VITEEE 2023 Question Paper

Vellore Institute of Technology Engineering Entrance Examination

VITEEE Paper - 2023

Physics

Question 1

Light of wavelength λ_A and λ_B falls on two identical metal plates A and B respectively. The maximum kinetic energy of photoelectrons is K_A and K_B respectively, then which one of the following relations is true ($\lambda_A = 2\lambda_B$)

Options:

A. $K_A < \frac{K_B}{2}$

B. $2K_A = K_B$

C. $K_A = 2K_B$

D. $K_A > 2K_B$

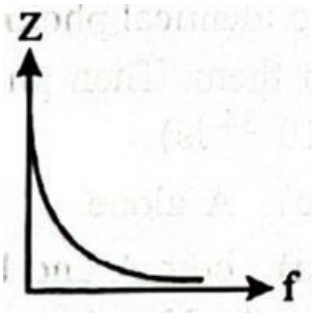
Answer: A

Question 2

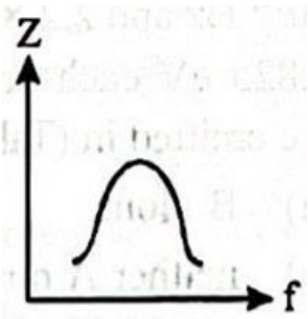
Which one of the following curves represents the variation of impedance (Z) with frequency f in series LCR circuit?

Options:

A.



B.



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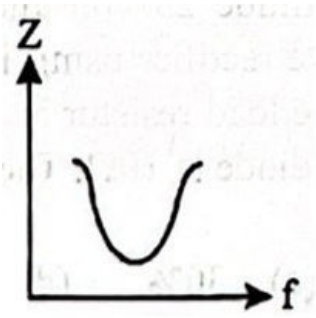
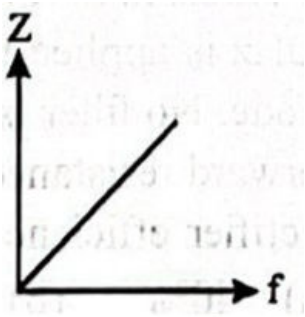


D.



Answer: C

Question 3

A Carnot engine takes 3×10^6 cal. of heat from a reservoir at 627˚C, and gives it to a sink at 27˚C. The work done by the engine is

Options:

A. 4.2×10^6J

B. 8.4×10^6J

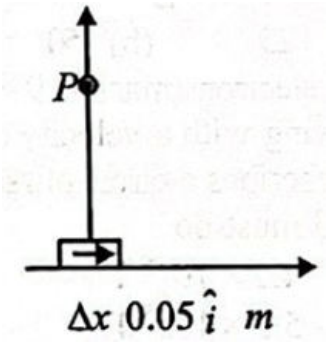
C. 16.8×10^6J

D. zero

Answer: B

Question 4

An element of 0.05im is placed at the origin as shown in figure which carries a large current of 10A. distance of 1m in perpendicular direction. The value of magnetic field is



Options:

A. 4.5×10^{-8}T

B. 5.5×10^{-8}T

C. 5.0×10^{-8}T

D. 7.5×10^{-8}T

Answer: C

Question 5

A sinusoidal voltage of amplitude 25 volt and frequency 50 Hz is applied to a half wave rectifier using P-n junction diode. No filter is used and the load resistor is 1000Ω. The forward resistance R_f of ideal diode is 10Ω. The percentage rectifier efficiency is

Options:

A. 40%

B. 20%

C. 30%

D. 15%

Answer: A

Question 6

A flask contains a monoatomic and a diatomic gas in the ratio of 4 : 1 by mass at a temperature of 300K The ratio of average kinetic energy per molecule of the two gases is

Options:

A. 1 : 1

B. 2 : 1

C. 4 : 1

D. 1 : 4

Answer: A

Question 7

The potential energy of a particle (U_x) executing S.H.M. is given by

Options:

A. $U_x = \frac{k}{2}(x-a)^2$

B. $U_x = k_1x + k_2x^2 + k_3x^3$

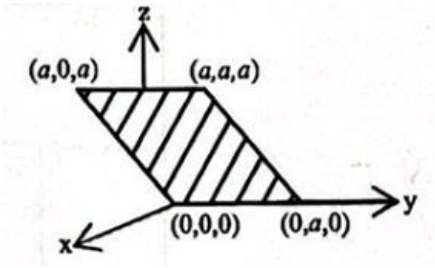
C. $U_x = Ae^{-bx}$

D. U_x = a constant

Answer: A

Question 8

Consider an electric field $\vec{E} = E_0\hat{x}$ where E_0 is a constant. The flux through the shaded area (as shown in the figure) due to this field is



Options:

A. $2E_0a_2$

B. $\sqrt{2}E_0a^2$

C. E_0a^2

D. $\frac{E_0a^2}{\sqrt{2}}$

Answer: C

Question 9

The equation of a wave on a string of linear mass density $0.04\,kg\,m^{-1}$ is given by

$y = 0.02(m)\sin\left[2\pi\left(\frac{t}{0.04(s)} - \frac{x}{0.50(m)}\right)\right]$

The tension in the string is

Options:

A. 4.0N

B. 12.5N

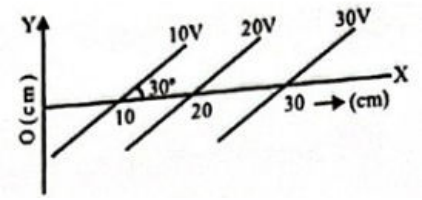
C. 0.5N

D. 6.25N

Answer: D

Question 10

Equipotential surfaces are shown in figure. Then the electric field strength will be



Options:

A. 100Vm^{-1} along X-axis

B. 100Vm^{-1} along Y-axis

C. 200Vm^{-1} at an angle 120° with X-axis

D. 50Vm^{-1} at an angle 120° with X-axis

Answer: C

Question 11

Water falls from a 40m high dam at the rate of 9×10^4 kg per hour. Fifty percentage of gravitational potential energy can be converted into electrical energy. Using this hydro electric energy, number of 100W lamps, that can be lit, is : (. Take g = 10ms^{-2})

Options:

A. 25

B. 50

C. 100

D. 18

Answer: B

Question 12

An electron (mass $= 9 \times 10^{-31}$ kg, charge $= 1.6 \times 10^{-19}$C) moving with a velocity of 10^6m / s enters a magnetic field. If it describes a circle of radius 0.1m, then strength of magnetic field must be

Options:

A. 4.5×10^{-5}T

B. 1.4×10^{-5}T

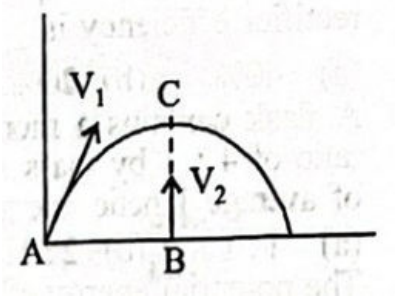
C. 5.5×10^{-5}T

D. 2.6×10^{-5}T

Answer: C

Question 13

If V_1 is velocity of a body projected from the point A and V_2 is the velocity of a body projected from point B which is vertically below the highest point C. if both the bodies collide, then



Options:

A. $V_1 = \frac{1}{2}V_2$

B. $V_2 = \frac{1}{2}V_1$

C. $V_1 = V_2$

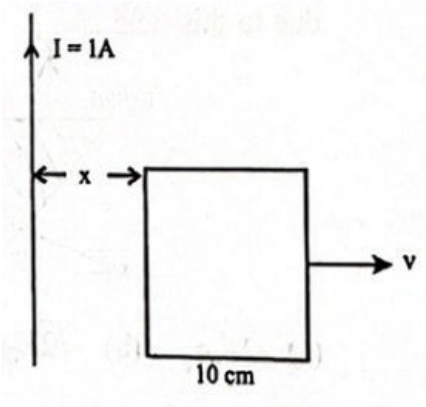
D. $V_1 = 3V_2$

Answer: B

Question 14

A square frame of side 10 cm and a long straight wire carrying current 1A are in the plate of the paper. Starting from close to the wire, the frame moves towards the right with a constant speed of $10ms^{-1}$ (see figure).

The e.m. finduced at the time the left arm of the frame is at x = 10 cm from the wire is



Options:

A. 2μV

B. 1μV

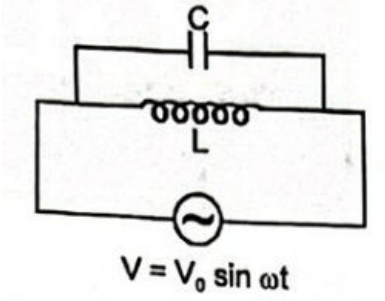
C. 0.75μV

D. 0.5μV

Answer: B

Question 15

For the circuit shown in the fig., the current through the inductor is 0.9A while the current through the condenser is 0.4A. Then



Options:

A. current drawn from source I = 1.13A

B. ω = 1 / (1.5 LC)

C. I = 0.5A

D. I = 0.6A

Answer: C

Question 16

The ozone layer in the atmosphere absorbs

Options:

A. only the radiowaves

B. only the visible light

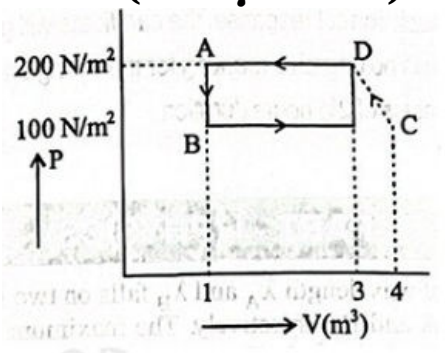
C. only the γ-rays

D. X-rays and ultraviolet rays

Answer: D

Question 17

The P − V diagram of a diatomic ideal gas system going under cyclic process as shown in figure. The work done during an adiabatic process CD is (Use γ = 1.4):



Options:

A. −500J

B. 200J

C. −400J

D. 400J

Answer: A

Question 18

In YDSE, how many maximas can be obtained on a screen including central maxima in both sides of the central fringe if λ = 3000Å, d = 5000Å

Options:

A. 2

B. 5

C. 3

D. 1

Answer: C

Question 19

A and B are two metals with threshold frequencies 1.8×10^{14} Hz and 2.2×10^{14} Hz. Two identical photons of energy 0.825 eV each are incident on them. Then photoelectrons are emitted in (Take $h = 6.6 \times 10^{-34}$ Js)

Options:

A. B alone

B. A alone

C. neither A nor B

D. both A and B

Answer: B

Question 20

A sinusoidal voltage of amplitude 25 volt and frequency 50 Hz is applied to a half wave rectifier using P-n junction diode. No filter is used and the load resistor is 1000Ω. The forward resistance R_f of ideal diode is 10Ω. The percentage rectifier efficiency is

Options:

A. 40%

B. 20%

C. 30%

D. 15%

Answer: A

Question 21

The force between two short bar magnets with magnetic moments M_1 and M_2 whose centres are r metres apart is 8 N when their axes are in same line. if the separation is increased to 2r, the force between them is reduced to

Options:

A. 4N

B. 2N

C. 1N

D. 0.5N

Answer: D

Question 22

In a Rutherford scattering experiment when a projectile of charge Z_1 and mass M_1 approaches a target nucleus of charge Z_2 and mass M_2, the distance of closest approach is r_0. The energy of the projectile is

Options:

A. directly proportional to $Z_1 Z_2$

B. inversely proportional to Z_1

C. directly proportional to mass M_1

D. directly proportional to $M_1 \times M_2$

Answer: A

Question 23

What will be the maximum speed of a car on a road turn of radius 30m if the coefficient of friction between the tyres and the road is 0.4 (Take $g = 9.8m/s^2$)

Options:

A. 10.84m / s

B. 9.84m / s

C. 8.84m / s

D. 6.84m / s

Answer: A

Question 24

A person aiming to reach the exactly opposite point on the bank of a stream is swimming with speed of 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water in the stream is

Options:

A. 1 m/s

B. 0.5 m/s

C. 0.25 m/s

D. 0.433 m/s

Answer: C

Question 25

A car moves at a speed of $20ms^{-1}$ on a banked track and describes an arc of a circle of radius $40\sqrt{3}$m. The angle of banking is ($g = 10ms^{-2}$)

Options:

A. 25°

B. 60°

C. 45°

D. 30°

Answer: D

Question 26

A force $\vec{F} = \alpha\hat{i} + 3\hat{j} + 6\hat{k}$ is acting at a point $\vec{r} = 2\hat{i} - 6\hat{j} - 12\hat{k}$. The value of α for which angular momentum about origin is conserved is

Options:

A. 2

B. zero

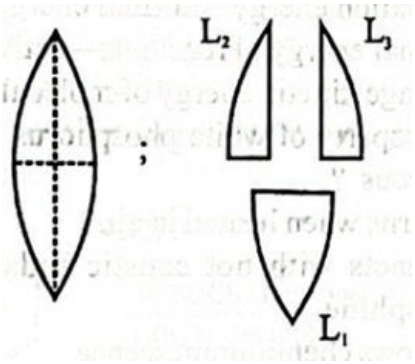
C. 1

D. -1

Answer: D

Question 27

A convex lens has power P. It is cut into two halves along its principal axis. Further one piece (out of the two halves) is cut into two halves perpendicular to the principal axis (as shown in figure). Choose the incorrect option for the reported pieces.



Options:

A. Power of $L_1 = \frac{P}{2}$

B. Power of $L_2 = \frac{P}{2}$

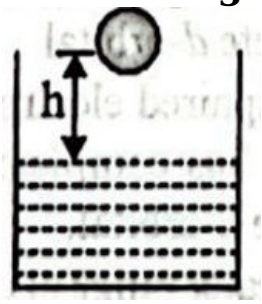
C. Power of $L_3 = \frac{P}{2}$

D. Power of $L_1 = P$

Answer: A

Question 28

A ball of radius r and density ρ falls freely under gravity through a distance h before entering water. Velocity of ball does not change even on entering water. If viscosity of water is η the value of h is given by



Options:

A. $\frac{2}{9}r^2\left(\frac{1-\rho}{\eta}\right)g$

B. $\frac{2}{81}r^2\left(\frac{\rho-1}{\eta}\right)g$

C. $\frac{2}{81}r^4\left(\frac{\rho-1}{\eta}\right)^2g$

D. $\frac{2}{9}r^4\left(\frac{\rho-1}{\eta}\right)^2g$

Answer: C

Question 29

The pressure inside a tyre is 4 times that of atmosphere. If the tyre bursts suddenly at temperature 300K, what will be the new temperature?

Options:

A. $300(4)^{7/2}$

B. $300(4)^{2/7}$

C. $300(2)^{7/2}$

D. $300(4)^{-27}$

Answer: D

Question 30

A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect?

Options:

A. The energy stored in the capacitor decreases K times.

B. The chance in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$.

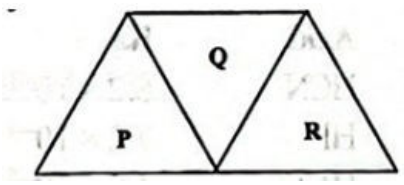
C. The charge on the capacitor is not conserved.

D. The potential difference between the plates decreases K times.

Answer: C

Question 31

A given ray of light suffers minimum deviation in an equilateral prism P. Additional prism Q and R of identical shape and of the same material as P are now added as shown in the figure. The ray will now suffer



Options:

A. greater deviation

B. no deviation

C. same deviation as before

D. total internal reflection

Answer: C

Question 32

If m is magnetic moment and B is the magnetic field, then the torque is given by

Options:

A. $\vec{m} \cdot \vec{B}$

B. $\frac{|\vec{m}|}{|\vec{B}|}$

C. $\vec{m} \times \vec{B}$

D. $|\vec{m}| \cdot |\vec{B}|$

Answer: C

Question 33

An α-particle of 10 MeV collides head-on with a copper nucleus (Z = 29) and is deflected back. Then, the minimum distance of approach between the centres of the two is:

Options:

A. 8.4×10^{-15} cm

B. 8.4×10^{-15}m

C. 4.2×10^{-15}m

D. 4.2×10^{-15} cm

Answer: B

Question 34

A planet in a distant solar system is 10 times more massive than the earth and its radius is 10 times smaller. Given that the escape velocity from the earth's surface is 11 km s s^{-1}, the escape velocity from the surface of the planet would be

Options:

A. $1.1\,km\ s^{-1}$

B. $11\,km\ s^{-1}$

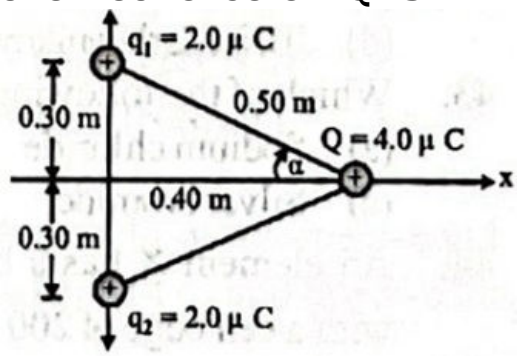
C. $110\,km\ s^{-1}$

D. $0.11 kms^{-1}$

Answer: C

Question 35

In fig., two equal positive point charges $q_1 = q_2 = 2.0\mu C$ interact with a third point charge Q = 4.0μC. The magnitude, as well as direction, of the net force on Q is



Options:

A. 0.23N in the +x-direction

B. 0.46N in the +x-direction

C. 0.23N in the - x-direction

D. 0.46N in the −x-direction

Answer: B

Chemistry

Question 36

PART - II (CHEMISTRY)

Which of the following sets of quantum numbers is correct for an electron in 4 forbital?

Options:

A. n = 4, l = 3, m = +1, s = +1 / 2

B. n = 4, l = 4, m = −4, s = −1 / 2

C. n = 4, l = 3, m = +4, s = +1 / 2

D. $n = 3, l = 2, m = -2, s = +1 / 2$

Answer: A

Question 37

Arrange the following in increasing order of ionic radii?
C^4, N^3, F, O^{2-}

Options:

A. $C^4 < N^{3-} < O^{2-} < F^-$

B. $N^{3-} < C^4 < O^{2-} < F^-$

C. $F^- < O^{2-} < N^{3-} < C^4$

D. $O^{2-} < F < N^{3-} < C^4$

Answer: C

Question 38

The bond dissociation energies of X_2, Y_2 and XY are in the ratio of $1 : 0.5 : 1$. ΔH for the formation of XY is $-200\,kJ\,mol^{-1}$. The bond dissociation energy of X_2 will be

Options:

A. $200\,kJ\,mol^{-1}$

B. $100\,kJ\,mol^{-1}$

C. $400\,kJ\,mol^{-1}$

D. $800\,kJ\,mol^{-1}$

Answer: D

Question 39

Values of dissociation constant, K_a are given as follows.

Acid	Ka
HCN	6.2×10^{-10}
HF	7.2×10^{-4}
HNO_2	4.0×10^{-4}

Correct order of increasing base strength of the base CN^-, F^- and NO_2^- will be :

Options:

A. $F < CN^- < NO_2^-$

B. $NO_2^- < CN^- < F^-$

C. $F < NO_2^- < CN^-$

D. $NO_2^- < F^- < CN^-$

Answer: C

Question 40

The product/s formed when diborane is hydrolysed is/are

Options:

A. B_2O_3 and H_3BO_3

B. B_2O_3 only

C. H_3BO_3 and H_2

D. H_3BO_3 only

Answer: C

Question 41

The compounds $CH_3CH = CHCH_3$ and $CH_3CH_2CH = CH_2$

Options:

A. are tautomers

B. are position isomers

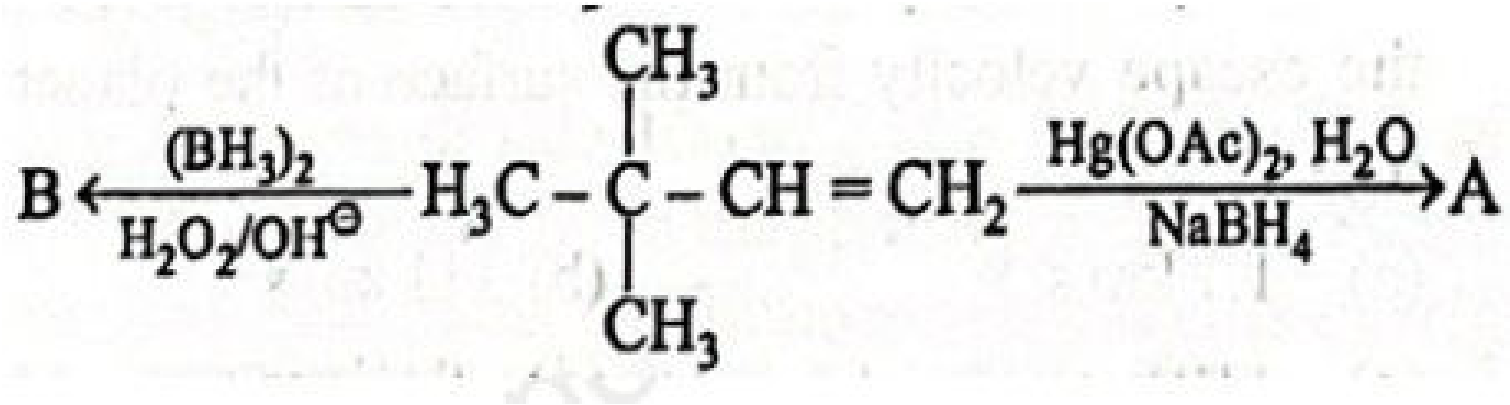
C. contain same number of $sp^3 - sp^3$, $sp^3 - sp^2$ and $sp^2 - sp^2$ carbon-carbon bonds

D. exist together in dynamic equilibrium

Answer: B

Question 42

Choose the correct option for the following reactions.



Options:

A. ' A ' and ' B ' are both Markovnikov addition products.

B. ' A ' is Markovnikov product and ' B ' is antiMarkovnikov product.

C. ' A ' and ' B ' are both anti-Markovnikov products.

D. ' B ' is Markovnikovand ' A ' is anti-Markovnikov product.

Answer: B

Question 43

Which of the following has Frenkel defects?

Options:

A. Sodium chloride

B. Silver bromide

C. Graphite

D. Diamond

Answer: C

Question 44

An element X has a body centred cubic (bcc) structure with a cell edge of 200 pm. The density of the element is 5 gcm^{-3}. The number of atoms present in 300g of the element X is Given:Avogadro Constant, $N_A = 6.0 \times 10^{23} mol^{-1}$.

Options:

A. $5N_A$

B. $6N_A$

C. $15N_A$

D. $25N_A$

Answer: D

Question 45

On passing current through two cells, connected in series, containing solution of $AgNO_3$ and $CuSO_4$, 0.18g of Ag is deposited. The amount of the Cu deposited is:

Options:

A. 0.529g

B. 10.623g

C. 0.0529g

D. 1.2708g

Answer: C

Question 46

The limiting molar conductivities of HCl, CH_3COONa and NaCl are respectively 425,90 and 125 $mho\,cm^2\,mol^{-1}$ at 25°C. The molar conductivity of 0, 1MCH_3COOH solutions is 7.8 $mho\,cm^2\,mol^{-1}$ at the same temperature. The degree of dissociation of 0.1M acetic acid solution at the same temperature is

Options:

A. 0.10

B. 0.02

C. 0.15

D. 0.03

Answer: B

Question 47

The rate law for a reaction between the substances A and B is given by Rate $= k[A]^n[B]^m$
On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as

Options:

A. $(m + n)$

B. $(n - m)$

C. $2^{(n - m)}$

D. $\frac{1}{2^{(m + n)}}$

Answer: C

Question 48

In a reaction, the threshold energy is equal to

Options:

A. activation energy + normal energy of reactants

B. activation energy - normal energy of reactants

C. normal energy of reactants - activation energy

D. average kinetic energy of molecules of reactants

Answer: A

Question 49

Which property of white phosphorus is common to red phosphorous?

Options:

A. It burns when heated in air.

B. It reacts with hot caustic soda solution to give phosphine.

C. It shows chemiluminescence.

D. It is soluble in carbon disulphide.

Answer: A

Question 50

XeO_4 molecule is tetrahedral having:

Options:

A. Two pπ − d π bonds

B. One pπ − d π bonds

C. Four pπ − d π bonds

D. Three pπ − d π bonds

Answer: C

Question 51

Cuprous ion is colourless while cupric ion is coloured because

Options:

A. both have half filled p-and d -orbitals

B. cuprous ion has incomplete d -orbital and cupric ion has a complete d -orbital

C. both have unpaired electrons in the d -orbitals

D. cuprous ion has complete d -orbital and cupric ion has an incomplete d -orbital.

Answer: D

Question 52

The reason for greater range of oxidation states in actinoids is attributed to :

Options:

A. actinoid contraction

B. 5f , 6d and 7s levels having comparable energies

C. 4f and 5d levels being close in energies

D. the redioactive nature of actinoids

Answer: B

Question 53

The geometry and magnetic behaviour of the complex $[Ni(CO)_4]$ are

Options:

A. Square planar geometry and diamagnetic

B. Tetrahedral geometry and diamagnetic

C. Tetrahedral geometry and paramagnetic

D. Square planar geometry and paramagnetic

Answer: B

Question 54

Indicate the complex ion which shows geometrical isomerism.

Options:

A. $[Cr(H_2O)_4Cl_2]^+$

B. $[Pt(NH_3)_3Cl]^{2-}$

C. $[Co(NH_3)_6]^{3-}$

D. $[Co(CN)_5(NC)]^{3-}$

Answer: A

Question 55

Reaction of $C_6H_5CH_2Br$ with aqueous sodium hydroxide follows

Options:

A. S_N1 mechanism

B. S_N2 mechanism

C. Any of the above two depending upon the temperature of reaction

D. Saytzeff rule

Answer: A

Question 56

What is the correct order of reactivity of alcohols in the following reaction?

$$R-OH + HCl \xrightarrow{ZnCl_2} R-Cl + H_2O$$

Options:

A. $1^\circ > 2^\circ > 3^\circ$

B. $3^\circ > 2^\circ > 1^\circ$

C. $1^\circ < 2^\circ < 3^\circ$

D. $3^\circ > 1^\circ > 2^\circ$

Answer: C

Question 57

Which of the following cannot be made by using Williamson's synthesis?

Options:

A. Methoxybenzene

B. Benzyl p-nitrophenyl ether

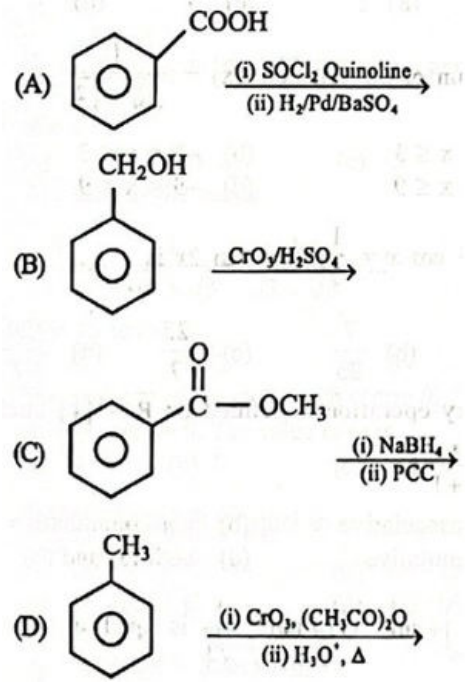
C. Methyl tertiary butyl ether

D. Di-tert-butyl ether

Answer: D

Question 58

Which of the following reactions will yield benzaldehyde as a product?



Options:

A. (B) and (C)

B. (C) and (D)

C. (A) and (D)

D. (A) and (C)

Answer: C

Question 59

In Clemmensen reduction, carbonyl compounds is treated with

Options:

A. zinc amalgam +HCl

B. sodium amalgam +HCl

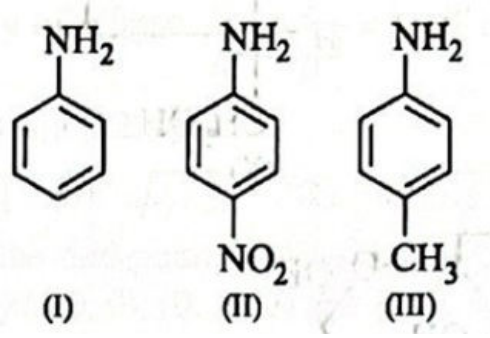
C. zinc amalgan + nitric acid

D. sodiumamalgam +HNO_3

Answer: A

Question 60

The correct increasing order of basic strength for the following compounds is



Options:

A. II < III < I

B. III < I < II

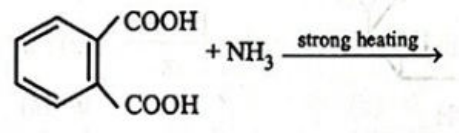
C. III < II < I

D. II < I < III

Answer: D

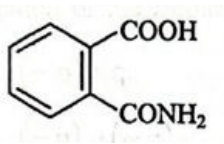
Question 61

The major product of the following reaction is :

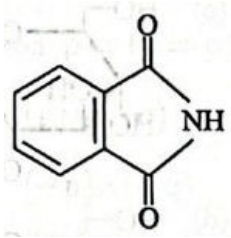


Options:

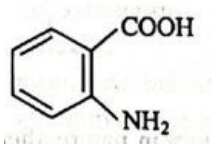
A.



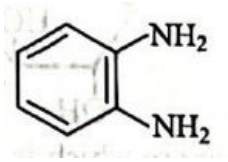
B.



C.



D.



Answer: B

Question 62

Blister copper is

Options:

A. Impure Cu

B. Cu alloy

C. Pure Cu

D. Cu having 1% impurity

Answer: D

Question 63

P_A and P_B are the vapour pressure of pure liquid components, A and B, respectively of an ideal binary solution. If X_A represents the mole fraction of component A, the total pressure of the solution will be.

Options:

A. $P_A + X_A(P_B - P_A)$

B. $P_B + X_A(P_B - P_A)$

C. $P_A + X_A(P_A - P_B)$

D. $P_B + X_A(P_A - P_B)$

Answer: D

Question 64

Which of the following complex shows sp^3d^2 hybridization

Options:

A. $[Cr(NO_2)_6]^{3-}$

B. $[Fe(CN)_6]^{4-}$

C. $[CoF_6]^{3-}$

D. $[Ni(CO)_4]$

Answer: C

Question 65

2- Pentene contains

Options:

A. 15σ - and one π - bond

B. 14σ-and one π-bond

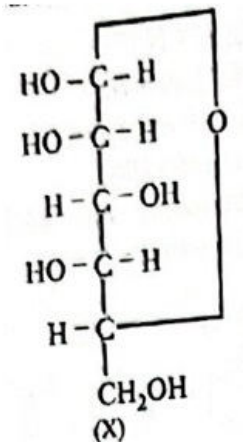
C. 15σ - and two π-bonds

D. 14σ - and two π - bonds

Answer: B

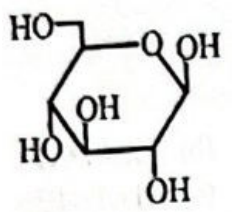
Question 66

For the below given cyclic hemiacetal (X), the correct pyranose structure is :

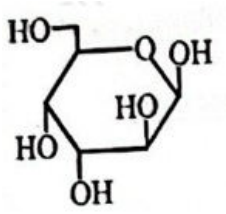


Options:

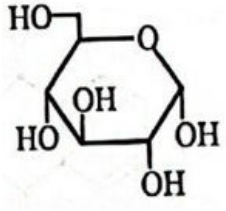
A.



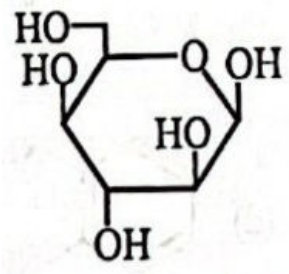
B.



C.



D.



Answer: D

Question 67

Sucrose which is dextrorotatory in nature after hydrolysis gives glucose and fructose, among which
(i) Glucose is laevorotatory and fructose is dextrorotatory.

(ii) Glucose is dextrorotatory and fructose is laevorotatory
(iii) The mixture is laevorotatory.

(iv) Both are dextrorotatory.

Options:

A. (i) and (iii)

B. (iii) and (iv)

C. (ii) and (iii)

D. (iii) only

Answer: B

Question 68

Allyl cyanide molecule contains

Options:

A. 9 sigma bonds, 4 pi bonds and no lone pair

B. 9 sigma bonds, 3 pi bonds and one lone pair

C. 8 sigma bonds, 5 pi bonds and one lone pair

D. 8 sigma bonds, 3 pi bonds and two lone pairs

Answer: B

Question 69

Which of the following pairs of compounds is isoelectronic and isostructural?

Options:

A. TeI_2, XeF_2

B. IBr_2^-, XeF_2

C. IF., XeF,

D. $BeCl_2$, XeF_2

Answer: B

Question 70

In which case change in entropy is negative?

Options:

A. Evaporation of water

B. Expansion of a gas at constant temperature

C. Sublimation of solid to gas

D. $2H(g) \rightarrow H_2(g)$

Answer: D

Mathematics

Question 71

PART-III Mathematics

The argument of the complex number $\left(\frac{i}{2} - \frac{2}{i}\right)$ is equal to

Options:

A. $\frac{\pi}{4}$

B. $\frac{3\pi}{4}$

C. $\frac{\pi}{12}$

D. $\frac{\pi}{2}$

Answer: D

Question 72

The lines $p(p^2 + 1)x - y + q = 0$ and $(p^2 + 1)^2x + (p^2 + 1)y + 2q = 0$ are perpendicular to a common line for

Options:

A. exactly one value of p

B. exactly two values of p

C. more than two values of p

D. no value of p

Answer: A

Question 73

The probability that a card drawn from a pack of 52 cards will be a diamond or king is

Options:

A. $\frac{1}{52}$

B. $\frac{2}{13}$

C. $\frac{4}{13}$

D. $\frac{1}{13}$

Answer: C

Question 74

If n(A) = 4 and n(B) = 7, then the difference between maximum and minimum value of n(A ∪ B) is

Options:

A. 1

B. 2

C. 3

D. 4

Answer: D

Question 75

The domain of the function f (x) = $\frac{1}{\sqrt{9 - x^2}}$ is

Options:

A. $-3 \leq x \leq 3$

B. $-3 < x < 3$

C. $-9 \leq x \leq 9$

D. $-9 < x < 9$

Answer: B

Question 76

If $\sin x + \cos x = \frac{1}{5}$, then $\tan 2x$ is

Options:

A. $\frac{25}{17}$

B. $\frac{7}{25}$

C. $\frac{25}{7}$

D. $\frac{24}{7}$

Answer: D

Question 77

For binary operation * defined on R − {1} such that a * b = $\frac{a}{b+1}$ is

Options:

A. not associative

B. commutative

C. not commutative

D. both (a) and (b)

Answer: D

Question 78

$\cos^{-1}\left(\frac{1}{2}\right) + \sin^{-1}(1) + \tan^{-1}\frac{1}{\sqrt{3}}$ is equal to

Options:

A. π

B. $\frac{\pi}{3}$

C. $\frac{4\pi}{3}$

D. $\frac{3\pi}{4}$

Answer: A

Question 79

If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} x & 1 \\ y & -1 \end{bmatrix}$ and $(A+B)^2 = A^2 + B^2$, then x + y =

Options:

A. 2

B. 3

C. 4

D. 5

Answer: D

Question 80

The value of $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$ **is :**

Options:

A. 0

B. abc

C. $4a^2b^2c^2$

D. None of these

Answer: C

Question 81

If A = $\begin{bmatrix} \alpha & \beta \\ \gamma & \alpha \end{bmatrix}$**, then Adj . A is equal to :**

Options:

A. $\begin{bmatrix} \delta & -\gamma \\ -\beta & \alpha \end{bmatrix}$

B. $\begin{bmatrix} \delta & -\beta \\ -\gamma & \alpha \end{bmatrix}$

C. $\begin{bmatrix} -\delta & \beta \\ \gamma & -\alpha \end{bmatrix}$

D. $\begin{bmatrix} -\delta & -\beta \\ \gamma & \alpha \end{bmatrix}$

Answer: B

Question 82

If $\sec\left(\frac{x-y}{x+y}\right)$ **= a, then** $\frac{dy}{dx}$ **is**

Options:

A. $-\frac{y}{x}$

B. $\frac{x}{y}$

C. $-\frac{x}{y}$

D. $\frac{y}{x}$

Answer: D

Question 83

The number of non zero terms in the expansion of $(1 + 3\sqrt{2}x)^9 + (1 - 3\sqrt{2}x)^9$ is

Options:

A. 2

B. 3

C. 4

D. 5

Answer: D

Question 84

If $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ is the A.M. between a and b, then the value of n is

Options:

A. 1

B. 2

C. 3

D. 4

Answer: A

Question 85

The sum of the series $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \ldots$ upto 15 terms is

Options:

A. 1

B. 2

C. 3

D. 4

Answer: C

Question 86

The equation of the circle with centre (0, 2) and radius 2 is $x^2 + y^2 - my = 0$. The value of m is

Options:

A. 1

B. 2

C. 4

D. 3

Answer: C

Question 87

$\int x^x(1 + \log x)\,dx$ is equal to

Options:

A. $x^x + C$

B. $x^{2x} + C$

C. $x^x \log x + C$

D. $1 / 2(1 + \log x)^2 + C$

Answer: A

Question 88

$\int_0^{\pi/2} (\sqrt{\tan x} + \sqrt{\cot x})\,dx =$

Options:

A. $\frac{\pi}{\sqrt{2}}$

B. $\pi\sqrt{2}$

C. $\frac{\pi}{2}$

D. $\frac{\sqrt{2}}{\pi}$

Answer: B

Question 89

The area of the region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ is

Options:

A. 12π

B. 3π

C. 24π

D. π

Answer: A

Question 90

If vertex of a parabola is (2, −1) and the equation of its directrix is 4x − 3y = 21, then the length of its latus rectum is

Options:

A. 2

B. 8

C. 12

D. 16

Answer: B

Question 91

Eccentricity of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, if it passes through point (9, 5) and (12, 4) is

Options:

A. $\sqrt{3 / 4}$

B. $\sqrt{4 / 5}$

C. $\sqrt{5 / 6}$

D. $\sqrt{6 / 7}$

Answer: D

Question 92

In $\triangle ABC$ the mid-point of the sides AB, BC and CA are respectively $(l, 0, 0), (0, m, 0)$ and $(0, 0, n)$. Then, $\frac{AB^2 + BC^2 + CA^2}{l^2 + m^2 + n^2}$ is equal to

Options:

A. 8

B. 16

C. 9

D. 25

Answer: A

Question 93

If $f(x) = \frac{x + |x|}{x}$, then the value of $\lim_{x \to 0} f(x)$ is

Options:

A. 0

B. 2

C. does not exist

D. None of these

Answer: C

Question 94

Negation of the Boolean expression $p \Leftrightarrow (q \Rightarrow p)$ is

Options:

A. $(\sim p) \wedge q$

B. $(p) \wedge (\sim q)$

C. $(\sim p) \vee (\sim q)$

D. $(\sim p) \wedge (\sim q)$

Answer: D

Question 95

If R = { (x, y) : x is exactly 7 cm taller than y }, then R is

Options:

A. not symmetric

B. reflexive

C. symmetric but not transitive

D. an equivalence relation

Answer: A

Question 96

The particular solution of log $\frac{dy}{dx}$ = 3x + 4y, y(0) = 0 is

Options:

A. $e^{3x} + 3e^{-4y} = 4$

B. $4e^{3x} - 3^{-4y} = 3$

C. $3e^{3x} + 4e^{4y} = 7$

D. $4e^{3x} + 3e^{-4y} = 7$

Answer: D

Question 97

$\tan^{-1}x + \tan^{-1}y = c$ is the general solution of the differential equation

Options:

A. $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$

B. $\frac{dy}{dx} = \frac{1+x^2}{1+y^2}$

C. $(1 + x^2)dy + (1 + y^2)\,dx = 0$

D. $(1 + x^2)\,dx + (1 + y^2)dy = 0$

Answer: C

Question 98

If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4$, then a value of λ for which $\vec{a} + \lambda\vec{b}$ is perpendicular to

$\vec{a} - \lambda\vec{b}$ is :

Options:

A. $\frac{9}{16}$

B. $\frac{3}{4}$

C. $\frac{3}{2}$

D. $\frac{4}{3}$

Answer: B

Question 99

The area of the parallelogram whose diagonals are $\frac{3}{2}\hat{i} + \frac{1}{2}\hat{j} - \hat{k}$ and $2\hat{i} - 6\hat{j} + 8\hat{k}$ is :

Options:

A. $5\sqrt{3}$

B. $5\sqrt{2}$

C. $25\sqrt{3}$

D. $25\sqrt{2}$

Answer: A

Question 100

Bag P contains 6 red and 4 blue balls and bag Q contains 5 red and 6 blue balls. A ball is transferred from bag P to bag Q and then a ball is drawn from bag Q. What is the probability that the ball drawn is blue?

Options:

A. $\frac{7}{15}$

B. $\frac{8}{15}$

C. $\frac{4}{19}$

D. $\frac{8}{19}$

Answer: B

Question 101

The mean and variance of a random variable X having binomial distribution are 4 and 2 respectively, then P(X = 1) is

Options:

A. $\frac{1}{4}$

B. $\frac{1}{32}$

C. $\frac{1}{16}$

D. $\frac{1}{8}$

Answer: B

Question 102

The value of $\tan\left(\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{2}{3}\right)$ =

Options:

A. $\frac{6}{17}$

B. $\frac{7}{16}$

C. $\frac{16}{7}$

D. None of these

Answer: D

Question 103

If the function f (x) = $\begin{cases} 1, & x \le 2 \\ ax+b, & 2 < x < 4 \\ 7, & x \ge 4 \end{cases}$

is continuous at x = 2 and 4 , then the values of a and b are.

Options:

A. a = 3, b = −5

B. a = −5, b = 3

C. a = −3, b = 5

D. a = 5, b = −3

Answer: A

Question 104

The derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ with respect to $\cos^{-1}\left[\frac{1-x^2}{1+x^2}\right]$ is equal to :

Options:

A. 1

B. -1

C. 2

D. None of these

Answer: A

Question 105

The number of distinct real roots of the equation $x^7 - 7x - 2 = 0$ is

Options:

A. 5

B. 7

C. 1

D. 3

Answer: D

Question 106

The minimum value of the function $y = x^4 - 2x^2 + 1$ in the interval $\left[\frac{1}{2}, 2\right]$ is

Options:

A. 0

B. 2

C. 8

D. 9

Answer: A

Question 107

$\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x} dx =$

Options:

A. $\tan x + \cot x + c$

B. $\text{cosec}\, x + \text{scex} + c$

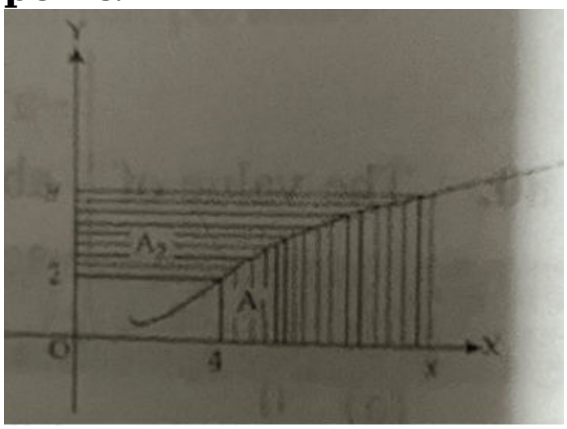
C. $\tan x + \sec x + c$

D. $\tan x + \text{cosec}\, x + c$

Answer: A

Question 108

Consider a curve y = y(x) in the first quadrant as shown in the figure. Let the area A_1 is twice the area A_2. Then the normal to the curve perpendicular to the line 2x − 12y = 15 does NOT pass through the point.



Options:

A. (6, 21)

B. (8, 9)

C. (10, −4)

D. (12, −15)

Answer: C

Question 109

The shortest distance between the lines x = y + 2 = 6z − 6 and

x + 1 = 2y = −12z is

Options:

A. $\frac{1}{2}$

B. 2

C. 1

D. $\frac{3}{2}$

Answer: B

Question 110

The angle between two lines $\frac{x+1}{2} = \frac{y+3}{2} = \frac{z-4}{-1}$ and $\frac{x-4}{1} = \frac{y+4}{2} = \frac{z+1}{2}$ is:

Options:

A. $\cos^{-1}\left(\frac{1}{9}\right)$

B. $\cos^{-1}\left(\frac{4}{9}\right)$

C. $\cos^{-1}\left(\frac{2}{9}\right)$

D. $\cos^{-1}\left(\frac{3}{9}\right)$

Answer: B

Aptitude

Question 111

What is the approximate percentage increase in the production of Monopoly form 1993 to 1995 ?

Options:

A. 10

B. 20

C. 30

D. 25

Answer: B

Solution:

Solution:

Question 112

For which toy category there has been a continuous increase in the production over the years?

Options:

A. Ludo

B. Chess

C. Monopoly

D. Carrom

Answer: C

Solution:

Solution:

Question 113

What is the percentage drop in the production of Ludo from 1992 to 1994 ?

Options:

A. 30

B. 50

C. 20

D. 10

Answer: D

Solution:

Solution:

Question 114

285, 253, 221, 189, ?

Options:

A. 150

B. 182

C. 157

D. 156

Answer: C

Solution:

Solution:

Question 115

In a certain code language PRESENTATION is written as ENESTAITPRON. How would INTELLIGENCE be written in that code language?

Options:

A. TETGLLTNENCE

B. LUENLINTETG

C. LLKKTGTEEBTB

D. LLTEIGENINCE

Answer: D

Solution:

Solution:

Question 116

Ram moves from a point X to 20 metres towards North. Then he moves 40 metres towards West. Then he moves 20 metres North. Then he moves 40 metres towards East and then 10 metres towards right and he reaches to a point Y . Find the distance and direction of Y from X ?

Options:

A. 30 metres, North

B. 40 metres, North

C. 30 metres, South

D. 40 metres, South

Answer: A

Solution:

Solution:

Question 117

If the 5 th date of a month is Tuesday, what date will be 3 days after the 3 rd Friday in the month?

Options:

A. 17

B. 22

C. 19

D. 18

Answer: D

Solution:

Solution:

Question 118

Statements:
I. Some cats are dogs.
II. No dog is a toy.
Conclusions:
I. Some dogs are cats.
II. Some toys are cats.
III. Some cats are not toys.
IV. All toys are cats.

Options:

A. Only Conclusions I and either II or III.

B. Only Conclusions II and III follow

C. Only Conclusions I and II follow

D. Only Conclusion I follows

Answer: A

Solution:

Solution:

Question 119

How is H related to B ?
I. H is married to P. P is the mother of T. T is married to D . D is the father of B.
II. B is the daughter of T. T Is the sister of N. H is the father of N.

Options:

A. if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.

B. if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.

C. if the data in Statement I alone or in Statement II alone are sufficient to answer the question.

D. if the data in both the Statements I and II together are not sufficient to answer the question.

E. if the data in both the Statements I and II together are necessary to answer the question.

Answer: C

Solution:

Solution:

Question 120

Among five persons D, E, F, G and H each of whom having different height, who is the second tallest ?
I. D is taller than only G and E . F is not the tallest.
II. His taller than F. G is taller than E but shorter than D.

Options:

A. if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.

B. if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.

C. if the data in Statement I alone or in Statement II alone are sufficient to answer the question.

D. if the data in both the Statements I and II together are not sufficient to answer the question.

E. if the data in both the Statements I and II together are necessary to answer the question.

Answer: A

Solution:

Solution:

English

Question 121

If someone else's opinion makes us angry, it means that

Options:

A. we are subconsciously aware of having no good reason for becoming angry

B. there may be good reasons for his opinion but we are not consciously aware of them

C. our own opinion is not based on good reason and we know this subconsciously

D. we are not consciously aware of any reason for our own opinion

Answer: C

Solution:

Solution:

Question 122

"Your own contrary conviction" refers to

Options:

A. the fact that you feel pity rather than anger

B. the opinion that two and two are four and that Iceland is a long way from the Equator

C. the opinion that two and two are five and that Iceland is on the Equator

D. the fact that you know so little about arithmetic or geography

Answer: A

Solution:

Solution:

Question 123

Conviction means

Options:

A. persuasion

B. disbelief

C. strong belief

D. ignorance

Answer: C

Solution:

Solution:

Question 124

The writer says if someone maintains that two and two are five you feel pity because you

Options:

A. have sympathy

B. don't agree with him

C. want to help the person

D. feel sorry for his ignorance

Answer: D

Solution:

Solution:

Question 125

The second sentence in the passage

Options:

A. builds up the argument of the first sentence by restating it from the opposite point of view

B. makes the main point which has only been introduced by the first sentence

C. simply adds, a further point to the argument already stated in the first sentence

D. illustrates the point made in the first sentence

Answer: D

Solution:

Solution:
