

**PART—II**  
**( SCIENCE )**

- 41.** A rocket, set for vertical firing, weighs 50 kg and contains 450 kg of fuel. It can have a maximum exhaust velocity of 5 km/sec. What should be its minimum rate of fuel consumption to just lift it off the launching pad?
- (A) 0.98 kg/sec  
(B) 0.098 kg/sec  
(C) 9.8 kg/sec  
(D) More than one of the above  
(E) None of the above
- 42.** Consider circular orbits in a central force potential  $V(r) = -k/r^n$ , where  $k > 0$  and  $0 < n < 2$ . If the time period of a circular orbit of radius  $R$  is  $T_1$  and that of radius  $2R$  is  $T_2$ , then  $T_2/T_1$  is
- (A)  $2^{\frac{n}{2}}$   
(B)  $2^{\frac{2n}{3}}$   
(C)  $2^{\frac{n}{2}+1}$   
(D) More than one of the above  
(E) None of the above
- 43.** What is the ratio of total kinetic energies in laboratory system ( $T_L$ ) and centre of mass system ( $T_C$ ) in the scattering with projectile of mass  $m_1$  and target of mass  $m_2$ ?
- (A)  $m_1 : m_2$   
(B)  $(m_1 + m_2) : m_2$   
(C)  $(m_1 + m_2) : m_1$   
(D) More than one of the above  
(E) None of the above
- 44.** In the analysis of flow velocity of a fluid for a fixed instant of time, a space curve is drawn so that it is tangent everywhere to the velocity vector. Then this curve is usually known as
- (A) instantaneous curve  
(B) momentum curve  
(C) streamline  
(D) More than one of the above  
(E) None of the above



45. Two boxes  $A$  and  $B$  contain equal number of molecules of the same gas. If the volumes are  $V_A$  and  $V_B$ , and  $\lambda_A$  and  $\lambda_B$  denote respective mean free paths, then
- (A)  $\lambda_A = \lambda_B$
- (B)  $\frac{\lambda_A}{V_A} = \frac{\lambda_B}{V_B}$
- (C)  $\frac{\lambda_A}{V_A^{1/3}} = \frac{\lambda_B}{V_B^{1/3}}$
- (D) More than one of the above
- (E) None of the above
46. Which of the following is **not** the characteristic of Planck's black-body radiation distribution?
- (A) As temperature increases, the peak of the curve shifts towards higher wavelength.
- (B) Spectral emissive power varies continuously with the change in wavelength.
- (C) At a given wavelength, as temperature increases, emissive power also increases.
- (D) More than one of the above
- (E) None of the above
47. In an interference pattern produced by two identical slits, the intensity at the site of maxima is  $I$ . If either of the slits is closed, the intensity at the same spot is  $I_0$ . What is the relation between  $I$  and  $I_0$ ?
- (A)  $I = I_0$
- (B)  $I = 2I_0$
- (C)  $I = 4I_0$
- (D) More than one of the above
- (E) None of the above
48. A light of 600 nm wavelength is incident on a single slit. The first minimum of the diffraction pattern is obtained at a distance of 4 mm from the centre. The distance between the screen and the slit is 2 m. What is the width of the slit?
- (A) 0.1 mm
- (B) 0.3 mm
- (C) 0.5 mm
- (D) More than one of the above
- (E) None of the above



49. At what angle of incidence of plane-polarized light with quarter-wave plate, elliptically polarized light becomes circularly polarized?

- (A) 90°
- (B) 45°
- (C) 60°
- (D) More than one of the above
- (E) None of the above

50. If a wave is having group velocity of  $2 \times 10^8$  m/sec, then what is phase velocity?

- (A)  $4.5 \times 10^8$  m/sec
- (B)  $5.5 \times 10^8$  m/sec
- (C)  $9 \times 10^8$  m/sec
- (D) More than one of the above
- (E) None of the above

51. From the wave equation

$$y = 0.5 \sin \frac{2\pi}{3.2} (64t - x)$$

the frequency of the wave is

- (A) 5 Hz
- (B) 15 Hz
- (C) 20 Hz
- (D) More than one of the above
- (E) None of the above

52. Identify which of the following expressions is **not** Maxwell's equation for time-varying fields.

(A)  $\vec{\nabla} \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$

(B)  $\vec{\nabla} \cdot \vec{D} = \rho$

(C)  $\vec{\nabla} \times \vec{E} = \frac{\partial \vec{B}}{\partial t}$

- (D) More than one of the above
- (E) None of the above

53. The voltage induced across a stationary conductor in an external static magnetic field

- (A) depends on the angle of the conductor with the magnetic field
- (B) increases with time
- (C) is zero
- (D) More than one of the above
- (E) None of the above

54. A wire in the shape of an equilateral triangle with sides of length 1 m sits in a magnetic field of 2 T, pointing to the right. What is the magnitude of the magnetic flux through the triangle?

- (A) 0 Wb
- (B) 1 Wb
- (C) 1.73 Wb
- (D) More than one of the above
- (E) None of the above

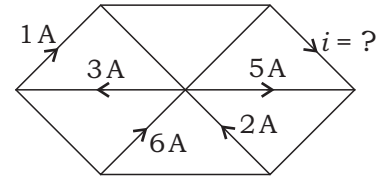
55. Which of the following statements is/are true regarding Biot-Savart law?

- (i) Magnetic field is directly proportional to the length of element.
- (ii) Biot-Savart law deals with electric field.
- (iii) Magnetic field is directly proportional to the current through the conductor.

Select the correct answer using the codes given below.

- (A) (i) only
- (B) (i) and (ii)
- (C) (i) and (iii)
- (D) More than one of the above
- (E) None of the above

56. Find the value of the current  $i$  in the given circuit :



- (A) 2 A
- (B) 3 A
- (C) 1 A
- (D) More than one of the above
- (E) None of the above

57. Which of the following statements is **not** correct about quality factor of a parallel resonance circuit?

- (A) Q-factor of parallel resonance is the same as that of series resonance.
- (B) Q-factor provides the current magnification.
- (C) Q-factor provides the voltage magnification.
- (D) More than one of the above
- (E) None of the above

- 58.** In a photoelectric experiment, both sodium (work function = 2.3 eV) and tungsten (work function = 4.5 eV) metals are illuminated by an ultraviolet light of same wavelength. If the stopping potential for tungsten is measured to be 1.8 V, then the value of the stopping potential for sodium will be
- (A) 4 V  
 (B) 2.2 V  
 (C) 1.8 V  
 (D) More than one of the above  
 (E) None of the above
- 59.** The fine structure of atomic spectral lines arises from
- (A) electron spin-orbit coupling  
 (B) nuclear spin  
 (C) interaction between electron and nucleus  
 (D) More than one of the above  
 (E) None of the above
- 60.** An atom with proton number 84 and nucleon number 216 decays into a new element. In this process, it emits an alpha particle. What is the structure of the new nucleus after the emission?
- (A) Proton number 82, Nucleon number 212  
 (B) Proton number 82, Nucleon number 214  
 (C) Proton number 85, Nucleon number 215  
 (D) More than one of the above  
 (E) None of the above
- 61.** Which of the following reactions is **not** allowed?
- (A)  $\pi^+ + n \rightarrow K^+ + \Sigma^0$   
 (B)  $\Lambda^+ + n \rightarrow \Sigma^+ + p$   
 (C)  $\rho^0 \rightarrow \pi^+ \pi^-$   
 (D) More than one of the above  
 (E) None of the above
- 62.** Donor-type impurities are the materials of
- (A) V group of periodic table  
 (B) IV group of periodic table  
 (C) III group of periodic table  
 (D) More than one of the above  
 (E) None of the above

- 63.** In an  $n$ -type semiconductor, the Fermi level lies
- (A) above the top of the valence band
  - (B) below the bottom of the conduction band
  - (C) in the middle of the forbidden gap
  - (D) More than one of the above
  - (E) None of the above
- 64.** The maximum efficiency of a half-wave rectifier is
- (A) 33.3%
  - (B) 40.6%
  - (C) 66.6%
  - (D) More than one of the above
  - (E) None of the above
- 65.** Consider the following types of modulation :
- (i) Amplitude modulation
  - (ii) Frequency modulation
  - (iii) Phase modulation
  - (iv) Pulse modulation
- Which of the above modulations are used for telecasting TV programs?
- (A) (ii) and (iii)
  - (B) (iii) and (iv)
  - (C) (i) and (ii)
  - (D) More than one of the above
  - (E) None of the above
- 66.** For every  $10^\circ\text{C}$  increase in temperature, the reverse saturation current of a  $p$ - $n$  junction will be increased by
- (A) 10 times
  - (B) 2 times
  - (C) 4 times
  - (D) More than one of the above
  - (E) None of the above
- 67.** The band gap energies for silicon and germanium photodiodes are 1.1 eV and 0.67 eV respectively. Their cut-off wavelengths respectively would be
- (A) 1127.27 nm, 1850.75 nm
  - (B) 456.12 nm, 1127.27 nm
  - (C) 1315.45 nm, 1850.75 nm
  - (D) More than one of the above
  - (E) None of the above

**68.** Which method can be employed to produce a high degree of homogeneity in the creation of  $ZnFe_2O_4$  spinel?

- (A) Distillation method
- (B) Vaporization method
- (C) Coprecipitation method
- (D) More than one of the above
- (E) None of the above

**69.** \_\_\_\_\_ is a crystalline solid's basic repetitive structural unit.

- (A) Monomer
- (B) Molecule
- (C) Unit cell
- (D) More than one of the above
- (E) None of the above

**70.** For all the reactions, what is the nature of the chemical dissociation?

- (A) Exothermic
- (B) Reversible
- (C) Endothermic
- (D) More than one of the above
- (E) None of the above

**71.** The radius of an atomic nucleus is of the order of

- (A)  $10^{-10}$  cm
- (B)  $10^{-13}$  cm
- (C)  $10^{-15}$  cm
- (D) More than one of the above
- (E) None of the above

**72.** Atomic orbital is

- (A) the circular path of electron
- (B) an elliptical shaped orbit
- (C) the region in which there is a maximum possibility of finding an electron
- (D) More than one of the above
- (E) None of the above

- 73.** In the rate equation, when the concentration of reactants is unity, then the rate is equal to
- (A) specific rate constant
  - (B) average rate constant
  - (C) instantaneous rate constant
  - (D) More than one of the above
  - (E) None of the above
- 74.** In the reaction  $2A + B \rightarrow A_2B$ , if the concentration of  $A$  is doubled and that of  $B$  is halved, then the rate of the reaction will
- (A) increase 2 times
  - (B) increase 4 times
  - (C) decrease 2 times
  - (D) More than one of the above
  - (E) None of the above
- 75.** A substance  $A$  decomposes by a first-order reaction starting initially with  $[A] = 2.00 M$  and after 200 minutes,  $[A]$  becomes  $0.15 M$ . For this reaction  $t_{1/2}$  is
- (A) 53.72 minutes
  - (B) 50.49 minutes
  - (C) 48.45 minutes
  - (D) More than one of the above
  - (E) None of the above
- 76.** Which of the following assertions about the main cell is correct?
- (A) An example of a primary cell is a mercury cell.
  - (B) An example of a primary cell is a nickel-cadmium storage cell.
  - (C) The electrode reactions can be reversed.
  - (D) More than one of the above
  - (E) None of the above





- 77.** A catalyst alters which of the following in a chemical reaction?
- (A) Entropy
  - (B) Activation energy
  - (C) Internal energy
  - (D) More than one of the above
  - (E) None of the above
- 78.** Photochemistry deals with the study of
- (A) photons
  - (B) photos
  - (C) reactions which proceed with absorptions of visible or UV light
  - (D) More than one of the above
  - (E) None of the above
- 79.** The number of photons that pass through a unit area in a unit time is called
- (A) amplitude of light
  - (B) frequency of light
  - (C) intensity of light
  - (D) More than one of the above
  - (E) None of the above
- 80.** The transition without emission of radiation of a molecule from a stable excited state to an unstable excited state that leads to dissociation is
- (A) predissociation
  - (B) dissociation
  - (C) photodissociation
  - (D) More than one of the above
  - (E) None of the above
- 81.** Which of the following products are obtained when  $\text{Na}_2\text{CO}_3$  is added to a solution of copper sulphate?
- (A) Basic copper carbonate, sodium sulphate and  $\text{CO}_2$
  - (B) Copper hydroxide, sodium sulphate and  $\text{CO}_2$
  - (C) Copper carbonate, sodium sulphate and  $\text{CO}_2$
  - (D) More than one of the above
  - (E) None of the above



**82.** The pair that has similar atomic radii is

- (A) Mn and Re
- (B) Mo and W
- (C) Sc and Ni
- (D) More than one of the above
- (E) None of the above

**83.** According to the IUPAC nomenclature, sodium nitroprusside dihydrate is named as

- (A) sodium pentacyanonitrosylferrate(III)
- (B) sodium nitroferrocyanide
- (C) sodium pentacyanonitrosylferrate(II)
- (D) More than one of the above
- (E) None of the above

**84.** A substance  $X$  is used in whitewashing and is obtained by heating limestone in the absence of air. Identify  $X$ .

- (A)  $\text{CaOCl}_2$
- (B)  $\text{Ca(OH)}_2$
- (C)  $\text{CaO}$
- (D) More than one of the above
- (E) None of the above

**85.** A dilute ferrous sulphate solution is gradually added to the beaker containing acidified permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation?

- (A)  $\text{KMnO}_4$  is an oxidizing agent and it oxidizes  $\text{FeSO}_4$ .
- (B)  $\text{FeSO}_4$  acts as an oxidizing agent and it oxidizes  $\text{KMnO}_4$ .
- (C) The colour disappears due to dilution, no reaction is involved.
- (D) More than one of the above
- (E) None of the above



**86.** How many structural isomers are possible if one hydrogen in diphenylmethane is replaced by chlorine?

- (A) 8
- (B) 4
- (C) 7
- (D) More than one of the above
- (E) None of the above

**87.** Which among the following statements is/are true?

Exposure of silver chloride to sunlight for a long duration turns it grey due to the

- (i) formation of silver by decomposition of silver chloride
- (ii) sublimation of silver chloride
- (iii) decomposition of chlorine gas from silver chloride
- (iv) oxidation of silver chloride

Select the correct answer using the codes given below.

- (A) (i) only
- (B) (i) and (iii)
- (C) (ii) and (iv)
- (D) More than one of the above
- (E) None of the above

**88.** Which of the following is a branched polymer?

- (A) Low-density polymer
- (B) Polyester
- (C) High-density polymer
- (D) More than one of the above
- (E) None of the above

**89.** Which of the following monomers form biodegradable polymers?

- (A) 3-Hydroxybutanoic acid + 3-Hydroxypentanoic acid
- (B) Glycine + Aminocaproic acid
- (C) Ethylene glycol + Phthalic acid
- (D) More than one of the above
- (E) None of the above

- 90.** The correct order of increasing nucleophilicity is
- (A)  $\text{Cl}^- < \text{Br}^- < \text{I}^-$
- (B)  $\text{Br}^- < \text{Cl}^- < \text{I}^-$
- (C)  $\text{I}^- < \text{Br}^- < \text{Cl}^-$
- (D) More than one of the above
- (E) None of the above
- 91.** Select the correct statement from the following options.
- (A) Spectroscopic methods require less time and more amount of sample than classical methods.
- (B) Spectroscopic methods require more time and more amount of sample than classical methods.
- (C) Spectroscopic methods require less time and less amount of sample than classical methods.
- (D) More than one of the above
- (E) None of the above
- 92.** A carbonyl group will cause a sharp dip at about \_\_\_\_\_  $\text{cm}^{-1}$ .
- (A) 1700
- (B) 2800
- (C) 3400
- (D) More than one of the above
- (E) None of the above
- 93.** Which is the best suited method for the separation of *para*- and *ortho*-nitrophenols from 1:1 mixture?
- (A) Crystallization
- (B) Chromatography
- (C) Steam distillation
- (D) More than one of the above
- (E) None of the above
- 94.** Find the compound which undergoes nucleophilic substitution reaction exclusively by an  $\text{S}_{\text{N}}1$  mechanism.
- (A) Benzyl chloride
- (B) Chlorobenzene
- (C) Ethyl chloride
- (D) More than one of the above
- (E) None of the above



- 95.** The majority of phytophagous nematodes are
- (A) root parasites
  - (B) stem parasites
  - (C) tissue parasites
  - (D) More than one of the above
  - (E) None of the above
- 96.** One of the purposes of secondary treatment of wastewater and sewage is
- (A) to increase the chlorine content
  - (B) to reduce the BOD
  - (C) to encourage the formation of PCBs
  - (D) More than one of the above
  - (E) None of the above
- 97.** Most bacteria that cause plant diseases are members of the group of
- (A) rod-shaped and gram-positive bacteria
  - (B) rod-shaped and gram-negative bacteria
  - (C) filament-shaped and gram-positive bacteria
  - (D) More than one of the above
  - (E) None of the above
- 98.** Nutritionally Albugo is
- (A) saprophyte
  - (B) facultative saprophyte
  - (C) obligate parasite
  - (D) More than one of the above
  - (E) None of the above
- 99.** Which of the following is incorrect statement?
- (A) In Liliaceae, some plants have underground parts.
  - (B) Fibre-yielding plants are found in Malvaceae.
  - (C) Trees with large flowers and seeds are found in Compositae.
  - (D) More than one of the above
  - (E) None of the above
- 100.** One of the major Basmati rice-producing States in our country is
- (A) Kerala
  - (B) Andhra Pradesh
  - (C) Uttar Pradesh
  - (D) More than one of the above
  - (E) None of the above

- 101.** What is Somaclone?
- (A) Plant which is chemically identical to the source plant
  - (B) Plant which is morphologically similar to the original plant
  - (C) Plant which is automatically identical to the original plant
  - (D) More than one of the above
  - (E) None of the above
- 102.** The functional unit of synthesis of protein is
- (A) peroxisome
  - (B) polysome
  - (C) lysosome
  - (D) More than one of the above
  - (E) None of the above
- 103.** Active transport takes place
- (A) against concentration gradient and requires ATP
  - (B) against concentration gradient and does not require ATP
  - (C) with concentration gradient and does not require ATP
  - (D) More than one of the above
  - (E) None of the above
- 104.** Tropical evergreen forests are found in which of the following States of India?
- (A) Tamil Nadu
  - (B) Assam
  - (C) Madhya Pradesh
  - (D) More than one of the above
  - (E) None of the above
- 105.** Ozone hole refers to
- (A) decrease in ozone concentration in stratosphere
  - (B) decrease in the thickness of ozone layer in stratosphere
  - (C) increase in the thick layer of ozone in stratosphere
  - (D) More than one of the above
  - (E) None of the above
- 106.** Groundnut oil is obtained from
- (A) *Brassica juncea*
  - (B) *Artabotrys odoratissimus*
  - (C) *Arachis hypogaea*
  - (D) More than one of the above
  - (E) None of the above
- 107.** The component of food that does not provide any nutrient to our body and yet is essential in our food is
- (A) fat
  - (B) carbohydrate
  - (C) roughage
  - (D) More than one of the above
  - (E) None of the above

- 108.** Plasma membrane is built up of
- (A) protein
  - (B) lipid
  - (C) carbohydrate
  - (D) More than one of the above
  - (E) None of the above
- 109.** Mendel's principle of inheritance is based on
- (A) vegetative reproduction
  - (B) asexual reproduction
  - (C) sexual reproduction
  - (D) More than one of the above
  - (E) None of the above
- 110.** When there is a decrease in the concentration of oxygen in the blood, the rate of breathing
- (A) decreases
  - (B) increases
  - (C) does not change
  - (D) More than one of the above
  - (E) None of the above
- 111.** In human body, which one of the following hormones regulates blood calcium and phosphate?
- (A) Glucagon
  - (B) Growth hormone
  - (C) Parathyroid hormone
  - (D) More than one of the above
  - (E) None of the above
- 112.** Quick response towards stress is done by
- (A) androgen
  - (B) epinephrine
  - (C) corticosteroid
  - (D) More than one of the above
  - (E) None of the above
- 113.** *Cimex hemipterus* parasitizes on
- (A) sheep
  - (B) man
  - (C) elephant
  - (D) More than one of the above
  - (E) None of the above
- 114.** Which of the following is a human 'blood fluke'?
- (A) *Enterobius vermicularis*
  - (B) *Schistosoma mansoni*
  - (C) *Wuchereria bancrofti*
  - (D) More than one of the above
  - (E) None of the above

- 115.** The embryonic respiratory organ in chick is
- (A) amnion
  - (B) chorion
  - (C) allantois
  - (D) More than one of the above
  - (E) None of the above
- 116.** Which of the following characterizes aging?
- (A) An increase in the consumption of oxygen
  - (B) Increased anabolism
  - (C) Increased metabolic activity
  - (D) More than one of the above
  - (E) None of the above
- 117.** Eugenics is the study of
- (A) different races
  - (B) people of European origin
  - (C) altering human beings by changing the genetic components
  - (D) More than one of the above
  - (E) None of the above
- 118.** In some animal groups, the body is found divided into compartments with at least some organs serially repeated. This feature is named as
- (A) segmentation
  - (B) metamerism
  - (C) metagenesis
  - (D) More than one of the above
  - (E) None of the above
- 119.** Which type of larva is found in majority of Crustacea?
- (A) Tornaria
  - (B) Bipinnaria
  - (C) Nauplius
  - (D) More than one of the above
  - (E) None of the above
- 120.** According to Oparin, which of the following was **not** present in the primitive atmosphere of the Earth?
- (A) Oxygen
  - (B) Hydrogen
  - (C) Water vapour
  - (D) More than one of the above
  - (E) None of the above