| Roll No:   |  |  |  |  |  |  |
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| Application No:  |  |  |  |  |  |  |
| Name:  |  |  |  |  |  |  |
| Exam Date: 06-Oct-2020   |  |  |  |  |  |  |
| Exam Time: 15:00-18:00   |  |  |  |  |  |  |
| Examination: 1. Course Code - Ph.D.                                      |  |  |  |  |  |  |
| 2. Field of Study - Nanoscience (NNSH)                                   |  |  |  |  |  |  |
| SECTION 1 - GROUP A  |  |  |  |  |  |  |
| Question No.1 (Question Id - 13)   |  |  |  |  |  |  |
| Which of the following is an application of molecular spectroscopy ?     |  |  |  |  |  |  |
| (A) O Structural investigation   |  |  |  |  |  |  |
| (B) O Basis of understanding of colors                                   |  |  |  |  |  |  |
| $(C) \bigcirc$ Study of energetically excited reaction products          |  |  |  |  |  |  |
| $(D) \bigcirc All of these (Correct Answer)$                             |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Question No.2 (Question Id - 6)  |  |  |  |  |  |  |
| When preparing an oral presentation, one must keep in mind :             |  |  |  |  |  |  |
| $(A) \bigcirc$ Who is the audience                                       |  |  |  |  |  |  |
| (B) O What does he/she hope to gain from the presentation                |  |  |  |  |  |  |
| (C) O What should be the core of the briefing                            |  |  |  |  |  |  |
| $(D) \cap All of these are important (Correct Answer)$                   |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Question No.3 (Question Id - 28)   |  |  |  |  |  |  |
| Which of the following is not true about e journals ?                    |  |  |  |  |  |  |
| (A) O They are distributed through digital methods                       |  |  |  |  |  |  |
| (B) 🔿 They also have editors or editorial boards                         |  |  |  |  |  |  |
| (C) O They are publications of serial nature                             |  |  |  |  |  |  |
| (D) O They are always free of cost (Correct Answer)                      |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Question No.4 (Question Id - 23)   |  |  |  |  |  |  |
| A periodical evaluation of a researcher is done through                  |  |  |  |  |  |  |
| $(A) \bigcirc \text{ Derformence energies} (Oerrest Answer)$             |  |  |  |  |  |  |
| (B) O Performance appraisal (Correct Answer)                             |  |  |  |  |  |  |
| (C) C Refresher course   |  |  |  |  |  |  |
| (D) O Work guide   |  |  |  |  |  |  |
| Question No.5 (Question Id - 4)  |  |  |  |  |  |  |
| The region of electromagnetic spectrum for nuclear magnetic resonance is |  |  |  |  |  |  |
| (A) Microwave  |  |  |  |  |  |  |
| (B) O Radio frequency (Correct Answer)                                   |  |  |  |  |  |  |
| $(C) \cap \text{Infrared}$   |  |  |  |  |  |  |
| $(D) \cap UV$ -rays  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Question No.6 (Question Id - 3)  |  |  |  |  |  |  |
| Where is RAM located ?   |  |  |  |  |  |  |
| (A) O Expansion board  |  |  |  |  |  |  |
| (B) O External Drive   |  |  |  |  |  |  |
| (C) O Mother board (Correct Answer)                                      |  |  |  |  |  |  |
| (D) O All of these   |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Question No.7 (Question Id - 43)   |  |  |  |  |  |  |
| Graphite is a good conductor of electricity due to :                     |  |  |  |  |  |  |

(A) O strong electrostatic bonding

(B) O free localized bonds

(C) O delocalized electrons (Correct Answer)

# Question No.8 (Question Id - 29)

A detailed description of methodology of research is required in :

(A) O Thesis/Dissertation (Correct Answer)

- (B) O Symposium/Workshop
- (C) O Seminar paper/Articles
- (D)  $\bigcirc$  Conference and Seminar Papers

# Question No.9 (Question Id - 12)

Intellectual Property Rights (IPR) protect the use of information and ideas that are of :

- (A) O Ethical value
- (B) O Moral value
- (C) O Social value
- (D) O Commercial value (Correct Answer)

#### Question No.10 (Question Id - 15)

Which of the following is used in electron microscope ?

- $(A) \bigcirc$  Electron beams only
- (B) O Magnetic fields only
- (C) O Both 1 and 2 (Correct Answer)
- (D) O Light waves

#### Question No.11 (Question Id - 32)

Which of the following is susceptible to the issue of research ethics ?

- (A)  $\bigcirc$  Faulty research design
- (B)  $\bigcirc$  Choice of sampling technique

#### (C) O Reporting of research findings (Correct Answer)

(D) O Inaccurate application of statistical techniques

#### Question No.12 (Question Id - 14)

In a simple random sampling design, each element of the population has the following chance of being selected in the sample :

- (A) O Unequal
- (B) O Unknown
- (C) O Equal and known (Correct Answer)
- (D) O Unequal and known

#### Question No.13 (Question Id - 8)

When the power of the ocular lens is 10X and that of objective lens is 20X, then the magnification is :

- (A) 🔿 30 times
- (B) O 20 times

(C) O 200 times (Correct Answer)

(D) O 2000 times

# Question No.14 (Question Id - 44)

Where do you provide a step-by-step account of what the researcher and participants did during the research study ?

- (A) O Introduction
- (B) O Abstract

(C) O Procedure (Correct Answer)

(D) O Discussion

# Question No.15 (Question Id - 10)

Which of the following is E-journal database ?

- (A) O Science Direct
- (B) 🔘 Scopus
- (C) O MEDLINE

(D)  $\bigcirc$  All of these (Correct Answer)

### Question No.16 (Question Id - 31)

Put the following units of storage into the correct order, starting with the smallest unit first and going down to the largest unit :

- A. Kilobyte
- B. Byte
- C. Megabyte
- D. Terabyte
- E. Gigabyte

Give your answer from the following code :

(A) 🔿 B, A, C, D, E

- (B) 🔘 B, A, D, E, C
- $(C) \bigcirc B, A, C, E, D (Correct Answer)$
- (D) 🔿 B, A, D, C, E

Question No.17 (Question Id - 48)

Compressed natural gas is :

(A) O propane

- (B) O methane (Correct Answer)
- (C) O ethane
- (D) O butane

# Question No.18 (Question Id - 26)

A good hypothesis should be :

- (A)  $\bigcirc$  Formulated in such a way that the validity can be tested using a scientific method
- (B) O Precise, specific and consistent with most known facts
- (C)  $\bigcirc\,$  Provide a conceptual framework in research and act as guide to address problems which are still in formative stage

# (D) O All of these (Correct Answer)

# Question No.19 (Question Id - 11)

In an experiment, the researcher varies one or more variables in an attempt to determine its effect on the :

 $(A) \bigcirc$  Independent variable

- (B) O Dependent variable (Correct Answer)
- (C) O Treatment
- (D) O Test variable

# Question No.20 (Question Id - 20)

The degree of freedom for paired t-test based on n pairs of observations is :

- (A) 🔿 2n 1
- (B) 🔿 n 2
- (C) 🔘 2 (n 1)
- (D) O n 1 (Correct Answer)

The data of research is

- (A) O Qualitative only
- (B) O Quantitative only
- (C) O Both 1 and 2 (Correct Answer)
- (D) O Neither 1 nor 2

# Question No.22 (Question Id - 37)

In the list given below, identify those statements which correctly describe the meaning and characteristics of research.

- A. Research is a method of improving our common sense.
- B. Deductive and inductive methods get integrated in a research process.
- C. Research is creativity and charisma.
- D. Research is the use of scientific method to provide answers to meaningful questions.
- E. The answers provided by research can be empirically verified.

Choose the correct answer from the codes given below :

# (A) O B, D and E (Correct Answer)

- (B) 🔘 A, B and C
- (C) O A, C and D
- (D) O C, D and E

# Question No.23 (Question Id - 34)

What is the name of a webpage address ?

- (A) O Directory
- (B) O Protocol
- (C) O URL (Correct Answer)
- (D) 🔘 Domain

# Question No.24 (Question Id - 50)

Which of the following is the way to control vehicular air-pollution in Indian cities ?

- (A) 🔘 Use of CNG as fuel
- (B) O Use of unleaded petrol in the vehicles
- $(C) \bigcirc$  Use of catalytic converter in the vehicles
- (D) O All of these (Correct Answer)

# Question No.25 (Question Id - 41)

Separation of ions in mass spectrometer take place on the basis of which of the following ?

- (A) 🔿 Mass
- (B) 🔿 Charge
- (C) O Molecular weight
- (D)  $\bigcirc$  Mass to charge ratio (Correct Answer)

# Question No.26 (Question Id - 36)

What is the full form of USB as used in computer related activities ?

(A)  $\bigcirc$  Universal Security Block

# (B) O Universal Serial Bus (Correct Answer)

- (C) O United Serial Bus
- (D) O Ultra Security Block

# Question No.27 (Question Id - 17)

The different types of energies associated with a molecule are :

(A) O Electronic energy

(B) O Vibrational energy

| <ul> <li>(C) ○ Rotational energy</li> <li>(D) ○ All of these (Correct Answer)</li> </ul>  |
|---|
| Question No.28 (Question Id - 22)         Resolving power of a microscope is a function of         (A) O Wavelength of light used only         (B) Numerical aperture of lens system only         (C) Both 1 and 2 (Correct Answer)         (D) Magnifying power of the lenses                        |
| Question No.29 (Question Id - 33)         Student's t-statistic is applicable in case of :         (A)       Equal number of samples         (B)       Unequal number of samples         (C)       Small samples         (D)       All of these (Correct Answer)                                      |
| Question No.30 (Question Id - 39)What is the unit of absorbance which can be derived from Beer Lambert's Law ? $(A) \bigcirc L mol^{-1} cm^{-1}$ $(B) \bigcirc L gm^{-1} cm^{-1}$ $(C) \bigcirc cm$ $(D) \bigcirc$ no unit (Correct Answer)   |
| Question No.31 (Question Id - 24)         Which of the following is not covered under Intellectual Property Rights ?         (A)       Copyrights         (B)       Patents         (C)       Trade Marks         (D)       Thesaurus (Correct Answer)  |
| Question No.32 (Question Id - 21)         Which of the following is not a "Graphic representation" ?         (A)       Pie Chart         (B)       Bar Chart         (C)       Table (Correct Answer)         (D)       Histogram   |
| Question No.33 (Question Id - 16)         In comparison to primary data, the secondary data can be collected :         (A)        rapidly and easily         (B)        at a relatively low cost         (C)        in a short time with less effort         (D)        all of these (Correct Answer) |
| Question No.34 (Question Id - 47)<br>The practice of showing someone's work/ idea/ paper as one's own without proper acknowledgement<br>is called :   |
| <ul> <li>(A) ○ citation</li> <li>(B) ○ reference</li> <li>(C) ○ plagiarism (Correct Answer)</li> <li>(D) ○ none of these</li> </ul>   |
| Question No.35 (Question Id - 40)         Which of the following is the formula for pH calculation ?         (A) ○ log <sub>10</sub> [H <sup>+</sup> ]  |

| (B) ○ -log <sub>10</sub> [H <sup>+</sup> ] (Correct Answer)   |  |
|---|--|
| (C) ○ log <sub>2</sub> [H <sup>+</sup> ]  |  |
| (D) $\bigcirc -\log_2 [H^+]$  |  |
| Question No.36 (Question Id - 9)  |  |
| According to authors, research methods are not :  |  |
| (A) Unstructured (Correct Answer)   |  |
|   |  |
| $(C) \bigcirc$ sequential $(D) \bigcirc$ directed   |  |
|   |  |
| Question No.37 (Question Id - 7)  |  |
| Random sampling is helpful as it is   |  |
| $(A) \bigcirc \text{ Reasonably accurate} \\ (B) \bigcirc \text{ Free from personal biases} $ |  |
| $(C) \bigcirc An economical method of data collection$  |  |
| $(\mathbf{C}) \bigcirc \text{All of these (Correct Answer)}$  |  |
|   |  |
| Question No.38 (Question Id - 38)   |  |
| $(A) \cap$ Doctoral level thesis (Correct Answer)   |  |
| (B) $\bigcirc$ Conference of researchers  |  |
| $(C) \bigcirc$ Workshops and seminars   |  |
| (D) O Symposia  |  |
| Question No.39 (Question Id - 18)   |  |
| The probability of rejecting the null hypothesis when it is true is called :  |  |
| (A) C Level of confidence   |  |
| (B) O Level of significance (Correct Answer)  |  |
| (C) $\bigcirc$ Power of the test  |  |
| (D) $\bigcirc$ Difficult to tell  |  |
| Question No.40 (Question Id - 1)  |  |
| Which of the following is a measure of consistency of data ?  |  |
|   |  |
| (B) O Standard deviation (Correct Answer)   |  |
| (C) Mode  |  |
|   |  |
| Question No.41 (Question Id - 27)   |  |
| (A) $\bigcirc$ has no relevance in research   |  |
| $(B) \cap$ shows vast knowledge of researcher   |  |
| (C) $\bigcirc$ helps those interested in further research (Correct Answer)  |  |
| (D) $\bigcirc$ all of these   |  |
| Question No 42 (Question Id - 30)   |  |
| The ozone layer absorbs what range of wavelengths of sun's radiation ?  |  |
| (A) ○ 0.80 nm - 1.50 nm   |  |
|   |  |
| (B) 〇 200 nm - 315 nm (Correct Answer)  |  |
| <ul> <li>(B) ○ 200 nm - 315 nm (Correct Answer)</li> <li>(C) ○ 450 nm - 570 nm</li> </ul>   |  |
| <ul> <li>(B) ○ 200 nm - 315 nm (Correct Answer)</li> <li>(C) ○ 450 nm - 570 nm</li> <li>(D) ○ 600 nm - 750 nm</li> </ul>  |  |
| <ul> <li>(B) ○ 200 nm - 315 nm (Correct Answer)</li> <li>(C) ○ 450 nm - 570 nm</li> <li>(D) ○ 600 nm - 750 nm</li> </ul> Question No.43 (Question Id - 35)  |  |
| <ul> <li>(B) ○ 200 nm - 315 nm (Correct Answer)</li> <li>(C) ○ 450 nm - 570 nm</li> <li>(D) ○ 600 nm - 750 nm</li> </ul> Question No.43 (Question Id - 35) Which of the following domains is used for-profit businesses ?   |  |
| <ul> <li>(B) ○ 200 nm - 315 nm (Correct Answer)</li> <li>(C) ○ 450 nm - 570 nm</li> <li>(D) ○ 600 nm - 750 nm</li> </ul> Question No.43 (Question Id - 35) Which of the following domains is used for-profit businesses ? <ul> <li>(A) ○ .net</li> </ul>  |  |

| (C) (D) (D)  | .com (Correct Answer)<br>.org   |
|--|---|
| <b>Ques</b><br>What d  | <b>tion No.44 (Question Id - 49)</b><br>Io you consider as the main aim of interdisciplinary research ?   |
| <ul> <li>(A) ○</li> <li>(B) ○</li> <li>(C) ○</li> <li>(D) ○</li> </ul> | To over simplify the problem of research<br><b>To bring out holistic approach to research (Correct Answer)</b><br>To create a new trend in research methodology<br>To reduce the emphasis of single subject in research |
| Ques<br>Resear<br>(A) ○<br>(B) ○<br>(C) ○<br>(D) ○                     | tion No.45 (Question Id - 5)<br>rch involves all except :<br>Promotion (Correct Answer)<br>Validation<br>Control<br>Testing   |
| Ques<br>One nn<br>(A) ()<br>(B) ()<br>(C) ()<br>(D) ()                 | tion No.46 (Question Id - 2)<br>n is equal to :<br>10 <sup>-7</sup> cm (Correct Answer)<br>10 <sup>-8</sup> cm<br>10 <sup>-9</sup> cm<br>10 <sup>-10</sup> cm   |
| Question<br>(A) (D) (C) (D) (C) (C) (C) (C) (C) (C) (C) (C) (C) (C     | tion No.47 (Question Id - 19)<br>onnaire is a :<br>Research method<br>Measurement technique<br>Tool for data collection (Correct Answer)<br>Data analysis technique   |
| <b>Ques</b><br>In a lir  | tion No.48 (Question Id - 25)<br>The graph within a research report, the variable is put on the X-axis and the<br>variable is generally shown on the Y-axis.  |
| (A) ○<br>(B) ○<br>(C) ○<br>(D) ○                                       | Dependent and independent respectively<br>Independent and dependent respectively (Correct Answer)<br>Interdependent and spontaneous respectively<br>Spontaneous and dependent respectively                              |
| Ques<br>Increas<br>(A) (C) (C) (C) (C) (C) (C) (C) (C) (C) (C          | tion No.49 (Question Id - 45)<br>sing skin cancer and high mutation rate are the result of :<br>Ozone depletion (Correct Answer)<br>Acid rain<br>CO pollution<br>CO <sub>2</sub> pollution                              |
| Ques<br>Which<br>(A) (C)<br>(C) (C)<br>(D) (C)                         | tion No.50 (Question Id - 42)<br>of the following diseases has been eradicated ?<br>Small pox<br>Rinderpest<br>Polio<br>All of these (Correct Answer)   |

**SECTION 2 - Physical Science** 

| Which of the following XRD reflections are NOT found in the XRD pattern of Body Centred Cubic (BCC) material ?   |
|--|
| <ul> <li>(A) ○ (200)</li> <li>(B) ○ (312)</li> <li>(C) ○ (110)</li> <li>(D) ○ (111) (Correct Answer)</li> </ul>  |
| Question No.2 (Question Id - 66)<br>Arrange the following in correct chronological order from the earliest to most recent.   |
| A. Electron microscope   |
| B. De-Broglie hypothesis   |
| C. Bohr theory of atom   |
| D. Heisenberg uncertainty principle  |
| Choose the <b>correct</b> answer from the options given below :  |
| <ul> <li>(A) ○ A, B, C, D</li> <li>(B) ○ C, B, D, A (Correct Answer)</li> <li>(C) ○ A, C, B, D</li> <li>(D) ○ D, B, C, A</li> </ul>  |
| Question No.3 (Question Id - 65)<br>Arrange the following in correct chronological order from the earliest to most recent.   |
| A. De-Broglie hypothesis   |
| B. Planck radiation formula  |
|  |
| C. Explanation of photoelectric effect   |
| C. Explanation of photoelectric effect<br>D. Young's double slit experiment  |
| <ul><li>C. Explanation of photoelectric effect</li><li>D. Young's double slit experiment</li><li>Choose the <b>correct</b> answer from the options given below :</li></ul>   |
| <ul> <li>C. Explanation of photoelectric effect</li> <li>D. Young's double slit experiment</li> <li>Choose the correct answer from the options given below :</li> <li>(A) ○ B, D, C, A</li> <li>(B) ○ D, B, A, C</li> <li>(C) ○ D, C, B, A</li> <li>(D) ○ D, B, C, A (Correct Answer)</li> </ul>   |
| <ul> <li>C. Explanation of photoelectric effect</li> <li>D. Young's double slit experiment</li> <li>Choose the correct answer from the options given below :</li> <li>(A) ○ B, D, C, A</li> <li>(B) ○ D, B, A, C</li> <li>(C) ○ D, C, B, A</li> <li>(D) ○ D, B, C, A (Correct Answer)</li> </ul> Question No.4 (Question Id - 61) How much phase change is introduces by a quarter wave plate between ordinary and extra-ordinary rays ?   |
| C. Explanation of photoelectric effect<br>D. Young's double slit experiment<br>Choose the <b>correct</b> answer from the options given below :<br>(A) $\bigcirc$ B, D, C, A<br>(B) $\bigcirc$ D, B, A, C<br>(C) $\bigcirc$ D, C, B, A<br>(D) $\bigcirc$ D, B, C, A (Correct Answer)<br>Question No.4 (Question Id - 61)<br>How much phase change is introduces by a quarter wave plate between ordinary and extra-ordinary<br>rays ?<br>(A) $\bigcirc$ $\pi$<br>(B) $\bigcirc$ $2\pi$<br>(C) $\bigcirc$ $\pi/2$ (Correct Answer)<br>(D) $\bigcirc$ $\pi/4$ |

Question No.5 (Question Id - 59) Which of the following phenomena **cannot** be explained by the classical theory ?

A. Photoelectric effect

B. Compton effect

C. Raman effect

Choose the  $\ensuremath{\textbf{correct}}$  answer from the options given below :

| $(A) \bigcirc A \text{ Only}$ $(B) \bigcirc B \text{ Only}$   |
|---|
| $(C) \cap C$ Only   |
| (D) O A, B and C (Correct Answer)   |
| Question No.6 (Question Id - 60)  |
| The energy of a particle in infinite potential well is :  |
| (A) ⊖ Proportional to n <sup>2</sup> (Correct Answer)   |
| (B) O Proportional to n   |
| (C) $\bigcirc$ Inversely proportional to n <sup>2</sup>   |
| (D) ○ None of these   |
| Question No.7 (Question Id - 77)  |
| Zero point energy of one dimensional harmonic oscillator is :<br>(A) $\bigcirc$ E <sub>2</sub> = 0  |
| $(A) \bigcirc E_0 = \delta$   |
| $(C) \bigcirc E_0 = \hbar w/2 \text{ (Correct Apswor)}$   |
| $(D) \bigcirc \text{Nene of the choice}$  |
|   |
| <b>Question No.8 (Question Id - 75)</b><br>A Carnot heat engine absorbs 100 J of heat at high temperature reservoir and gives 70 J of heat to<br>low temperature reservoir. What is the efficiency of the engine ?  |
| (A) \cap 70%  |
| (B) O 30% (Correct Answer)  |
| (C) ○ 40%   |
| (D) O None of the above   |
| Question No.9 (Question Id - 52)         The energy gap in diamond is :         (A) ○       5.4 eV (Correct Answer)         (B) ○       1.1 eV         (C) ○       2.2 eV         (D) ○       0.7 eV  |
| Question No.10 (Question Id - 51)         Which of the following does not support the wave nature of light ?         (A)        Interference         (B)        Polarization         (C)        Compton effect (Correct Answer)         (D)        Diffraction              |
| Question No.11 (Question Id - 55)         A cation vacancy and an anion vacancy in an ionic crystal is called :         (A)        Schottky defect (Correct Answer)         (B)        Frenkel defect         (C)        Pair of vacancies         (D)        None of these |
| Question No.12 (Question Id - 69)<br>A dielectric slab is inserted between the plates of an isolated charged capacitor. Which of the<br>following quantities will remain the same :   |
| (A) 〇 the charge on the capacitor (Correct Answer)  |
| (B) $\bigcirc$ the electric field in the capacitor  |
| $(C) \bigcirc$ the potential difference between the plates  |

| (D) $\bigcirc$ the stored energy in the capacitor  |
|--|
| Question No.13 (Question Id - 78)<br>Electric potential outside an uniformly charged sphere of radius R and total charge q at distance r<br>(>R) from its centre is proportional to :  |
| (A) $\bigcirc$ q/r (Correct Answer)(B) $\bigcirc$ q/r <sup>2</sup> (C) $\bigcirc$ q/R(D) $\bigcirc$ q/R <sup>2</sup>   |
| Question No.14 (Question Id - 62)<br>In a semiconductor :  |
| A. there are no free electrons at 0 K  |
| B. there are no free electrons at any temperature  |
| C. the number of free electrons increases with temperature   |
| Choose the <b>correct</b> answer from the options given below :  |
| <ul> <li>(A) ○ Only A</li> <li>(B) ○ Only B</li> <li>(C) ○ Only C</li> <li>(D) ○ Only A and C (Correct Answer)</li> </ul>  |
| Question No.15 (Question Id - 53)         Ionic polarization :         (A) () is independent of temperature (Correct Answer)         (B) () decreases with temperature         (C) () increases with temperature         (D) () may increase or decrease with temperature  |
| $\begin{array}{l} \textbf{Question No.16 (Question Id - 63)} \\ As temperature increases, the electrical resistivity of pure metals ($\rho_m$) and intrinsic semiconductors ($\rho_s$) varies in general as : (A) O Both $\rho_m$ and $\rho_s$ increases (B) Both $\rho_m$ and $\rho_s$ decreases (C) O $\rho_m$ decreases and $\rho_s$ increases (C) $\rho_m$ increases and $\rho_s$ decreases (Correct Answer) \\ \end{array}$ |
| Question No.17 (Question Id - 54)         Displacement current appears because of :         (A)        time varying electric field (Correct Answer)         (B)        negative charge only         (C)        positive charge only         (D)        time varying magnetic field   |
| Question No.18 (Question Id - 71)<br>Given below are two statements : One is labeled as Assertion A and the other is labeled as Reason<br>R.   |
| Assertion A :  |
| Electrons are diffracted by a crystal.   |
| Reason R :   |
| Periodic arrangement of atoms in a crystal acts like a grating.  |

| In the light of the above statements, choose the <b>correct</b> answer from the options given below :   |  |  |  |
|---|--|--|--|
|   |  |  |  |
| (A) ○ Both A and R are true and R is the correct explanation of A (Correct Answer)  |  |  |  |
| (C) $\bigcirc$ <b>A</b> is true but <b>R</b> is false   |  |  |  |
| (D) $\bigcirc$ <b>A</b> is false but <b>R</b> is true   |  |  |  |
|   |  |  |  |
| Question No.19 (Question Id - 72)   |  |  |  |
| In a completely isolated system consisting of hot body A and cold body B, heat flows from A to B.<br>Which of the following is <b>correct</b> ? |  |  |  |
|   |  |  |  |
| (A) O Entropy of system decreases   |  |  |  |
| (B) O Entropy of system Increases (Correct Answer)  |  |  |  |
| (C) O Entropy of system does not change   |  |  |  |
| (D) O None of the above   |  |  |  |
| Question No. 20 (Question Id., 74)  |  |  |  |
| Which of the following is <b>not</b> a state variable of an ideal gas system ?  |  |  |  |
|   |  |  |  |
| (A) O Pressure  |  |  |  |
| (B) O Work done (Correct Answer)  |  |  |  |
| (C) O Volume  |  |  |  |
| (D) O Temperature   |  |  |  |
| Question No.21 (Question Id - 67)   |  |  |  |
| Consider the following statements.  |  |  |  |
| A. Diffraction of light can be explained by wave model  |  |  |  |
| B. Diffraction of light can be explained by particle model  |  |  |  |
| C. Refraction of light can be explained by wave model   |  |  |  |
| D. Refraction of light can be explained by particle model   |  |  |  |
| Choose the <b>correct</b> answer from the options given below :   |  |  |  |
|   |  |  |  |
| (A) $\bigcirc$ B Only<br>(B) $\bigcirc$ A, C and D Only (Correct Answer)  |  |  |  |
| $(C) \bigcirc C$ Only   |  |  |  |
|   |  |  |  |
| Question No 22 (Question Id - 76)   |  |  |  |
| In a transistor :   |  |  |  |
| (A) $\bigcirc$ the emitter has the least concentration of impurity.   |  |  |  |
| (B) $\bigcirc$ the collector has the least concentration of impurity.   |  |  |  |
| (C) $\cup$ the base has the least concentration of impurity. (Correct Answer)   |  |  |  |
| (D) C all the three regions have equal concentrations of impunity.  |  |  |  |
| Question No.23 (Question Id - 56)   |  |  |  |
| Light waves are :   |  |  |  |
| (A) C iongitudinal only<br>(B) C transverse only (Correct Answer)   |  |  |  |
| $(C) \cap$ longitudinal as well as transverse   |  |  |  |
| (D) ⊖ neither longitudinal nor transverse   |  |  |  |
| Question No. 24 (Question Id., 64)  |  |  |  |
|   |  |  |  |

A plane cuts intercepts 3a, b and 2c along the crystallographic axes in a crystal. The Miller indices of plane :

| (A) $\bigcirc$ (623)         (B) $\bigcirc$ (263) (Correct Answer)         (C) $\bigcirc$ (312)         (D) $\bigcirc$ None of these   |  |  |  |  |
|--|--|--|--|--|
| Question No.25 (Question Id - 70)<br>Consider the following statements.  |  |  |  |  |
| A. Diamagnetism occurs in all metals   |  |  |  |  |
| B. Diamagnetism results from the partial alignment of permanent magnetic moment  |  |  |  |  |
| C. The magnetizing field intensity H is always zero in the free space  |  |  |  |  |
| D. The magnetic field of induced magnetic moment is opposite to the applied field.   |  |  |  |  |
| Choose the <b>correct</b> option :   |  |  |  |  |
| <ul> <li>(A) ○ A and D (Correct Answer)</li> <li>(B) ○ Only B</li> <li>(C) ○ Only C</li> <li>(D) ○ Only D</li> </ul>   |  |  |  |  |
| Question No.26 (Question Id - 57)         Wave nature of light was first proposed by :         (A)       Newton         (B)       Young         (C)       Descates         (D)       Huygen (Correct Answer) |  |  |  |  |
| Question No.27 (Question Id - 73)<br>Let Q and W denote the amount of heat given to an ideal gas and the work done by it in an<br>isothermal process.<br>Which of the following is correct ?                 |  |  |  |  |
| $ \begin{array}{l} (A) \bigcirc Q = 0, \\ (B) \bigcirc W = 0 \\ (C) \bigcirc Q \neq W \\ (D) \bigcirc Q = W \mbox{ (Correct Answer)} \end{array} $   |  |  |  |  |
| Question No.28 (Question Id - 58)           The divergence of curl of a vector is always :           (A) ○ 0 (Correct Answer)           (B) ○ 1           (C) ○ ½           (D) ○ π/2                        |  |  |  |  |
| <b>Question No.29 (Question Id - 68)</b><br>A unit cell has a = 5 Å, b = 8 Å, c = 3 Å, $\alpha$ = 90°, $\beta$ = 65°, $\Upsilon$ = 54°. The space lattice for this unit cell is :                            |  |  |  |  |
| <ul> <li>(A) ○ Tetragonal</li> <li>(B) ○ Triclinic (Correct Answer)</li> <li>(C) ○ Monoclinic</li> <li>(D) ○ Orthorhombic</li> </ul>   |  |  |  |  |
|  |  |  |  |  |

**Question No.30 (Question Id - 80)** Longest De-Broglie wavelength that can be associated with a particle trapped in a box of width L with infinitely hard walls is :

| (A) 🔿 L  |  |  |  |  |  |
|--|--|--|--|--|--|
| (B) O 2L (Correct Answer)  |  |  |  |  |  |
| (C) ○ L/2  |  |  |  |  |  |
| (D) O None of the above  |  |  |  |  |  |
| SECTION 3 - Biological Science   |  |  |  |  |  |
| Question No.1 (Question Id - 94)   |  |  |  |  |  |
| Down's syndrome is due to :  |  |  |  |  |  |
| (A) Crossing over  |  |  |  |  |  |
| $(B) \bigcirc \text{ linkage}$   |  |  |  |  |  |
| $(C) \bigcirc \text{sex-initial ce}$<br>(D) $\bigcirc$ non disjunction of chromosomes (Correct Answer) |  |  |  |  |  |
|  |  |  |  |  |  |
| Question No.2 (Question Id - 82)   |  |  |  |  |  |
| Polymerase used for PCR is extracted from  |  |  |  |  |  |
| $(\Lambda) \bigcirc$ Exploriphic coli  |  |  |  |  |  |
| $(R) \bigcirc Homo \text{ sapiens}$  |  |  |  |  |  |
| (C) C Thermus aquaticus (Correct Answer)   |  |  |  |  |  |
| (D) O Saccharomyces cerevisiae   |  |  |  |  |  |
|  |  |  |  |  |  |
| Question No.3 (Question Id - 84)   |  |  |  |  |  |
| (A)  |  |  |  |  |  |
| (B) oprothrombin   |  |  |  |  |  |
| (C) ⊖ thromboplastin   |  |  |  |  |  |
| (D) O all of these   |  |  |  |  |  |
|  |  |  |  |  |  |
| Question No.4 (Question Id - 107)<br>What is an appenzyme 2  |  |  |  |  |  |
| (A)  |  |  |  |  |  |
| (B) ◯ It is a non-protein group  |  |  |  |  |  |
| (C) O It is a complete, biologically active conjugated enzyme  |  |  |  |  |  |
| (D) 🔿 It is a prosthetic group   |  |  |  |  |  |
| Question No 5 (Question Id - 81)   |  |  |  |  |  |
| With respect to nucleosides which of the following is paired <b>correctly</b> ?                        |  |  |  |  |  |
| (A) 🔘 Purine – Adenosine, Thymidine  |  |  |  |  |  |
| (B) O Purine – Guanosine, Thymidine  |  |  |  |  |  |
| (C) O Pyrimidine – Uridine, Cytidine (Correct Answer)  |  |  |  |  |  |
| (D) O Pyrimidine – Uridine, Adenosine  |  |  |  |  |  |
| Question No.6 (Question Id - 89)   |  |  |  |  |  |
| Non-coding sequence in mRNA is known as  |  |  |  |  |  |
| $(A) \bigcirc \text{ Iemplate}$  |  |  |  |  |  |
| (B) $\bigcirc$ Non – template<br>(C) $\bigcirc$ Introp (Correct Answer)                                |  |  |  |  |  |
| $(D) \cap Exon$  |  |  |  |  |  |
|  |  |  |  |  |  |
| Question No.7 (Question Id - 106)  |  |  |  |  |  |
| Wilkins X-ray diffraction showed the diameter of the DNA helix as :                                    |  |  |  |  |  |
| (A) $\bigcirc$ TO Angstrom<br>(B) $\bigcirc$ 20 Angstrom (Correct Answer)                              |  |  |  |  |  |
| (C) $\bigcirc$ 30 Anastrom   |  |  |  |  |  |
| $(D) \bigcirc 40$ Angstrom   |  |  |  |  |  |
|  |  |  |  |  |  |

# Question No.8 (Question Id - 109)

Match Column - I with Column - II and select the correct option from the codes given below :

| Column - I   | Column - II                     |  |
|--|---------------------------------|--|
| A. Autosomal recessive trait                           | I. Down's syndrome or Mongolism |  |
| B. Sex-linked recessive trait                          | II. Phenylketonuria             |  |
| C. Metabolic error linked to autosomal recessive trait | III. Haemophilia                |  |
| D. Additional 21 <sup>st</sup> chromosome              | IV. Sickle cell anaemia         |  |

Choose the correct answer from the options given below :

(A) 🔘 A - II, B - I, C - IV, D - III

- (B) 🔿 A IV, B I, C II, D III
- (C) O A IV, B III, C II, D I (Correct Answer)
- (D) 🔿 A III, B IV, C I, D II

# Question No.9 (Question Id - 110)

Read the following statements :

A. One codon codes for only one amino acid.

B. Some amino acids are coded by more than one codon.

C. The sequence of triplet nitrogenous bases in DNA or mRNA corresponds to the amino acid sequence in the polypeptide chain.

Give suitable terms for the characteristic of 'genetic code' as per the above statements.

| (A) ()                        | Degeneracy                                    | Colinearity                  | Unambiguous                 |
|-------------------------------|---|------------------------------|-----------------------------|
|                               | (i)   | (iii)                        | (ii)                        |
| (B) 🔿                         | Degeneracy                                    | Colinearity                  | Unambiguous                 |
|                               | (iii)   | (ii)                         | (i)                         |
| $\langle \mathbf{c} \rangle $ | Dogoporacy                                    | Colinearity                  | Unambiguous                 |
| $(\mathbf{C})$                | Degeneracy                                    |                              | -                           |
| (C) (                         | (ii)  | (iii)                        | (i)                         |
| (C) ()                        | (ii)<br>(Correct Answer)                      | (iii)                        | (i)                         |
| (C) (D) (D)                   | (ii)<br>(Correct Answer)<br>Degeneracy        | (iii)<br>Colinearity         | (i)<br>Unambiguous          |
| (C) (D) (D)                   | (ii)<br>(Correct Answer)<br>Degeneracy<br>(i) | (iii)<br>Colinearity<br>(ii) | (i)<br>Unambiguous<br>(iii) |

# Question No.10 (Question Id - 91)

Which of the following statement is true about affinity chromatography ?

(A)  $\bigcirc$  During the separation of a mixture of proteins, the protein which does not bind to ligand is eluted first.

# (Correct Answer)

(B) ○ During the separation of a mixture of proteins, the protein which does not bind to ligand is eluted last.

 $(C) \bigcirc$  During the separation of a mixture of proteins, the protein which binds to ligand is eluted first.

 $(D) \bigcirc$  Unwanted proteins are eluted by ligand solution.

Which of the following reactions is required for proof-reading during DNA replication by DNA polymerase III ?

- (A)  $\bigcirc$  5' to 3' exonuclease activity
- (B)  $\bigcirc$  3' to 5' exonuclease activity (Correct Answer)
- (C)  $\bigcirc$  3' to 5' endonuclease activity
- (D)  $\bigcirc$  5' to 3' endonuclease activity

#### Question No.12 (Question Id - 87)

Magnification of a microscope is equal to :

(A)  $\bigcirc$  Magnification of the objective lens x number of eye pieces

- (B) O Magnification of objective x magnification of ocular (Correct Answer)
- (C) Total of all objectives
- $(D) \bigcirc$  None of the above

#### Question No.13 (Question Id - 108)

Match Column - I with Column - II and select the correct option from the codes given below :

| Column - I |                              | Column - II                                  |  |
|------------|------------------------------|--|--|
| Α.         | Rough Endoplasmic Reticulum  | I. Intracellular and extracellular digestion |  |
| Β.         | Smooth Endoplasmic Reticulum | II. Lipid synthesis                          |  |
| C.         | Golgi Complex                | III. Protein synthesis and secretion         |  |
| D.         | Lysosomes                    | IV. Moves materials out of the cells         |  |

Choose the correct answer from the options given below :

#### (A) O A - III, B - II, C - IV, D - I (Correct Answer)

(B) 🔘 A - II, B - III, C - IV, D - I

- (C) 🔘 A I, B III, C II, D IV
- (D) 🔘 A IV, B II, C III, D I

#### Question No.14 (Question Id - 102)

Scurvy results from deficiency of \_\_\_\_\_\_ and rickets results from deficiency of \_\_\_\_\_\_.

 $(A) \bigcirc$  Retinol; Pantothenic acid

- (B) O Pantothenic acid; Retinol
- $(C) \bigcirc$  Calciferol; Ascorbic acid

### (D) O Ascorbic acid; Calciferol (Correct Answer)

#### Question No.15 (Question Id - 98)

Insulin administration \_\_\_\_\_\_ the release of glucose to the systemic blood by the liver.

(A) O increases

(B) O decreases (Correct Answer)

- $(C) \bigcirc$  does not change
- (D) O is not related to

#### Question No.16 (Question Id - 90)

Pentameric antibody is :

- (A) 🔘 IgA
- (B) 🔘 IgG
- (C) O IgM (Correct Answer)
- (D) 🔘 IgE

#### Question No.17 (Question Id - 103)

The differential staining properties of Gram staining is primarily due to :

(A) ○ difference in lipid content in Gram positive and Gram negative bacteria. (Correct Answer)

| <ul> <li>(B) O difference in protoplasmic contents in Gram positive and Gram negative bacteria.</li> <li>(C) O difference in teichoic acid content in Gram positive and Gram negative bacteria.</li> <li>(D) O all of these.</li> </ul>   |
|---|
| Question No.18 (Question Id - 83)         Which form of pathogen is used in vaccination ?         (A)        Activated and strong pathogenic antigens         (B)        Inactivated and weakened pathogenic antigens (Correct Answer)         (C)        Hyperactive and strong pathogen         (D)        Preformed antibodies |
| Question No.19 (Question Id - 86)         Which of the following involves heat, redness, swelling and pain ?         (A)       Inflammation (Correct Answer)         (B)       Cell mediated response         (C)       Humoral response         (D)       Complement cascade   |
| Question No.20 (Question Id - 100)<br>Phosphoglycerides consist of backbone to which are attached two fatty acids in ester<br>linkage and phosphorylated alcohol; whereas glycosphingolipids are sugar containing lipids built on a<br>backbone of  |
| <ul> <li>(A) glycerol; ceramide (Correct Answer)</li> <li>(B) ceramide; glycerol</li> <li>(C) ergosterol; ceramide</li> <li>(D) ceramide; ergosterol</li> </ul>   |
| Question No.21 (Question Id - 99)           The net gain of ATP in the glycolysis and Kreb's cycle is :           (A)         36 (Correct Answer)           (B)         38           (C)         34           (D)         32  |
| Question No.22 (Question Id - 88)<br>Use of vaccines and immunization programmes have controlled which of the following infectious<br>diseases ?  |
| <ul> <li>(A) ○ Polio and tetanus</li> <li>(B) ○ Diptheria and pneumonia</li> <li>(C) ○ Cancer and AIDS</li> <li>(D) ○ Both 1 and 2 (Correct Answer)</li> </ul>  |
| Question No.23 (Question Id - 97)<br>A process by which a protein structure assumes its functional shape or conformation<br>is :  |
| <ul> <li>(A) ○ Denaturing</li> <li>(B) ○ Folding (Correct Answer)</li> <li>(C) ○ Synthesis</li> <li>(D) ○ Hydrolysis</li> </ul>   |

Question No.24 (Question Id - 104) During cell division, the end of chromosome contain structures called :

| <ul> <li>(B) ○ telomere (Correct Answer)</li> <li>(C) ○ kinetochore</li> <li>(D) ○ telocentric</li> </ul>   |
|---|
| Question No.25 (Question Id - 95)           The number of autosomes in man is :           (A) ○         22 pairs (Correct Answer)           (B) ○         11 pairs           (C) ○         30 A           (D) ○         40 A  |
| Question No.26 (Question Id - 93)<br>Which of the following is true about Michaelis-Menten kinetics ?   |
| (A) ○ Km, the Michaelis constant, is defined as that concentration of substrate at which enzyme is<br>working at maximum velocity.  |
| $(B) \cap It$ describes single substrate enzymes (Correct Answer)   |
| $(C) \bigcirc$ Km, the Michaelis constant is defined as the dissociation constant of the enzyme-substrate   |
| complex.  |
| (D) ○ It assumes covalent binding occurs between enzyme and substrate.  |
| Question No.27 (Question Id - 101)<br>The shape of the red blood cells increase the surface to volume ratio and facilitate rapid<br>gaseous exchange.   |
| (A) O Concave   |
| (B) O Biconvex  |
| (C) O Convex  |
| (D) O Biconcave (Correct Answer)  |
| <ul> <li>Question No.28 (Question Id - 96)</li> <li>Which role do biofilms not play ? Please choose the incorrect statement.</li> <li>(A) ○ A biofilm can play a role in preventing phagocytosis.</li> <li>(B) ○ Biofilms protects bacteria from killing by antibiotics.</li> <li>(C) ○ Biofilms are composed of adherent cells embedded within slimy extracellular matrix that is formed of Extracellular Polymeric Substances (EPS).</li> </ul> |
| (D) O Biofilms prevents bacteria from attaching to any one specific surface. (Correct Answer)   |
| Question No.29 (Question Id - 85)         Which of the following hormones is a steroid ?         (A)        Estrogen (Correct Answer)         (B)        Glucagon         (C)        Insulin         (D)        Oxvtoxin  |
| Question No.30 (Question Id - 105)         Application of Southern blotting includes :         (A)        Identification of transferred genes         (B)        DNA fingerprinting         (C)        Preparation of RFLP maps         (D)        All of these (Correct Answer)  |
| SECTION 4 - Chemical Science  |
| Question No.1 (Question Id - 137)   |

| Given below are two statements : One is labelled as <b>Assertion A</b> and the other is labelled as <b>Reason R</b> .  |
|--|
| Assertion A:   |
| E <sub>cell</sub> is an intensive parameter.   |
| Reason R:  |
| $\Delta_r$ G is an extensive thermodynamic property.   |
| In the light of the above statements, choose the <b>most appropriate</b> answer from the options given below :   |
| <ul> <li>(A) O Both A and R are correct and R is the correct explanation of A</li> <li>(B) O Both A and R are correct but R is NOT the correct explanation of A (Correct Answer)</li> <li>(C) A is correct but R is not correct</li> <li>(D) A is not correct but R is correct</li> </ul>  |
| Question No.2 (Question Id - 115)Unit of second order reaction is :(A) $\bigcirc$ mol L s <sup>-1</sup> (B) $\bigcirc$ mol L <sup>-1</sup> s <sup>-1</sup> (C) $\bigcirc$ mol <sup>-1</sup> L s <sup>-1</sup> (Correct Answer)(D) $\bigcirc$ s <sup>-1</sup>   |
| Question No.3 (Question Id - 118)         The term anomers of glucose refers to :         (A)       Cyclic hemiacetal forms of glucose differ only in configuration at C-4         (B)       A mixture of α-glucose and β-glucose         (C)       Enantiomers of glucose         (D)       Cyclic hemiacetal forms of glucose differ only in configuration at C-1 (Correct Answer) |
| Question No.4 (Question Id - 138)         Which of the following statement is not correct for pericyclic reactions ?         (A) ○       These reaction proceed in a single concerted step via formation of a cyclic transition state involving π or         σ-electrons.  |
| (B) ○ The energy for this reaction is supplied by heat in a thermally induced reaction or by<br>ultraviolet light in a photo-induced reaction.   |
| <ul> <li>(C) O These reactions are not highly stereospecific. (Correct Answer)</li> <li>(D) O These reactions do not involve ionic or free radical intermediates.</li> </ul>   |
| <b>Question No.5 (Question Id - 119)</b><br>For a chemical reaction, $A \rightarrow P$ , the graph of [A] versus time is found to be a straight line. The order of a reaction is :   |
| <ul> <li>(A) ○ Zero order (Correct Answer)</li> <li>(B) ○ First order</li> <li>(C) ○ Second order</li> <li>(D) ○ Third order</li> </ul>  |
| Question No.6 (Question Id - 140)         Which of the metal ion is present in variable oxidation states in the following oxides ?         (A) ○ Mn <sub>2</sub> O <sub>7</sub> (B) ○ Mn <sub>3</sub> O <sub>4</sub> (Correct Answer)  |

| $(c) \cap M_{c}$   |
|--|
| $(C) \bigcirc \operatorname{Mil}_2 \operatorname{O}_3$   |
|  |
| Question No.7 (Question Id - 133)  |
| A solution contains 25% water, 25% ethanol and remaining ethanoic acid. The total number of moles                |
| in the solution is :   |
|  |
| (A) O 0.83 moles   |
| (B)  |
| (C) $\bigcirc$ 0.54 moles  |
| (D) $\bigcirc$ 2.76 moles (Correct Answer)   |
| Question No.8 (Question Id - 117)  |
| Find out the incorrect statement.  |
| (A) 🔘 Ferromagnetism is an extreme form of paramagnetism.  |
| (B) O The magnetic moment increases with the decreasing number of unpaired electrons.                            |
| $(C) \cap$ For the compounds of the first transition metals, the contribution of the orbital angular             |
| momentum is effectively quenched.  |
|  |
| (D) O A single unpaired electron has a magnetic moment of 1.73 Bohr magnetons.                                   |
|  |
| Question No.9 (Question Id - 132)  |
| The boiling point of benzene is 353.23 K. When 1.80 g of a non-volatile solute was dissolved in 90 g             |
| of benzene, the boiling point is raised to 354.11 K. The molar mass of the solute is $(R_b = 2.53 \text{ K kg})$ |
| moi ').  |
|  |
| (A) $\bigcirc$ 116 g mol <sup>-1</sup>   |
| (B) ○ 108 g mol <sup>-1</sup>  |
| (C) ○ 54 g mol <sup>-1</sup>   |
| (D) ◯ 58 g mol <sup>-1</sup> (Correct Answer)  |
| Question No. 10 (Question Id., 120)  |
| Question No. 10 (Question Id - 139)  |
| HOOC H hv HOOC COOH  |
| C = C  |
| H COOH H H   |
| A B  |
| In this reaction, A and B are :  |
| (A) 🔿 A=Fumaric acid (Z-isomer) and B=Maleic acid (E-isomer)   |
| (B) O A=Fumaric acid (E-isomer) and B=Maleic acid (Z-isomer) (Correct Answer)                                    |
| (C) 🔿 A=Maleic acid (Z-isomer) and B=Fumaric acid (E-isomer)   |
| (D) O A=Maleic acid (E-isomer) and B=Fumaric acid (Z-isomer)   |
| Question No.11 (Question Id - 120)   |
|  |
| The IUPAC name of :  |
|  |
| is:  |
|  |
| $(\Lambda) \sim 2.5.6$ Trimethylestens (Correct Assurpt)   |
| (A) $\bigcirc$ 2,5,5-Irimethyloctane (Correct Answer)  |
| (D) $\bigcirc$ 3,4,7-Inmethylociane<br>(C) $\bigcirc$ 2 othyl 3.6 dimothylboptone                                |
| $(\bigcirc) \bigcirc 6$ -ethyl-3 5-dimethylheptane   |
|  |

Ť.

# Question No.12 (Question Id - 123)

Match enzymes in List - I with their sources in List - II. List - I List - II A. Zymase I. Malt II. Soyabean B. Diastase C. Pepsin III. Stomach IV. Yeast D. Urease Choose the correct answer from the options given below : (A) O A - IV, B - I, C - III, D - II (Correct Answer) (B) 🔘 A - II, B - I, C - III, D - IV (C) 🔘 A - II, B - IV, C - I, D - III (D) 🔿 A - I, B - III, C - IV, D - II Question No.13 (Question Id - 126) In a reaction,  $2A \rightarrow P$ , the concentration of A decreases from 0.5 mol L<sup>-1</sup> to 0.4 mol L<sup>-1</sup> in 10 minutes. The rate during this interval is : (A) ○ 8.3 x 10<sup>-4</sup> mol L<sup>-1</sup> s<sup>-1</sup> (B)  $\bigcirc$  0.005 mol L<sup>-1</sup> s<sup>-1</sup> (C) O 0.05 mol L<sup>-1</sup> s<sup>-1</sup> (D) O 8.3 x 10<sup>-5</sup> mol L<sup>-1</sup> s<sup>-1</sup> (Correct Answer) Question No.14 (Question Id - 113) An S<sub>N</sub>1 reaction results in : (A) O Retention (B) O Racemisation (Correct Answer) (C) O Inversion (D) O Elimination Question No.15 (Question Id - 125) Find out the correct order of stability for free radicals is : (A)  $\bigcirc$  3° > 2° > 1° > primary (Correct Answer) (B)  $\bigcirc$  1° > 2° > 3° > primary (C)  $\bigcirc$  primary > 1° > 2° > 3° (D)  $\bigcirc$  primary > 3° > 2° > 1° Question No.16 (Question Id - 136) Cl KNH<sub>2</sub> Strong Base A In the following reaction, A is : (A) 🔿 Cl NH2 (B) 🔿



Choose the correct answer from the options given below :

(A) ○ A - III, B - II, C - I
(B) ○ A - II, B - I, C - III
(C) ○ A - II, B - III, C - I
(D) ○ A - III, B - I, C - II (Correct Answer)

# Question No.20 (Question Id - 114)

Which of the following molecule is square pyramid shape ?

(A) ○ SF<sub>4</sub>

(B) ○ CIF<sub>3</sub>

(C) O NH<sub>3</sub>

# (D) O BF<sub>5</sub> (Correct Answer) Question No.21 (Question Id - 121) Which of the following reactions of methane is incomplete combustion ? (A) $\bigcirc$ 2CH<sub>4</sub>+O<sub>2</sub> $\xrightarrow{Cu/523K/100 \text{ atm}}$ 2CH<sub>3</sub>OH (D) $\bigcirc$ CH<sub>4</sub> + 2O<sub>2</sub> $\longrightarrow$ CO<sub>2</sub>(g) + 2H<sub>2</sub>O(l) Question No.22 (Question Id - 135) The yield of XY(g) $X(g) + Y(g) \leftrightarrow XY(g) + heat$ would be increased by : $(A) \bigcirc$ Decrease the pressure (B) O Decrease the temperature (Correct Answer) (C) Adding more XY to the reaction (D) O Adding a non-reactive liquid to the reaction Question No.23 (Question Id - 116) In singlet state of carbene, hybridization state of carbon atom is : (A) 🔘 sp (B) $\bigcirc$ sp<sup>2</sup> (Correct Answer) (C) ○ sp<sup>3</sup> (D) O s only Question No.24 (Question Id - 112) Conductivity in graphite is due to : (A) O Strong electrostatic bonding (B) O Tetrahedral arrangement of particles (C) Free delocalized electrons (Correct Answer) (D) O Free localized bonds Question No.25 (Question Id - 124) Number of proton signals observed in NMR spectroscopy for ethyl chloride, n-propyl chloride and isopropyl chloride are, respectively : (A) O 2, 2, 3 (B) O 3, 2, 2 (C) O 2, 3, 3 (D) O 2, 3, 2 (Correct Answer) Question No.26 (Question Id - 130) Water gas is a mixture of : (A) $\bigcirc$ CO<sub>2</sub>(g) + H<sub>2</sub>(g) (B) $\bigcirc$ CO<sub>2</sub>(g) + H<sub>2</sub>O(g) (C) $\bigcirc$ CO(g) + H<sub>2</sub>(g) (Correct Answer) (D) $\bigcirc$ CO(g) + H<sub>2</sub>O(g) Question No.27 (Question Id - 131)

# Match theories in List - I with their scientists in List - II.

| List - I                    | List - II               |
|-----------------------------|-------------------------|
| A. VSEPR Theory             | I. Hund and Mulliken    |
| B. Covalent Bond            | II. Sidwick and Powel   |
| C. Valence Bond Theory      | III. Heitler and London |
| D. Molecular orbital Theory | IV. Langmuir            |

Choose the correct answer from the options given below :

(A) 🔘 A - IV, B - I, C - III, D - II

(B) O A - II, B - IV, C - III, D - I (Correct Answer)

(C) 🔿 A - II, B - III, C - IV, D - I

(D) 🔿 A - I, B - III, C - IV, D - II

#### Question No.28 (Question Id - 111)

Which of the following alkali metal halides has highest lattice energy ?

(A) O LiCl (Correct Answer)

(B) 🔿 NaCl

(C) 🔿 KCI

(D) O RbCl

#### Question No.29 (Question Id - 128)

Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**.

### Assertion A:

All the carbon atoms in  $CH_2 = C = CH_2$  are  $sp^2$  hybridised.

#### Reason R:

In this molecule, all the carbon atoms are attached to each other by double bond.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(A)  $\bigcirc$  Both A and R are correct and R is the correct explanation of A

- (B)  $\bigcirc$  Both A and R are correct but R is **NOT** the correct explanation of A
- (C)  $\bigcirc$  **A** is correct but **R** is not correct
- (D)  $\bigcirc$  A is not correct but R is correct (Correct Answer)

#### Question No.30 (Question Id - 122)

Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**.

# Assertion A:

An aqueous solution of ammonium acetate can act as a buffer.

#### Reason R:

Acetic acid is a weak acid and NH<sub>4</sub>OH is a weak base.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(A)  $\bigcirc$  Both **A** and **R** are correct and **R** is the correct explanation of **A**.

(B)  $\bigcirc$  Both A and R are correct but R is **NOT** the correct explanation of A.

(C)  $\bigcirc$  **A** is correct but **R** is not correct.

(D) O A is not correct but R is correct. (Correct Answer)

**SECTION 5 - Engineering Science** 

# Question No.1 (Question Id - 146)

Silicon is not suitable for fabrication of light emitting diodes because it is :

(A)  $\bigcirc$  indirect band gap semiconductor (Correct Answer)

- (B) direct band gap semiconductor
- (C) O wide band gap semiconductor
- (D) O narrow band gap semiconductor

#### Question No.2 (Question Id - 160)

A message signal with bandwidth 10 kHz is Lower-Side Band SSB modulated with carrier frequency  $f_{c1} = 10^6$  Hz. The resulting signal is then passed through a Narrow-Band Frequency Modulator with carrier frequency  $f_{c2} = 10^9$  Hz. The bandwidth of the output would be :

- (A)  $\bigcirc$  4 x 10<sup>4</sup> Hz
- (B)  $\bigcirc$  2 x 10<sup>6</sup> Hz
- (C)  $\bigcirc$  2 x 10<sup>9</sup> Hz (Correct Answer)
- (D) O 2 x 10<sup>10</sup> Hz

#### Question No.3 (Question Id - 143)

Excess-3 code is known as :

(A) O Weighted code

- (B) O Self-complimenting code (Correct Answer)
- $(C) \bigcirc$  Cyclic redundancy code
- (D) O Algebraic code

# Question No.4 (Question Id - 147)

Intel 80386 :

- (A)  $\bigcirc$  was the first 32 bit Intel microprocessor (Correct Answer)
- (B) was the first 8 bit Intel microprocessor
- (C) was the first 16 bit Intel microprocessor
- $(D) \bigcirc$  none of these

#### Question No.5 (Question Id - 155)

The number of product terms in the minimized sum-of-product expression obtained through the following K-map is (where, "d" denotes don't care states) :

| 1 | 0 | 0 | 1 |
|---|---|---|---|
| 0 | d | 0 | 0 |
| 0 | 0 | d | 1 |
| 1 | 0 | 0 | 1 |

(A)  $\bigcirc$  2 (Correct Answer)

(B) 🔿 3

(C) 🔿 4

(D) 🔿 5

#### Question No.6 (Question Id - 142)

As per Shannon-Hartley theorem, the noise less Gaussian channel has :

- (A) 🔘 zero capacity
- (B) O small capacity
- (C) O infinite capacity (Correct Answer)
- $(D) \bigcirc$  none of the above

Two series resonant filters are as shown in the figure. Let the 3-dB bandwidth of Filter 1 be  $B_1$  and that of Filter 2 be  $B_2$ . The value  $B_1 / B_2$  is :





- (B) O a high-pass filter
- (C) O a band-pass filter (Correct Answer)
- (D) O a band-reject filter

# Question No.9 (Question Id - 148)

The \_\_\_\_\_\_ is the part of the microprocessor that performs arithmetic operation.

- (A)  $\bigcirc$  arithmetic logic unit (Correct Answer)
- (B) O control unit
- (C) O cache unit
- (D) O accumulation

# Question No.10 (Question Id - 154)

A pn junction has a built-in potential of 0.8 V. The depletion layer width a reverse bias of 1.2 V is 2  $\mu$ m. For a reverse bias of 7.2 V, the depletion layer width will be :

# (A) O 4 µm (Correct Answer)

- (B) 🔿 4.9 µm
- (C) 🔿 8 µm
- (D) 🔿 12 µm

#### Question No.11 (Question Id - 159)

The diagonal clipping in Amplitude Demodulation (using envelop detector) can be avoided if RC timeconstant of the envelope detector satisfies the following condition, (here W is message bandwidth and  $\omega$  is carrier frequency both in rad/sec).

(A) ○ RC < 1/W (Correct Answer)</li>
 (B) ○ RC > 1/W

- (C)  $\bigcirc$  RC < 1 /  $\omega$
- (D)  $\bigcirc$  RC > 1 /  $\omega$

#### Question No.12 (Question Id - 156)

The electric field of an electromagnetic wave propagation in the positive direction is given by  $E = a_x \sin(\omega t - \omega z) + a_y \sin(\omega t - \beta z + \pi/2)$ . The wave is :



| (D) BJT   |
|---|
| Question No.18 (Question Id - 168)         Polarization of EM wave is in the direction of :         (A)        electric field (Correct Answer)         (B)        magnetic field         (C)        electric and magnetic field both         (D)        none of the above   |
| Question No.19 (Question Id - 164)         In a trans-conductance amplifier, it is desirable to have :         (A)        a large input resistance and a large output resistance (Correct Answer)         (B)        a large input resistance and a small output resistance         (C)        a small input resistance and a large output resistance         (D)        a small input resistance and a small output resistance |
| Question No.20 (Question Id - 149)         The light emitting diode (LED) :         (A)        is usually made from silicon         (B)        uses a reverse-bias junction         (C)        gives a light output which increases with increase in temperature         (D)        depends on the recombination of holes and electrons (Correct Answer)  |
| <b>Question No.21 (Question Id - 161)</b><br>The values of voltage ( $V_D$ ) across a tunnel-diode corresponding to peak and valley currents are $V_P$ , $V_V$ respectively. The range of tunnel-diode voltage for $V_D$ which the slope of its I - $V_D$ characteristics is negative would be :  |
|   |
| Question No.22 (Question Id - 145)         In monolithic ICs all the components are fabricated by :         (A)        diffusion (Correct Answer)         (B)        oxidation         (C)        evaporation         (D)        none of the above  |
| Question No.23 (Question Id - 144)         In which of these is reverse recovery time nearly zero ?         (A)       Zener diode         (B)       PIN diode         (C)       Tunnel diode         (D)       Schottky diode (Correct Answer)  |
| Question No.24 (Question Id - 157)<br>A heavily doped n-type semiconductor has the following data :   |
| Hole-electron ratio : 0.4   |
| Doping concentration : 4.2 x 10° atoms/m <sup>3</sup>   |
| Intrinsic concentration : 1.5 x 10 <sup>+</sup> atoms/m <sup>3</sup><br>The ratio of conductance of the ntype semiconductor to that of the intrinsic semiconductor of same<br>material and at the same temperature is given by :  |

| <ul> <li>(A) ○ 0.00005</li> <li>(B) ○ 2000</li> </ul>   |
|---|
| (C) ○ 10000<br>(D) ○ 20000 (Correct Answer)   |
| <b>Question No.25 (Question Id - 163)</b><br>An independent voltage source in series with an impedance $Z_S = R_S + {}_jX_S$ delivers a maximum average power to a load impedance $Z_L$ when :  |
| $ \begin{array}{l} (A) \bigcirc \ Z_L = R_S + {}_j X_S \\ (B) \bigcirc \ Z_L = R_S \\ (C) \bigcirc \ Z_L = {}_j X_S \\ (D) \bigcirc \ \textbf{Z}_L = \textbf{R}_S - {}_j \textbf{X}_S \ \textbf{(Correct Answer)} \end{array} $   |
| Question No.26 (Question Id - 162)         The concentration of minority carriers in an extrinsic semiconductor under equilibrium is :         (A) O Directly proportional to doping concentration (Correct Answer)         (B) Inversely proportional to the doping concentration         (C) O Directly proportional to the intrinsic concentration         (D) Inversely proportional to the intrinsic concentration         (D) Inversely proportional to the intrinsic concentration |
| Question No.27 (Question Id - 151)<br>In an abrupt p-n junction, the doping concentrations on the p-side and n-side are $N_A = 9 \times 10^{16}$ /cm <sup>3</sup> and $N_D = 1 \times 10^{16}$ /cm <sup>3</sup> respectively. The p-n junction is reverse biased and the total depletion width is 3 µm. The depletion width on the p-side is :  |
| <ul> <li>(A) ○ 2.7 μm</li> <li>(B) ○ 0.3 μm (Correct Answer)</li> <li>(C) ○ 2.25 μm</li> <li>(D) ○ 0.75 μm</li> </ul>   |
| Question No.28 (Question Id - 141)         The cascade amplifier is the multistage configuration of :         (A)       CE-CC         (B)       CE-CB (Correct Answer)         (C)       CB-CC         (D)       CC-CB  |
| Question No.29 (Question Id - 153)         A device with input X(t) and output Y(t) is characterized by: Y(t) = x <sup>2</sup> (t). An FM signal with frequency deviation of 90 kHz and modulating signal bandwidth of 5 kHz is applied to this device. The bandwidth of the output signal is :         (A) ○ 370 kHz (Correct Answer)         (B) ○ 190 kHz         (C) ○ 380 kHz         (D) ○ 95 kHz   |

Question No.30 (Question Id - 170)

In the circuit shown,  $V_C$  is 0 volts at t = 0 sec. For t > 0, the capacitor current  $i_C(t)$ , where t is in seconds is given by :



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