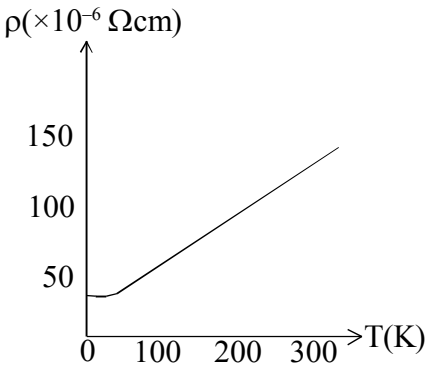
(A) A neutron in the nucleus decays emitting an electron

(B) An electron is already present within the nucleus is ejected

(C) An atomic electron is ejected

(D) A part of binding energy of nuclei is converted into an electron

57. As per the rough plot of the electric resistance of a solid. Define whether a material is :



(A) Insulator

(B) Metal

(C) Semiconductor

(D) Both metal and semiconductor

58. What is Brillouin zone ?

(A) A region of energy – space that encompasses all of the unique values of energy

(B) Another name for the unit cell of the crystal

(C) A region of k – space where the group velocity is positive

(D) A region of k – space that contains all the unique solutions of the wave equation

59. Thermal runaway is not encountered in FETs because :

(A) I_{DS} has a negative temperature coefficient

(B) I_{DS} has a positive temperature coefficient

(C) I_{DS} has a zero temperature coefficient

(D) The mobility of the carriers increases with increase in temperature

60. A single stage transistor amplifier with collector load RC and emitter resistance RE has d.c. load of :

(A) Rc

(B) RC + RE

(C) RC || RE

(D) RC – RE

ROUGH WORK

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