# VITEEE 2022 Question Paper

Vellore Institute of Technology Engineering Entrance Examination

# VITEEE Paper - 2022

# Physics

## Question 1

### PART - I (PHYSICS)

**The root mean square speed of smoke particles of mass $5 \times 10^{-17}$ kg in their Brownian motion in air at NTP is approximately.**
**[Given k = $1.38 \times 10^{-23} JK^{-1}$ ]**

**Options:**

A. $60\,mm\ s^{-1}$

B. $12\,mm\ s^{-1}$

C. $15\,mm\ s^{-1}$

D. $36\,mm\ s^{-1}$

**Answer: C**

### Solution:

**Solution:**

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## Question 2

**The equation of a particle executing simple harmonic motion is given by $x = \sin \pi \left( t + \frac{1}{3} \right)$ m. At t = 1s, the speed of particle will be (Given : $\pi = 3.14$ )**

**Options:**

A. $0\,cm\ s^{-1}$

B. $157\,cm\ s^{-1}$

C. $272\,cm\ s^{-1}$

D. $314\,cm\ s^{-1}$

**Answer: B**

### Solution:

**Solution:**

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# Question 3

**Following are expressions for four plane simple harmonic waves**

**(i)** $y_1 = A\cos 2\pi\left(n_1 t + \frac{x}{\lambda_1}\right)$

**(ii)** $y_2 = A\cos 2\pi\left(n_1 t + \frac{x}{\lambda_1} + \pi\right)$

**(iii)** $y_3 = A\cos 2\pi\left(n_2 t + \frac{x}{\lambda_2}\right)$

**(iv)** $y_4 = A\cos 2\pi\left(n_2 t - \frac{x}{\lambda_2}\right)$

**The pairs of waves which will produce destructive interference and stationary waves respectively in a medium, are**

**Options:**

A. (iii, iv), (i, ii)

B. (i, iii), (ii, iv)

C. (i, iv), (ii, iii)

D. (i, ii), (iii, iv)

**Answer: D**

## Solution:

**Solution:**

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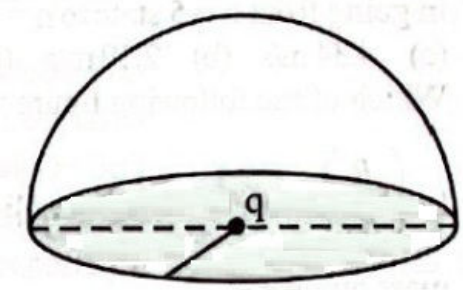
# Question 4

**If a charge q is placed at the centre of a closed hemispherical non-conducting surface, the total flux passing through the flat surface would be :**




**Options:**

A. zero

B. $\frac{q}{2\varepsilon_0}$

C. $\frac{q}{4\varepsilon_0}$

D. $\frac{q}{2\pi\varepsilon_0}$

**Answer: A**

## Solution:

**Solution:**

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# Question 5

### The electric potential V (x) in a region around the origin is given by $V(x) = 4x^2$ volts. The electric charge enclosed in a cube of 1m side with its centre at the origin is (in coulomb)

**Options:**

A. $8\varepsilon_0$

B. $-4\varepsilon_0$

C. 0

D. $-8\varepsilon_0$

**Answer: D**

## Solution:

**Solution:**

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# Question 6

### A heater coil is cut into two equal parts and only one part is now used in the heater. The heat generated will now be

**Options:**

A. four times

B. doubled

C. halved

D. one fourth

**Answer: B**

## Solution:

**Solution:**

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# Question 7

## In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be a

**Options:**

A. helix

B. straight line

C. ellipse

D. circle

**Answer: B**

## Solution:

**Solution:**

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# Question 8

## An object is thrown vertically upwards. At its maximum height, which of the following quantity becomes zero ?

**Options:**

A. Momentum

B. Potential energy

C. Acceleration

D. Force

**Answer: A**

## Solution:

**Solution:**

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# Question 9

## The self induced emf of a coil is 25 volts. When the current in it is changed at uniform rate from 10A to 25 A in 1 s, the change in the

**energy of the inductance is:**

**Options:**

A. 740J

B. 437.5J

C. 540J

D. 637.5J

**Answer: B**

## Solution:

**Solution:**

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# Question 10

## Alternating current can not be measured by D.C. ammeter because

**Options:**

A. Average value of current for complete cycle is zero

B. A.C. Changes direction

C. A.C. can not pass through D.C. Ammeter

D. D.C. Ammeter will get damaged.

**Answer: A**

## Solution:

**Solution:**

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# Question 11

## The magnetic field of a plane electromagnetic wave is given by: $\vec{B} = 2 \times 10^{-8} \sin(0.5 \times 10^{3} x + 1.5 \times 10^{11} t)\hat{j}T$ . The amplitude of the electric field would be:

**Options:**

A. $6 Vm^{-1}$ along x-axis

B. $3 Vm^{-1}$ along z-axis

C. $6 Vm^{-1}$ along z-axis

D. $2 \times 10^{-8} Vm^{-1}$ along z-axis

**Answer: A**

## Solution:

**Solution:**

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# Question 12

## An ideal gas is expanding such that $PT^3$ = constant. The coefficient of volume expansion of the gas is :

**Options:**

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

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

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

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

**Answer: C**

## Solution:

**Solution:**

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# Question 13

## Two light beams of intensities in the ratio of 9 : 4 are allowed to interfere. The ratio of the intensity of maxima and minima will be :

**Options:**

A. 2 : 3

B. 16 : 81

C. 25 : 169

D. 25 : 1

**Answer: B**

## Solution:

**Solution:**

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# Question 14

## The deBroglie wavelength of a proton and α-particle are equal. The ratio of their velocities is :

**Options:**

A. 4 : 3

B. 4 : 1

C. 4 : 2

D. 1 : 4

**Answer: B**

## Solution:

**Solution:**

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# Question 15

## The recoil speed of a hydrogen atom after it e in going from n = 5 state to n = 1 state will be

**Options:**

A. 4.34m / s

B. 2.19m / s

C. 4.17m / s

D. 3.25m / s

**Answer: C**

## Solution:

**Solution:**

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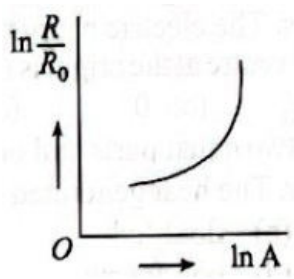
# Question 16

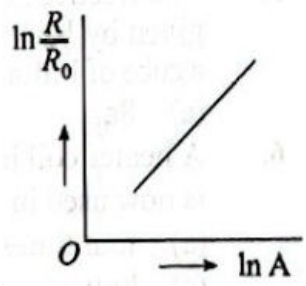
## Which of the following figure represents the variation or $\ln\left(\frac{R}{R_0}\right)$ with $\ln A$ (If R = radius of a nucleus and A = its mass number)?

**Options:**

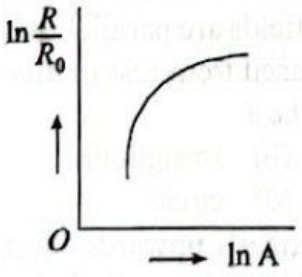
A.



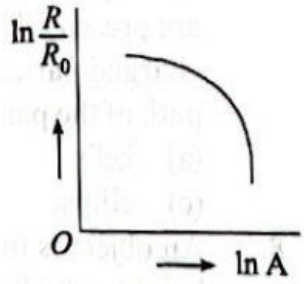

B.




C.




D.




**Answer: B**

## Solution:

**Solution:**

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# Question 17

## Zener breakdown occurs in a p − n junction having p and n both :

**Options:**

A. lightly doped and have wide depletion layer

B. heavily doped and have narrow depletion layer

C. lightly doped and have narrow depletion layer

D. heavily doped and have wide depletion layer

**Answer: B**

## Solution:

**Solution:**

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# Question 18

## If E and H represents the intensity of electric field and magnetising field respectively, then the unit of E / H will be :

**Options:**

A. ohm

B. mho

C. joule

D. newton

**Answer: A**

## Solution:

**Solution:**

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# Question 19

## A stone of mass m, tied to a string is being whiried in a vertical circle with a uniform speed. The tension in the string is :

**Options:**

A. the same throughout the motion

B. minimum at the highest position of the circular path

C. minimum at the lowest position of the circular path

D. minimum when the rope is in the horizontal position

**Answer: B**

## Solution:

**Solution:**

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# Question 20

**A particle is moving with a velocity $\vec{v} = K\left(y\hat{i} + x\hat{j}\right)$, where K is a constant. The general equation for its path is:**

**Options:**

A. $y = x^2 + \text{constant}$

B. $y^2 = x + \text{constant}$

C. $y^2 = x^2 + \text{constant}$

D. $xy = \text{constant}$

**Answer: C**

## Solution:

**Solution:**

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# Question 21

**A particle of mass M originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation**

$$F = F_0\left[1 - \left(\frac{t-T}{T}\right)^2\right]$$

**Where $F_0$ and T are constants. The force acts only for the time interval 2T. The velocityv of the particle after time 2T is:**

**Options:**

A. $2F_0T / M$

B. $F_0T / 2M$

C. $4F_0T / 3M$

D. $F_0T / 3M$

**Answer: C**

## Solution:

**Solution:**

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# Question 22

## The magnetic moment of an electron (e) revolving in an orbit around nucleus with an orbital angular momentum is given by:

**Options:**

A. $\vec{\mu}_L = \frac{e\vec{L}}{2m}$

B. $\vec{\mu}_L = -\frac{e\vec{L}}{2m}$

C. $\vec{\mu}_l = -\frac{e\vec{L}}{m}$

D. $\vec{\mu}_l = \frac{2e\vec{L}}{m}$

**Answer: B**

## Solution:

**Solution:**

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# Question 23

## Angular momentum of the particle rotating with a central force is constant due to

**Options:**

A. constant torque

B. constant force

C. constant linear momentum

D. zero torque

**Answer: D**

## Solution:

**Solution:**

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# Question 24

## The escape velocity of a body depends upon mass as

**Options:**

A. $m^0$

B. $m^1$

C. $m^2$

D. $m^3$

**Answer: A**

## Solution:

**Solution:**

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# Question 25

**Potential energy as a function of r is given by $U = \frac{A}{r^{10}} - \frac{B}{r^5}$, where r is the interatomic distance, A and B are positive constants. The equilibrium distance between the two atoms will be :**

**Options:**

A. $\left(\frac{A}{B}\right)^{\frac{1}{5}}$

B. $\left(\frac{B}{A}\right)^{\frac{1}{5}}$

C. $\left(\frac{2A}{B}\right)^{\frac{1}{5}}$

D. $\left(\frac{B}{2A}\right)^{\frac{1}{5}}$

**Answer: C**

## Solution:

**Solution:**

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# Question 26

**If two soap bubbles of different radii are connected by a tube**

**Options:**

A. air flows from the smaller bubble to the bigger

B. air flows from bigger bubble to the smaller bubble till the sizes are interchanged

C. air flows from the bigger bubble to the smaller bubble till the sizes become equal

D. there is no flow of air.

**Answer: A**

## Solution:

**Solution:**

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# Question 27

## The focal length f is related to the radius of curvature r of the spherical convex mirror by:

**Options:**

A. $f = +\frac{1}{2}r$

B. $f = -r$

C. $f = -\frac{1}{2}r$

D. $f = r$

**Answer: A**

## Solution:

**Solution:**

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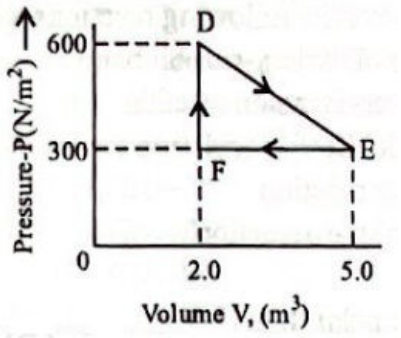
# Question 28

## A thermodynamic system is taken from an original state D to an intermediate state E by the linear process shown in the figure. Its volume is then reduced to the original volume from E to F by an isobaric process. The total work done by the gas from D to E to F will be

Volume V, ($m^3$)




**Options:**

A. $-450J$

B. 450J

C. 900J

D. 1350J

**Answer: B**

## Solution:

**Solution:**

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# Question 29

**A vertical electric field of magnitude $4.9 \times 10^5$N / C just prevents a water droplet of a mass 0.1g from falling. The value of charge on the droplet will be :**
**(Given g = 9.8m / $s^2$ )**

**Options:**

A. $1.6 \times 10^{-9}$C

B. $2.0 \times 10^{-9}$C

C. $3.2 \times 10^{-9}$C

D. $0.5 \times 10^{-9}$C

**Answer: B**

## Solution:

**Solution:**

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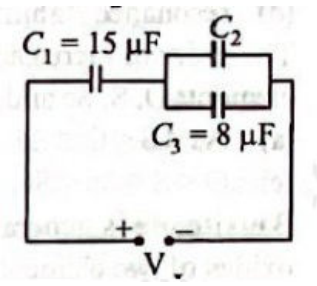
# Question 30

**In the circuit shown in the figure, the total charge is 750μC and the voltage across capacitor $C_2$ is 20V. Then the charge on capacitor $C_2$ is :**




**Options:**

A. 450μC

B. 590μC

C. 160μC

D. 650μC

**Answer: B**

## Solution:

**Solution:**

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# Question 31

## For a transistor α and β are given as α = $\frac{I_C}{I_E}$ and β = $\frac{I_C}{I_B}$. Then the correct relation between α and β will be:

**Options:**

A. $\alpha = \frac{1-\beta}{\beta}$

B. $\beta = \frac{\alpha}{1-\alpha}$

C. $\alpha\beta = 1$

D. $\alpha = \frac{\beta}{1-\beta}$

**Answer: B**

## Solution:

**Solution:**

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# Question 32

## A current I flows along the length of an infinitely long, straight, thin walled pipe. Then

**Options:**

A. the magnetic field at all points inside the pipe is the same, but not zero

B. the magnetic field is zero only on the axis of the pipe

C. the magnetic field is different at different points inside the pipe

D. the magnetic field at any point inside the pipe is zero

**Answer: D**

## Solution:

**Solution:**

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# Question 33

## A Carnot engine has efficiency of 50%. If the temperature of sink is reduced by 40˚C, its efficiency increases by 30%. The temperature of the source will be :

**Options:**

A. 166.7K

B. 255.1K

C. 266.7K

D. 367.7K

**Answer: C**

## Solution:

**Solution:**

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# Question 34

## When you walk through a metal detector carrying a metal object in your pocket, it raises an alarm. This phenomenon works on

**Options:**

A. Electromagnetic induction

B. Resonance in ac circuits

C. Mutual induction in ac circuits

D. interference of electromagnetic waves

**Answer: B**

## Solution:

**Solution:**

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# Question 35

## An electron moving with speed v and a pno with speed c, have same D-Broglie wavelength. The ratio of kinetic energy of electron to that of photon is :

**Options:**

A. $\frac{3c}{v}$

B. $\frac{v}{3c}$

C. $\frac{v}{2c}$

D. $\frac{2c}{v}$

**Answer: C**

## Solution:

**Solution:**

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# Chemistry

# Question 36

### PART-II (Chemistry)
### Assuming fully decomposed, the volume of $CO_2$ released will be

**Options:**

A. 1.12L

B. 2.24L

C. 4.06L

D. 0.84L

**Answer: A**

## Solution:

**Solution:**

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# Question 37

### Among the following, the species having the smallest bond is

**Options:**

A. $NO^-$

B. $NO^+$

C. $O_2$

D. NO

**Answer: B**

## Solution:

**Solution:**

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# Question 38

## The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is

**Options:**

A. +3

B. +2

C. +1

D. -1

**Answer: C**

## Solution:

**Solution:**

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# Question 39

## The correct order of thermal stability of hydroxides is:

**Options:**

A. $Ba(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Mg(OH)_2$

B. $Mg(OH)_2 < Sr(OH)_2 < Ca(OH)_2 < Ba(OH)_2$

C. $Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$

D. $Ba(OH)_2 < Sr(OH)_2 < Ca(OH)_2 < Mg(OH)_2$

**Answer: D**

## Solution:

**Solution:**

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# Question 40

## Which of the following has correct increasing basic strength?

**Options:**

A. MgO < BeO < CaO < BaO

B. BeO < MgO < CaO < BaO

C. BaO < CaO < MgO < BeO

D. CaO < BaO < BeO < MgO

**Answer: B**

## Solution:

**Solution:**

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# Question 41

## Water sample is reported to be highly polluted if BOD (Biological Oxygen Demand) value of sample becomes

**Options:**

A. more than 17 ppm.

B. equal to 10 ppm.

C. equal to 5 ppm.

D. less than 5 ppm.

**Answer: A**

## Solution:

**Solution:**

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# Question 42

## 200 mL of an aqueous solution of a protein contains its 1.26g. The osmotic pressure of this solution at 300K is found to be $2.57 \times 10^{-3}$ bar. The molar mass of protein will be (R = 0.083L bar mol $^{-1}K^{-1}$)

**Options:**

A. $51022 gmol^{-1}$

B. $122044 gmol^{-1}$

C. $31011 gmol^{-1}$

D. $61038 gmol^{-1}$

**Answer: D**

## Solution:

**Solution:**

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# Question 43

## Lyophilic sols are more stable than lyophobic sols because:

**Options:**

A. the colloidal particles have positive charge

B. the colloidal particles have negative charge

C. the colloidal particles are solvated

D. there is strong electrostatic repulsion between the colloidal particles

**Answer: C**

## Solution:

**Solution:**

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# Question 44

## Which of the following is not permissible arrangement of electrons in an atom?

**Options:**

A. $n = 5, l = 3, m = 0, s = +1 / 2$

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

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

D. $n = 4, l = 0, m = 0, s = -1 / 2$

**Answer: B**

## Solution:

**Solution:**

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# Question 45

**The value of van der Waals constant ' a ' for gases $O_2$, $N_2$ ' $NH_3$ and $CH_4$ are 1.360, 1.390, 4.170 and 2.253 litre $^2$ atm mol $^{-2}$ respectively. The gas which can most easily be liquefied is :**

**Options:**

A. $O_2$

B. $N_2$

C. $NH_3$

D. $CH_4$

**Answer: C**

## Solution:

**Solution:**

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# Question 46

**Which one of the following does not have a pyramidal shape?**

**Options:**

A. $(CH_3)_3N$

B. $(SiH_3)_3N$

C. $P(CH_3)_3$

D. $P(SiH_3)_3$

**Answer: B**

## Solution:

**Solution:**

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# Question 47

**Boric acid is polymeric due to**

**Options:**

A. its acidic nature

B. the presence of hydrogen bonds

C. its monobasic nature

D. its geometry

**Answer: B**

## Solution:

**Solution:**

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# Question 48

## Which of the following order is not correct?

**Options:**

A. $MeBr > Me_2CHBr > Me_3CBr > Et_3CBr(S_N2)$

B. $PhCH_2Br > PhCHBrMe > PhCBrMe_2 > PhCBrMePh(S_N1)$

C. $MeI > MeBr > MeCl > MeF(S_N2)$

D. All are correct

**Answer: B**

## Solution:

**Solution:**

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# Question 49

## A catalyst is a substance which :

**Options:**

A. is always in the same phase as in the reaction

B. alters the equilibrium in a reaction

C. does not participate in the reaction but alters the rate of reaction

D. participates in the reaction and provides an easier pathway for the same

**Answer: A**

## Solution:

**Solution:**

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# Question 50

## Which of the following is a non-reducing sugar?

**Options:**

A. Lactose

B. Fructose

C. Sucrose

D. Maltose

**Answer: C**

## Solution:

**Solution:**

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# Question 51

## An ideal gas expands against a constant external pressure of 2.0 atmosphere from 20 litre to 40 litre and absorbs 10 kJ of heat from surrounding. What is the change in internal energy of the system? (given: 1 atm-litre = 101.3J )

**Options:**

A. 4052J

B. 5948J

C. 14052J

D. 9940J

**Answer: B**

## Solution:

**Solution:**

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# Question 52

## The polymer used for optical lenses is :

**Options:**

A. polypropylene

B. polyvinyl chloride

C. polythene

D. polymethyl methacrylate

**Answer: D**

## Solution:

**Solution:**

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# Question 53

## Which of the following arrangements represents the increasing order (smallest to largest) of ionic radii of the given species $O^{2-}$, $S^{2-}$, $N^{3-}$, $P^{3-}$ ?

**Options:**

A. $O^{2-} < N^{3-} < S^{2-} < P^{3-}$

B. $O^{2-} < P^{3-} < N^{3-} < S^{2-}$

C. $N^{3} < O^{2-} < P^{3-} < S^{2-}$

D. $N^{3-} < S^{2-} < O^{2-} < P^{3-}$

**Answer: A**

## Solution:

**Solution:**

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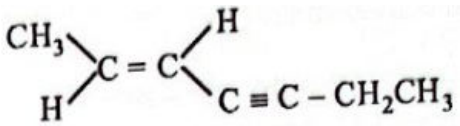
# Question 54

## The IUPAC name of the following compound is



**Options:**

A. (E)-2-hepten-4-yne

B. (Z)-5-hepten-3-yne

C. (E)-5-hepten-3-yne

D. (Z)-2-hepten-4-yne

**Answer: A**

## Solution:

**Solution:**

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# Question 55

## In CsCl type structure, the co-ordination number of $Cs^{+}$ and $Cl^{-}$respectively are

**Options:**

A. 6,6

B. 6,8

C. 8,8

D. 8,6

**Answer: C**

## Solution:

**Solution:**

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# Question 56

## Which one of the following reactions will not result in the formation of carbon-carbon bond?

**Options:**

A. Reimer-Tiemann reaction

B. Friedel Craft's acylation

C. Wurtz reaction

D. Cannizzaro reaction

**Answer: D**

## Solution:

**Solution:**

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# Question 57

### Water is :

**Options:**

A. more polar than $H_2S$

B. more or less identical in polarity with $H_2S$

C. less polar than $H_2S$

D. None of these

**Answer: A**

### Solution:

**Solution:**

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# Question 58

### Carboxylic acids are more acidic than phenol and alcohol because of

**Options:**

A. intermolecular hydrogen bonding

B. formation of dimers

C. highly acidic hydrogen

D. resonance stabilization of their conjugate base

**Answer: D**

### Solution:

**Solution:**

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# Question 59

### The order of increasing sizes of atomic radil among the elements O, S, Se and As is :

**Options:**

A. As <S < O < Se

B. Se < S < As <0

C. O < S < As <Se

D. O <S < Se < As

**Answer: D**

## Solution:

**Solution:**

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# Question 60

### Bauxite ore is generally contaminated with impurity of oxides of two elements X and Y. Which of the following statement is correct?

**Options:**

A. X is a non-metal and belongs to the third period while Y is a metal and belongs to the fourth period.

B. One of two oxides has three-dimensional polymeric structure.

C. Both (a) and (b) are correct.

D. None of the above.

**Answer: C**

## Solution:

**Solution:**

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# Question 61

### The partial pressure of $CH_3OH(g)$, $CO(g)$ and $H_2(g)$ in equilibrium mixture for the reaction, $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ are 2.0, 1.0 and 0.1 atm respectively at 427˚C. The value of $K_p$ for the decomposition of $CH_3OH$ to CO and $H_2$ is

**Options:**

A. $10^2$ atm

B. $2 \times 10^2 atm^{-1}$

C. $50 atm^2$

D. $5 \times 10^{-3} atm^2$

**Answer: D**

## Solution:

**Solution:**

---

# Question 62

## The conjugate base of $(CH_3)_2NH_2^+$ is

**Options:**

A. $(CH_3)_2\,NH$

B. $(CH_3)_2N^+$

C. $(CH_3)_3N^+$

D. $(CH_3)_2N^-$

**Answer: A**

## Solution:

**Solution:**

---

# Question 63

## Which of the following is not present in a nucleotide?

**Options:**

A. Guanine

B. Cytosine

C. Adenine

D. Tyrosine

**Answer: D**

## Solution:

**Solution:**

---

# Question 64

## The shape of $[Cu(NH_3)_4]^{2+}$ is

**Options:**

A. tetrahedral

B. square planar

C. pyramidal

D. octahedral

**Answer: B**

## Solution:

**Solution:**

---

# Question 65

## Heroin is a derivative of

**Options:**

A. cocaine

B. morphine

C. caffeine

D. nicotine

**Answer: B**

## Solution:

**Solution:**

---

# Question 66

## The limiting equivalent conductivity of NaCl, KCl and KBr are 126.5, 150.0 and 151.5$Scm^2$ $eq^{-1}$, respectively. The limiting equivalent ionic conductivity for Br is 78$Scm^2$ $eq^{-1}$. The limiting equivalent ionic conductivity for $Na^+$ions would be :

**Options:**

A. 128

B. 125

C. 49

D. 50

**Answer: D**

## Solution:

**Solution:**

---

# Question 67

## Rate of dehydration of alcohols follows the order:

**Options:**

A. $2^{\circ} > 1^{\circ} > CH_3OH > 3^{\circ}$

B. $3^{\circ} > 2^{\circ} > 1^{\circ} > CH_3OH$

C. $2^{\circ} > 3^{\circ} > 1^{\circ} > CH_3OH$

D. $CH_3OH > 1^{\circ} > 2^{\circ} > 3^{\circ}$

**Answer: B**

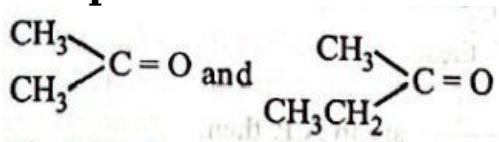
## Solution:

**Solution:**

---

# Question 68

## An alkene having molecular formula $C_7H_{14}$ was subjected to ozonolysis in the presence of zinc dust. An equimolar amount of the following two compounds was obtained




## The IUPAC name of the alkene is

**Options:**

A. 3,4-dimethyl-3-pentene

B. 3,4-dimethyl-2-pentene

C. 2,3-dimethyl-3-pentene

D. 2,3-dimethyl-2-pentene

**Answer: D**

## Solution:

**Solution:**

---

# Question 69

## Lanthanoid contraction can be observed in

**Options:**

A. At

B. Gd

C. Ac

D. Lw

**Answer: B**

## Solution:

**Solution:**

---

# Question 70

## The form of iron obtained from blast furnace is:

**Options:**

A. Steel

B. Cast Iron

C. Pig Iron

D. Wrought Iron

**Answer: B**

## Solution:

**Solution:**

---

# Mathematics

# Question 71

## Mathematics
## A class has 175 students. The following data shows the number of students opting one or more subjects. Maths-100, Physics-70, Chemistry-40, Maths and Physics-30, Maths and Chemistry-28, Physics and Chemistry-23, Maths, Physics and Chemistry-18. How many have offered Maths alone?

**Options:**

A. 35

B. 48

C. 60

D. 22

**Answer: C**

---

# Question 72

## Let R be a relation on the set N be defined by $\{(x, y) \mid x, y \in N, 2x + y = 41\}$. Then, R is

**Options:**

A. Reflexive

B. Symmetric

C. Transitive

D. None of these

**Answer: D**

---

# Question 73

## The function $f : R \to R$ defined by $f(x) = x^2 + x$ is.

**Options:**

A. one-one

B. onto

C. many-one

D. None of these

**Answer: C**

---

# Question 74

## If $12\cot^2\theta - 31\,\text{cosec}\,\theta + 32 = 0$, then the value of $\sin\theta$ is

**Options:**

A. $\frac{3}{5}$ or 1

B. $\frac{2}{3}$ or $\frac{-2}{3}$

C. $\frac{4}{5}$ or $\frac{3}{4}$

D. $\pm \frac{1}{2}$

**Answer: C**

---

# Question 75

## The modulus of $\frac{(1 + i\sqrt{3})(2 + 2i)}{(\sqrt{3} - i)}$ is

**Options:**

A. 2

B. 4

C. $3\sqrt{2}$

D. $2\sqrt{2}$

**Answer: D**

---

# Question 76

## If α, β are the roots of the equation $ax^2 + bx + c = 0$, then $\frac{\alpha}{a\beta + b} + \frac{\beta}{a\alpha + b} =$

**Options:**

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

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

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

D. $-\frac{2}{a}$

**Answer: D**

---

# Question 77

## The solution set of the inequality $37 - (3x + 5) \geq 9x - 8(x - 3)$ is

**Options:**

A. $(-\infty, 2)$

B. $(-\infty, -2)$

C. $(-\infty, 2]$

D. $(-\infty, -2]$

**Answer: C**

---

# Question 78

**If ${}^{n+2}C_8 : {}^{n-2}P_4 = 57 : 16$, then the value of n is:**

**Options:**

A. 20

B. 19

C. 18

D. 17

**Answer: B**

---

# Question 79

**The middle term in the expansion of $\left(\frac{10}{x} + \frac{x}{10}\right)^{10}$ is**

**Options:**

A. ${}^{10}C_5$

B. ${}^{10}C_6$

C. ${}^{10}C_5 \frac{1}{x^{10}}$

D. ${}^{10}C_5 x^{10}$

**Answer: A**

---

# Question 80

**The fourth, seventh and tenth terms of a G.P. are p, q, r respectively, then :**

**Options:**

A. $p^2 = q^2 + r^2$

B. $q^2 = pr$

C. $p^2 = qr$

D. $pqr + pq + 1 = 0$

**Answer: B**

---

# Question 81

## The point $(t^2 + 2t + 5, 2t^2 + t - 2)$ lies on the line $x + y = 2$ for

**Options:**

A. All real values of t

B. Some real values of t

C. t = $\frac{-3 \pm \sqrt{3}}{6}$

D. None of these

**Answer: D**

---

# Question 82

## The equations of the lines which cuts off an intercept 1 from y-axis and equally inclined to the axes are

**Options:**

A. $x - y + 1 = 0, x + y + 1 = 0$

B. $x - y - 1 = 0, x + y - 1 = 0$

C. $x - y - 1 = 0, x + y + 1 = 0$

D. None of these

**Answer: C**

---

# Question 83

## The distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$ is $\frac{a}{b}$. Value of a + b is

**Options:**

A. 2

B. 5

C. 7

D. 3

**Answer: C**

---

# Question 84

## For what value of k, does the equation

**$9x^2 + y^2 = k(x^2 - y^2 - 2x)$**
**represent equation of a circle ?**

**Options:**

A. 1

B. 2

C. -1

D. 4

**Answer: D**

---

# Question 85

**A parabola has the origin as its focus and the line x = 2 as the directrix. Then the vertex of the parabola is at**

**Options:**

A. (0, 2)

B. (1, 0)

C. (0, 1)

D. (2, 0)

**Answer: B**

---

# Question 86

**Equation of the ellipse whose axes are the axes of coordinates and which passes through the point $(-3, 1)$ and has eccentricity $\sqrt{\frac{2}{5}}$ is**

**Options:**

A. $5x^2 + 3y^2 - 48 = 0$

B. $3x^2 + 5y^2 - 15 = 0$

C. $5x^2 + 3y^2 - 32 = 0$

D. $3x^2 + 5y^2 - 32 = 0$

**Answer: D**

---

# Question 87

**The co-ordinates of the point which in the ratio 3; 4 internally are points $(2, -1, 3)$ and $(4, 3, 1)$ in the ratio 3 : 4 internally are given by :**

**Options:**

A. $\left( \frac{2}{7}, \frac{20}{7}, \frac{10}{7} \right)$

B. $\left( \frac{10}{7}, \frac{15}{7}, \frac{2}{7} \right)$

C. $\left( \frac{20}{7}, \frac{5}{7}, \frac{15}{7} \right)$

D. $\left( \frac{15}{7}, \frac{20}{7}, \frac{3}{7} \right)$

**Answer: C**

---

# Question 88

**The relationship between a and b, so that the function f defined by**

**f (x) =** $\begin{cases} ax + 1 & \text{if } x \leq 3 \\ bx + 3 & \text{if } x > 3 \end{cases}$ **. is continuous at x = 3, is**

**Options:**

A. $a = b + \frac{2}{3}$

B. $a - b = \frac{3}{2}$

C. $a + b = \frac{2}{3}$

D. $a + b = 2$

**Answer: A**

---

# Question 89

**f (x) =** $\begin{cases} x \sin \frac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$ **at x = 0 is**

**Options:**

A. continuous as well as differentiable

B. differentiable but not continuous

C. continuous but not differentiable

D. neither continuous nor differentiable

**Answer: C**

---

# Question 90

### The variance of the data 2, 4, 6, 8, 10 is

**Options:**

A. 8

B. 7

C. 6

D. None of these

**Answer: A**

---

# Question 91

### Find the probability of getting the sum as a perfect square number when two dice are thrown together.

**Options:**

A. 5 / 12

B. 7 / 18

C. 7 / 36

D. None of these

**Answer: C**

---

# Question 92

### The principal value of $\sin^{-1}\left(\sin\ \frac{5\pi}{3}\right)$ is

**Options:**

A. $-\frac{5\pi}{3}$

B. $\frac{5\pi}{3}$

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

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

**Answer: C**

---

# Question 93

**If the system of linear equations**
**$x + ky + 3z = 0$**
**$3x + ky - 2z = 0$**
**$2x + 4y - 3z = 0$**
**has a non-zero solution (x, y, z), then $\frac{xz}{y^2}$ is equal to :**

**Options:**

A. 10

B. -30

C. 30

D. -10

**Answer: A**

---

# Question 94

**The value of definite integral $\int_0^{\frac{\pi}{2}} \log(\tan x)\, dx$ is**

**Options:**

A. 0

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

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

D. p

**Answer: A**

---

# Question 95

**The area enclosed between the graph of $y = x^3$ and the lines $x = 0$, $y = 1$, $y = 8$ is**

**Options:**

A. $\frac{45}{4}$

B. 14

C. 7

D. None of these

**Answer: A**

---

# Question 96

**The total number of 3-digit numbers, the sum of whose digits is even, is equal to**

**Options:**

A. 450

B. 350

C. 250

D. 325

**Answer: A**

---

# Question 97

**To fill 12 vacancies, there are 25 candidates of which five are from scheduled caste. If 3 of the vacancies are reserved for scheduled caste candidates while the rest are open to all, then the number of ways in which the selection can be made**

**Options:**

A. ${}^{5}C_{3} \times {}^{22}C_{9}$

B. ${}^{22}C_{9} - {}^{5}C_{3}$

C. ${}^{22}C_{3} + {}^{5}C_{3}$

D. None of these

**Answer: A**

---

# Question 98

**$\frac{1}{q+r}$, $\frac{1}{r+p}$, $\frac{1}{p+q}$ are in A.P. then,**

**Options:**

A. p, q, r are in A.P

B. $p^2$, $q^2$, $r^2$ are in A.P

C. $\frac{1}{p}$, $\frac{1}{q}$, $\frac{1}{r}$ are in A.P

D. p + q + r are in A.P

**Answer: B**

---

# Question 99

**The sum of the first n terms of the series**
**$1^2 + 2.2^2 + 3^2 + 2.4^2 + 5^2 + 2.6^2 + \ldots$**
**is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd the sum is**

**Options:**

A. $\left[\frac{n(n+1)}{2}\right]^2$

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

C. $\frac{n(n+1)^2}{4}$

D. $\frac{3n(n+1)}{2}$

**Answer: B**

---

# Question 100

**The locus of a point that is equidistant from the lines $x + y - 2\sqrt{2} = 0$ and $x + y - \sqrt{2} = 0$ is**

**Options:**

A. $x + y - 5\sqrt{2} = 0$

B. $x + y - 3\sqrt{2} = 0$

C. $2x + 2y - 3\sqrt{2} = 0$

D. $2x + 2y - 5\sqrt{2} = 0$

**Answer: C**

---

# Question 101

**The point diametrically opposite to the point P(1, 0) on the circle $x^2 + y^2 + 2x + 4y - 3 = 0$ is**

**Options:**

A. $(3, -4)$

B. $(-3, 4)$

C. $(-3, -4)$

D. $(3, 4)$

**Answer: C**

---

# Question 102

**For the parabola $y^2 = -12x$, equation of directrix is x = a. The value of ' a ' is**

**Options:**

A. 3

B. 4

C. 2

D. 6

**Answer: A**

---

# Question 103

**The eccentricity of the curve $2x^2 + y^2 - 8x - 2y + 1 = 0$ is:**

**Options:**

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

B. $\frac{1}{\sqrt{2}}$

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

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

**Answer: B**

---

# Question 104

**The equation of the hyperbola with vertices at (0, ±6) and e = $\frac{5}{3}$ is**

**Options:**

A. $\frac{x^2}{36} - \frac{y^2}{64} = 1$

B. $\frac{y^2}{36} - \frac{x^2}{64} = 1$

C. $\frac{x^2}{64} - \frac{y^2}{36} = 1$

D. $\frac{y^2}{64} - \frac{x^2}{36} = 1$

**Answer: B**

---

# Question 105

$$\begin{vmatrix} \sin^2 x & \cos^2 x & 1 \\ \cos^2 x & \sin^2 x & 1 \\ -10 & 12 & 2 \end{vmatrix}$$ **is equal to:**

**Options:**

A. 0

B. $12\cos^2 x - 10\sin^2 x$

C. $12\cos^2 x - 10\sin^2 x - 2$

D. $10\sin 2x$

**Answer: A**

---

# Question 106

**The function f (x) =** $\begin{cases} x[x] & \text{if } 0 \le x < 2 \\ (x-1)x & \text{if } 2 \le x < 3 \end{cases}$ **.**

**Options:**

A. differentiable at x = 2

B. not differentiable at x = 2

C. continuous at x = 2

D. None of these

**Answer: B**

---

# Question 107

**The local minimum value of the function f given by f (x) = 3+ | x | ,x ∈ R is**

**Options:**

A. 1

B. 2

C. 3

D. 0

**Answer: C**

---

# Question 108

**Value of $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}\,dx$ is**

**Options:**

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

B. $\frac{-\pi}{2}$

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

D. None of these

**Answer: C**

---

# Question 109

**The equation of the plane which bisects the angle between the planes $3x - 6y + 2z + 5 = 0$ and $4x - 12y + 3z - 3 = 0$ which contains the origin is**

**Options:**

A. $33x - 13y + 32z + 45 = 0$

B. $x - 3y + z - 5 = 0$

C. $33x + 13y + 32z + 45 = 0$

D. None of these

**Answer: D**

---

# Question 110

**An urn contains five balls. Two balls are drawn and found to be white. The probability that all the balls are white is**

**Options:**

A. $\frac{1}{10}$

B. $\frac{3}{10}$

C. $\frac{3}{5}$

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

**Answer: D**

---

# Aptitude

## Question 111

### PART - IV (APTITUDE TEST)

### What is the total marks obtained by Meera in all the subject?

**Options:**

A. 448

B. 580

C. 470

D. 74.67

**Answer: C**

---

## Question 112

### What is the average marks obtained by these seven students in History? (rounded off to two digits)

**Options:**

A. 72.86

B. 27.32

C. 24.86

D. 29.14

**Answer: A**

---

## Question 113

### How many students have got 60% or more marks in all the subjects?

**Options:**

A. One

B. Two

C. Three

D. Four

**Answer: B**

---

# Question 114

### A series is given, with one term missing. Choose the correct alternative from the given ones that will complete the series. 5, 11, 24, 51, 106,_?

**Options:**

A. 122

B. 217

C. 120

D. 153

**Answer: B**

---

# Question 115

### In a certain code BANKER is written as LFSCBO. How will CONFER be written in that code?

**Options:**

A. GFSDPO

B. GFSEPO

C. FGSDOP

D. FHSDPO

**Answer: A**

---

# Question 116

### Kailash faces towards north. Turnings to his right, he walks 25 metres. He then turns to his left and walks 30 metres. Next, he moves 25 metres to his right. He then turns to the right again and walks 55 metres. Finally, he turns to the right and moves 40 metres. In which direction is he now from his starting point ?

**Options:**

A. South-West

B. North-West

C. South

D. South-East

**Answer: D**

---

# Question 117

**An accurate clock shows 8 O'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 20´ clock in the afternoon?**

**Options:**

A. 144˚

B. 150˚

C. 168˚

D. 180˚

**Answer: D**

---

# Question 118

**Two statements are given followed by three conclusions numbered I, II and III. Assuming the statements to be true, even if they seem to be at variance with commonly known facts, decide which of the conclusions logically follow(s) from the statements.**
**Statements:**
**All utensils are spoons.**
**All bowls are spoons.**
**Conclusions:**
**I. No utensil is a bowls.**
**II. Some utensils are bowls**
**III. No spoon is a utensil.**

**Options:**

A. Only conclusions I follows

B. Conclusions I and III follow

C. Either conclusion I or II follows

D. Only conclusion III follows

**Answer: C**

---

# Question 119

**What was the ratio between the ages of P and Q four years ago?**
**I The ratio between the present ages of P and Q is 3 : 4.**
**II. The ratio between the present ages of Q and R is 4:5.**

**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 both the statements I and II together are not sufficient to answer the question.

D. if the data in both the statementss I and II together are necessary to answer the question.

**Answer: C**

---

# Question 120

**What was the cost price of the suitcase purchased by Samir?**
**I Samir got 25 percent concession on the labelled price.**
**II. Samir sold the suitcase for ₹2000 with 25 percent profit on the labelled price:**

**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 both the statements I and II together are not sufficient to answer the question.

D. if the data in both the statementss I and II together are necessary to answer the question.

**Answer: D**

---

# English

# Question 121

**Read the following passage and answer the question that follows. Choose the correct answer.**
**His instrument struck against something hard, dangerously near the kidney.... "It is not quite at the kidney, my friend," Sadao murmured.... "My friend," he always called his patients and so he did now, forgetting that this was his enemy.**
**To whom does Sadao attend to in the lines above?**

**Options:**

A. A relative

B. His friend

C. His enemy

D. A patient

**Answer: C**

## Solution:

**Solution:**

---

# Question 122

## Choose the correct pronunciation for the word 'sorbet' from the following options:

**Options:**

A. sore-bet

B. sore-bay

C. sore-bye

D. shore- bay

**Answer: B**

## Solution:

**Solution:**

---

# Question 123

## What is the correct syllable division of the word 'indomitable'?

**Options:**

A. in - do - mit - able

B. in - dom- i - ta - ble

C. in - do - mi - ta - ble

D. in - dom - i - table

**Answer: B**

## Solution:

**Solution:**

---

# Question 124

**Read the following passage and the question below. Choose the correct answer.**
**Gandhi never contented himself with large political or economic solutions. He saw the cultural and social backwardness in the Champaran villages and wanted to do something about it immediately. He appealed to teachers.**
**Which of the following statements is true about the passage?**

**Options:**

A. Gandhi was dissatisfied with political or economic solutions

B. Gandhi was interested in the welfare of teachers of Champaran villages

C. Gandhi was happy about the cultural and social backwardness of Champaran villages

D. Gandhi was hopeful that teachers could save villages from cultural and social backwardness

**Answer: D**

## Solution:

**Solution:**

---

# Question 125

## Choose the correct meaning of the idiom 'a bolt out of the blue' from the given options:

**Options:**

A. Something totally unexpected

B. Lightning and thunderstorm

C. To do something kind

D. To mourn after someone

**Answer: A**

## Solution:

**Solution:**

---