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| <b>Seat No.</b> |  |
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**M.Phil / Ph.D. Entrance Examination, July - 2022****NANO - SCIENCE AND TECHNOLOGY****Day and Date : Friday, 15 - 07 - 2022****Total Marks : 100****Time : 02.00 p.m. to 04.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Each question carries 2 marks.
  - 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
  - 4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
  - 5) Follow the instructions given on OMR Sheet.
  - 6) Rough work shall be done on the sheet provided at the end of question paper.
  - 7) Only non-programmable calculators are allowed.

- 1) What is an hypothesis?
  - a) An experiment that test certain predictions
  - b) An independent variable
  - c) A prediction of a relationship between certain variables
  - d) A dependent variable
  
- 2) Read the following information to answer the given question. A B C D E F are sitting in a row.  
E and F are in the center, A and B are at the ends.  
C is sitting on the left of A.  
Who is sitting three places on the right of D?
  - a) B
  - b) C
  - c) A
  - d) D

- 3) Complete the given series by finding the missing term  
28,33,31,?, 34,39
- a) 34
  - b) 35
  - c) 36
  - d) 37
- 4) What do the initials IQ stands for \_\_\_\_\_
- a) Intelligence quotient
  - b) Investment in education quotient
  - c) Intelligence question
  - d) Intellect quotient
- 5) In an intelligence test, a 10-year old girl scored the I.Q. of 120, what is her mental age (MA)?
- a) 13
  - b) 15
  - c) 12
  - d) 10
- 6) The concept of “Mental Age” (MA) is meaningless for:
- a) Girls
  - b) Adults
  - c) Children
  - d) Boys
- 7) A clock strikes once at 1 O’Clock, twice at 2 O’ Clock ,thrice at 3 O’Clock and so on. How many times will it strike in 24 hours?
- a) 136
  - b) 156
  - c) 196
  - d) 78

- 8) Evaluation of  $8^3 \times 8^2 \times 8^{-5}$  is\_\_\_\_\_.
- a) 0
  - b) 8
  - c) 1
  - d) 10
- 9) What is long form of ISBN?
- a) International study Book Number
  - b) International Standard Book Number
  - c) Intelligent study Book Number
  - d) International standard Budget Name
- 10) What is long form of ISSN?
- a) International standard series Name
  - b) Intelligent standard serial number
  - c) International standard serial number
  - d) International study serial name
- 11) What is full form of DOI?
- a) Direct Object Identification
  - b) Digital Object Identification
  - c) Direct Object Identifier
  - d) digital object Identifier
- 12) Which of the following type of research is generally conducted to specifically help insolving problem situations?
- a) Basic research
  - b) Applied research
  - c) Novel research
  - d) Explanatory research

## M/P ENT – 14

- 13) The research aim to improve scientific theories for improved understanding or prediction of natural or other phenomena is \_\_\_\_\_
- a) Basic research
  - b) Applied research
  - c) Novel research
  - d) Explanatory research
- 14) Which of the following is NOT equivalent to 10 micrometers.
- a) cm
  - b) mm
  - c) 10,000 nm
  - d) 100,000 Angstroms
- 15) Why TEM images have much higher resolution than images from light microscopes?
- a) TEM is much greater in size than Light microscope
  - b) Electrons traveling as waves have wavelengths much shorter than visible light
  - c) TEM can achieve greater magnification
  - d) The fluorescent screen of TEM can generate high resolution images
- 16) In which region of the infrared spectrum would you expect to find a peak characteristic of a triple bond stretch?
- a) 4000 - 3000cm<sup>-1</sup>
  - b) 2500-2000cm<sup>-1</sup>
  - c) 2000-1500cm<sup>-1</sup>
  - d) 1500-750cm<sup>-1</sup>
- 17) Which of the following statements is most correct about Atomic Force Microscopy (AFM)?
- a) AFM can visualize protein bound to DNA molecules.
  - b) AFM can visualize unfixed specimens in water or buffer.
  - c) AFM moves a very sharp tip over the surface of the specimen to “feel” its shape.
  - d) All the statements above are true.

## M/P ENT – 14

- 18) Which of the following is an example of bottom-up approach for the preparation of nanomaterials?
- a) Etching
  - b) Dip pen nano-lithography
  - c) Lithography
  - d) Erosion
- 19) The properties like melting point, solubility, color, etc changes on varying the
- a) Size
  - b) Composition
  - c) Surface properties
  - d) None of the mentioned
- 20) The properties like dispersibility, conductivity, etc changes on varying the
- a) Size
  - b) Composition
  - c) Surface properties
  - d) None of the mentioned
- 21) Fluorescence occurs with in \_\_\_\_\_
- a) 10-5s.
  - b) 10-5 ms.
  - c) 10-5  $\mu$ s.
  - d) 10-5ns.
- 22) Electro-luminescence occurs in \_\_\_\_\_
- a) Electrical conductors
  - b) Electrical insulators
  - c) p-n junctions
  - d) all

- 23)** Sol-gel method is known since \_\_\_\_\_
- a) 1970
  - b) 1960
  - c) 1980
  - d) 1990
- 24)** \_\_\_\_\_ undergo hydrolysis and poly condensation reactions.
- a) Metal ions
  - b) Metal carbonates
  - c) Metal nitrates
  - d) Metal oxides
- 25)** The contact angle forming between magnesium stearate and water is larger than that between lactose and water because:
- a) Magnesium stearate is more hydrophilic
  - b) Magnesium stearate is more hydrophobic
  - c) Lactose has more surface energy
  - d) Both have equal hydrophilicity
- 26)** The average distance travelled by charge carrier before the recombination is called \_\_\_\_\_
- a) recombination rate
  - b) penetration depth
  - c) carrier life time
  - d) diffusion length
- 27)** Semiconductor-metal junction solar cells are also know a \_\_\_\_\_
- a) Sensitized solar cells
  - b) Photoelectrochemical cells
  - c) Wet chemical solar cells
  - d) Schottkey barrier cell

## M/P ENT – 14

- 28) The short circuit current ( $I_{sc}$ ) \_\_\_\_\_ to carrier generation rate and it \_\_\_\_\_ with respect to depth in solar cell.
- a) inversely proportional, exponentially decreases
  - b) directly proportional, exponentially increases
  - c) directly proportional, exponentially decreases
  - d) inversely proportional, decreases
- 29) The \_\_\_\_\_ of the QDs can be tuned by controlling their size so that the absorption spectra can be tuned to match the spectrum of sunlight
- a) QD size
  - b) extinction Bohr radius
  - c) energy band gap
  - d) Photoluminescence
- 30) In solar simulator generally \_\_\_\_\_ is used as a source of incident light.
- a) tungsten filament lamp
  - b) UV lamp
  - c) Hg arc lamp
  - d) sodium vapor lamp
- 31) Light trapping and surface texturing are techniques to reduce \_\_\_\_\_
- a) optical loss
  - b) optical absorbance
  - c) optical transmittance
  - d) all of above
- 32) Graphene is \_\_\_\_\_ because its conduction and valence bands meet at Dirac points.
- a) Semiconductor
  - b) Zero gap semiconductor
  - c) Positive gap semiconductor
  - d) Negative gap semiconductor
- 33) The theory of graphene was explored by \_\_\_\_\_
- a) P. R. Wallace
  - b) B. C. Brodie
  - c) G. W. Semenoff
  - d) None of the above

- 34)** Which of the following is not allotrope of carbon?
- a) Silicon
  - b) Carbon nanotube
  - c) Diamond
  - d) Graphite
- 35)** Fullerene is generally made up of \_\_\_\_\_ carbon atoms.
- a) 100
  - b) 75
  - c) 60
  - d) 20
- 36)** G band in Raman spectra of graphene indicate \_\_\_\_\_
- a) Disordered structure of graphene
  - b) C-C vibrational mode
  - c) Impurities present
  - d) None of the above
- 37)** The necessary condition for population inversion is,
- a)  $(E_{FC} - E_{FV}) < E_g$
  - b)  $(E_{FC} - E_{FV}) > E_g$
  - c)  $(E_{FC} + E_{FV}) < E_g$
  - d)  $(E_{FC} + E_{FV}) > E_g$
- 38)** The sequence of doping concentration in BJT is such that,
- a)  $E > B > C$
  - b)  $E < B < C$
  - c)  $E > C > B$
  - d)  $E < C < B$
- 39)** Gunn diode work in \_\_\_\_\_ frequency range.
- a) VIS
  - b) IR
  - c) Microwave
  - d) Radiowave



- 40)** In LED, light emission is due to \_\_\_\_\_
- a) spontaneous emission
  - b) stimulated emission
  - c) Absorption
  - d) all of the above
- 41)** Eyring equation relates
- a) rate constant and thermodynamics.
  - b) rate constant and activation energy.
  - c) rate constant and temperature.
  - d) None of the above
- 42)** Jablonski diagram deals with
- a) Decay of singlet excited state.
  - b) Decay of triplet excited state.
  - c) Both a) and b).
  - d) None of the above.
- 43)** BET deals with
- a) monolayer adsorption.
  - b) bilayer adsorption.
  - c) multilayer adsorption.
  - d) None of the above
- 44)** Half-life of a reaction is define as
- a) the time required for the concentration of the reactants to reduce to zero.
  - b) the time required for the concentration of the reactants to reduce to 50%.
  - c) the time required for the concentration of the reactants to reduce to 25%.
  - d) None of the above
- 45)** What are the materials that are used for nanolayered coatings for cutting tools?
- a) TiAlN
  - b) ZX Tin/AlN
  - c) DLC
  - d) All of the above

- 46)** Functional coatings includes
- a) optical
  - b) electronic
  - c) both (a) and (b)
  - d) None of the above
- 47)** Which type of nanocoatings are not used in the aircraft industries
- a) anti-corrosion coating
  - b) erosion resistant coating
  - c) gas barrier coating
  - d) thermal barrier coating
- 48)** Liposomes are
- a) Phospholipids
  - b) Proteins
  - c) Both
  - d) None
- 49)** Dynein and Kinesin are
- a) Motor proteins
  - b) Bio-assemblies
  - c) Both
  - d) None
- 50)** Protein cages are
- a) Biotemplates
  - b) Biomimics
  - c) Both
  - d) None



**Rough Work**

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