

Q1

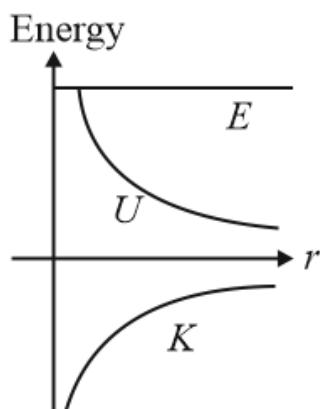
A bar magnet having magnetic moment of $2 \times 10^4 \text{ J T}^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4} \text{ T}$ exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is

- (1) 12 J
- (2) 6 J
- (3) 2 J
- (4) 0.6 J

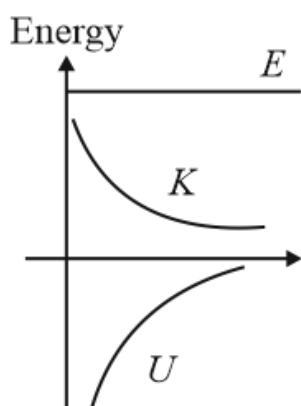
Answer: (2)

Q2

The correct graph representing the variation of total energy E , kinetic energy K and potential energy U of a satellite with its distance from the centre of earth is -

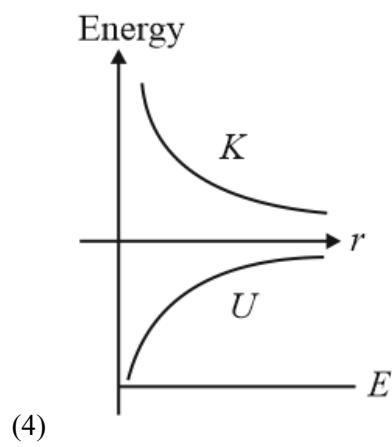
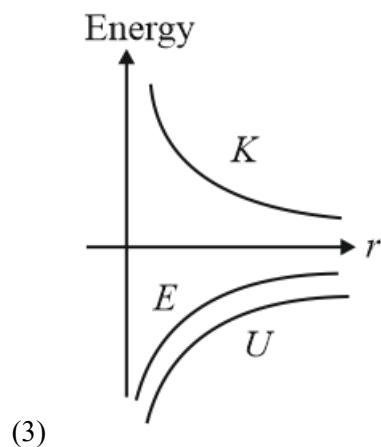


(1)



(2)

Questions with Answer Keys



Answer: (3)

Q3

Match the units/dimensions in Column-I with the physical quantities in column -II :

	Column - I		Column - II
(a)	$[ML^2 T^{-1}]$	(p)	Impulse
(b)	Joule-sec	(q)	Planck's constant
(c)	$[MLT^{-1}]$	(r)	Angular momentum
(d)	Energy per unit frequency	(s)	Linear momentum

(1) a \rightarrow q, r; b \rightarrow q, r; c \rightarrow p, s; d \rightarrow q, r

(2) a \rightarrow q, s; b \rightarrow p, s; c \rightarrow p, r; d \rightarrow p, r

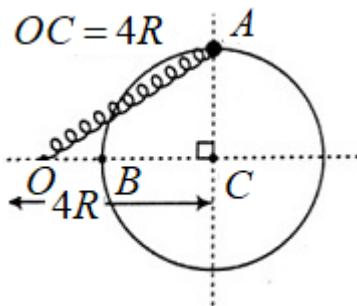
(3) a \rightarrow q, r; b \rightarrow q, r; c \rightarrow q, s; d \rightarrow q, r

(4) a \rightarrow q, s; b \rightarrow p, s; c \rightarrow q, r; d \rightarrow p, r

Answer: (1)

Q4

A bead of mass m can slide without friction on a fixed circular horizontal ring of radius $3R$ having a centre at the point C. The bead is attached to one of the ends of spring with spring constant k . The natural length of spring is R and the other end of the spring is fixed at point O as shown in the figure. If the bead is released from position A, then the kinetic energy of the bead when it reaches point B is



- (1) $\frac{25}{2}kR^2$
- (2) $\frac{9}{2}kR^2$
- (3) $8kR^2$
- (4) $12kR^2$

Answer: (3)

Q5

Photoelectric effect supports quantum nature of light because

1. There is minimum frequency of light below which no photoelectrons are emitted.
2. Electric charge of photoelectrons is quantized.
3. Maximum kinetic energy of photoelectrons depends only on the frequency of light and not on its intensity.
4. Even when metal surface is faintly illuminated the photoelectrons leave the surface immediately.

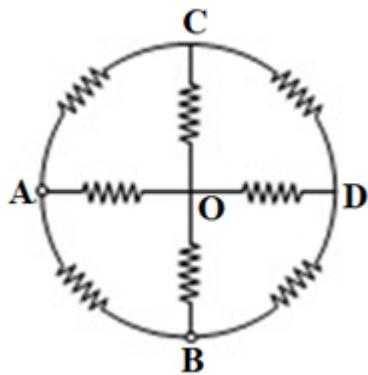
- (1) 1, 2, 3
- (2) 1, 2, 4
- (3) 2, 3, 4
- (4) 1, 3, 4

Answer: (4)

Q6

Questions with Answer Keys

Eight resistances each of resistance $5\ \Omega$ are connected in the circuit as shown in the figure. The equivalent resistance between A and B is –



- (1) $\frac{8}{3}\ \Omega$
- (2) $\frac{16}{3}\ \Omega$
- (3) $\frac{15}{7}\ \Omega$
- (4) $\frac{19}{2}\ \Omega$

Answer: (1)

Q7

Let g be the acceleration due to gravity at the earth's surface and K the rotational kinetic energy of the earth. Which of the following statement is correct if Earth's radius decreases by 2%?

- (1) g increases by 2% and K increases by 2%
- (2) g decreases by 4% and K decreases by 2%
- (3) g increases by 4% and K increases by 4%
- (4) g decreases by 2% and K decreases by 4%

Answer: (3)

Q8

A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant, uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statement from the following :

- (1) The entire rod is at the same electric potential
- (2) There is an electric field in the rod

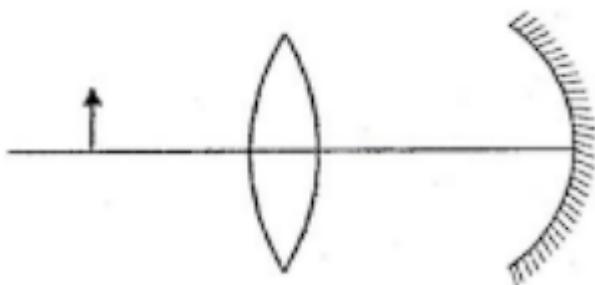
Questions with Answer Keys

- (3) The electric potential is highest at the center of the rod and decreases towards its ends
(4) The electric potential is lowest at the center of the rod and increases towards its ends

Answer: (2)

Q9

Figure shows a thin converging lens for which the focal length is 5.00 cm. The lens is in front of a concave spherical mirror of radius $R = 30$ cm. If the lens and mirror are 20.0 cm apart and an object is placed 15 cm to the left of the lens, determine the approximate distance of the final image from lens. (in cm).



- (1) 5.3 cm
(2) 4.6 cm
(3) 6.1 cm
(4) 12.7 cm

Answer: (1)

Q10

When the arrangement consisting of a horizontal thick copper wire of length $2L$ and radius $2R$, one end of which is welded to an end of another horizontal thin copper wire of length L and radius R is stretched by applying forces at two ends. Ratio of the elongation in the thick wire to that in the thin wire at equilibrium is

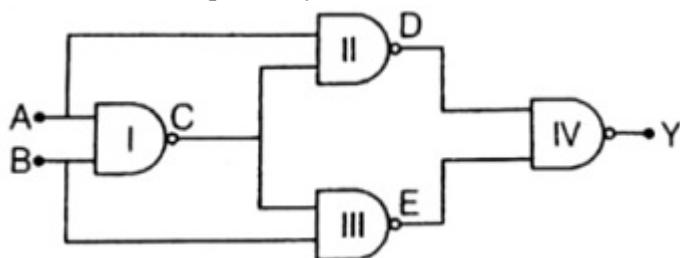
- (1) 0.50 |
(2) 0.25
(3) 4.00
(4) 2.00

Answer: (1)

Questions with Answer Keys

Q11

Select the output Y of the combination of gates shown in figure for inputs $A = 1, B = 0$; $A = 1, B = 1$ and $A = 0, B = 0$ respectively.

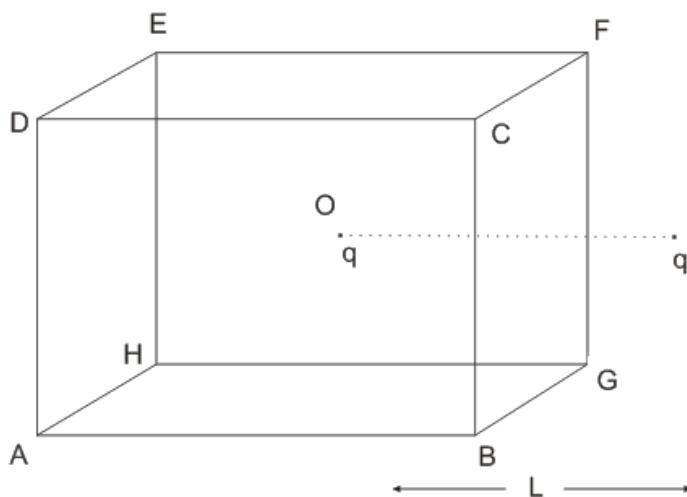


- (1) (0, 1, 1)
- (2) (1, 0, 1)
- (3) (1, 1, 1)
- (4) (1, 0, 0)

Answer: (4)

Q12

A charged particle q is placed at the centre O of a cube of length L (ABCDEFGH). Another same charge q is placed at a distance L from O. If the total electric flux through the cube is 6ϕ then the value of ϕ is



- (1) $\frac{q}{4\epsilon_0}$
- (2) $\frac{q}{6\epsilon_0}$

Questions with Answer Keys

(3) $\frac{q}{2\epsilon_0}$

(4) $\frac{q}{3\epsilon_0}$

Answer: (2)

Q13

A plane Electromagnetic Wave of frequency 30 MHz travels in free space along the x -direction. The electric field component of the wave at a particular point of space and time is $E = 6 \text{ Vm}^{-1}$ along y -direction. Its magnetic field component B at this point would be

- (1) $2 \times 10^{-8} \text{ T}$ along z -direction
- (2) $6 \times 10^{-8} \text{ T}$ along x -direction
- (3) $2 \times 10^{-8} \text{ T}$ along y -direction
- (4) $6 \times 10^{-8} \text{ T}$ along z -direction

Answer: (1)

Q14

The root-mean-square (*RMS*) speed of oxygen molecules (O_2) at a certain temperature T (on Kelvin scale) is V . If the temperature is doubled and oxygen gas dissociates into atomic oxygen, the *RMS* speed becomes

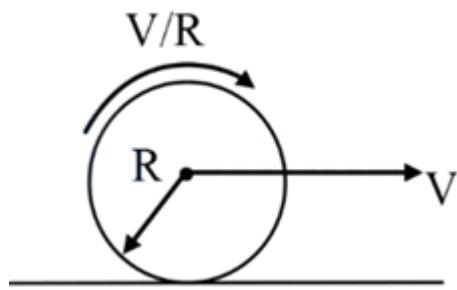
- (1) two times
- (2) three times
- (3) four times
- (4) unchanged

Answer: (1)

Q15

A disc is performing pure rolling on a smooth stationary surface with constant angular velocity as shown in the figure. At any instant, for the lowermost point of the disc.

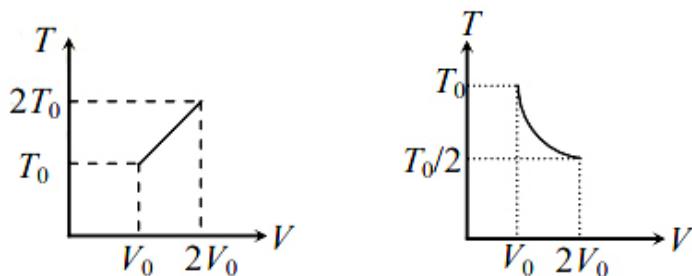
Questions with Answer Keys



- (1) Velocity is v, acceleration is zero
 (2) Velocity is zero, acceleration is zero
 (3) Velocity is v, acceleration is $\frac{v^2}{R}$
 (4) Velocity is zero, acceleration is non zero

Answer: (4)**Q16**

Temperature and volume curves are drawn for two thermodynamic processes. For the first process, it is a straight line and for the second, it is a rectangular hyperbola. The ratio of work done in the first process to the work done in the second process is



- (1) 2:1
 (2) 3:1
 (3) 4:1
 (4) 3:2

Answer: (1)**Q17**

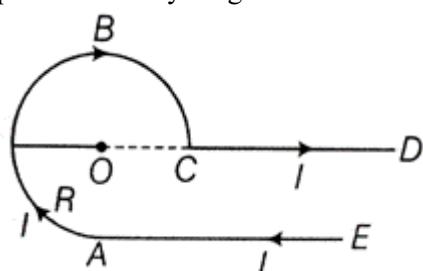
A sinusoidal wave with amplitude y is travelling with speed v on a string with linear density ρ . The angular frequency of the wave is ω . The following conclusions are drawn. Mark the one which is correct. (in particular option, if we are changing one quantity, assume others are kept constant)

Questions with Answer Keys

- (1) Doubling the frequency doubles the rate at which energy is carried along the string
- (2) If the amplitude were doubled, the rate at which energy is carried would be halved
- (3) If the amplitude were doubled, the rate at which energy is carried would be doubled
- (4) The rate at which energy is carried is directly proportional to the velocity of the wave

Answer: (4)**Q18**

Current I is flowing in a conductor as shown in the figure. The radius of the curved part is R . The length of straight portions is very long. The value of the magnetic field at the centre O will be



- (1) $\frac{\mu_0 I}{4\pi R} \left(\frac{3\pi}{2} + 1 \right)$
- (2) $\frac{\mu_0 I}{4\pi R} \left(\frac{3\pi}{2} - 1 \right)$
- (3) $\frac{\mu_0 I}{4\pi R} \left(\frac{\pi}{2} + 1 \right)$
- (4) $\frac{\mu_0 I}{4\pi R} \left(\frac{\pi}{2} - 1 \right)$

Answer: (1)**Q19**

What is likely to be orbit number for a circular orbit of diameter 20 nm of the hydrogen atom, if we assume Bohr orbit to be the same as that represented by the principal quantum number?

- (1) 10
- (2) 14
- (3) 12
- (4) 16

Answer: (2)

Questions with Answer Keys**Q20**

A stone is dropped into a well in which the level of water is h below the top of the well. If v is the velocity of sound, the time T after dropping the stone at which the splash is heard is given by,

(1) $T = \frac{2h}{v}$

(2) $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

(3) $T = \sqrt{\frac{2h}{g}} + \frac{h}{2v}$

(4) $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$

Answer: (2)**Q21**

Using the following data

Mass hydrogen atom = 1. 00783 u

Mass of neutron = 1. 00867 u

Mass of nitrogen atom (${}^7N^{14}$)= 14. 00307 u

The calculated value of the binding energy of the nucleus of the nitrogen atom (${}^7N^{14}$) is close to (Mark answer to nearest integer in MeV)

Answer: 105**Q22**

A $10\mu F$ capacitor is charged to a potential difference of 50 V and is connected to another uncharged capacitor in parallel. Now the common potential difference becomes 20 V. What is the capacitance value (in μF) of the second capacitor?

Answer: 15**Q23**

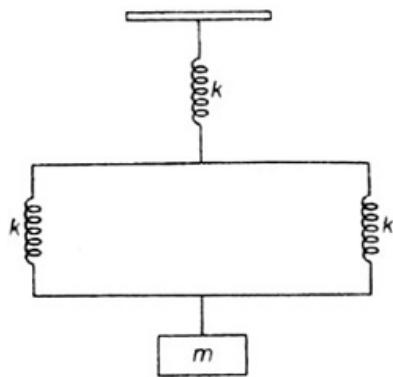
A ball is projected from the ground at an angle of 45° with the horizontal surface. It reaches a maximum height of 120 m and returns to the ground. Upon hitting the ground for the first time, it loses half of its kinetic energy. Immediately after the bounce, the velocity of the ball makes an angle of 30° with the horizontal surface. The maximum height it reaches after the bounce (in meters) is _____.

Answer: 30

Questions with Answer Keys

Q24

Two identical springs (spring constant = k) are connected to two light rigid rods in parallel combination and then a third spring (identical to the other two) is connected to this combination in series. The combined system is fixed to the ceiling and a block of mass m is attached as shown in the figure. If the mass is slightly displaced and then let go, then the system shall oscillate with a time period of $2\pi\sqrt{\frac{Pm}{2k}}$ where P is natural number. Find P .

**Answer: 3****Q25**

2 kg of ice at -20°C is mixed with 5 kg of water at 20°C . The water content of the final mixture is (Latent heat of ice = 80 kcal kg^{-1} , the specific heat of water = $1 \text{ kcal kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$ and specific heat of ice = $0.5 \text{ kcal kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$)
(Mark answer in Kg)

Answer: 6**Q26**

The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by μ . Find 4μ if $\cot \phi = 4$

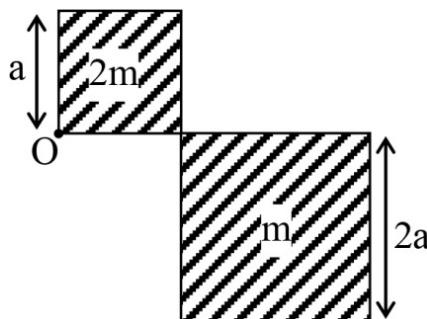
Answer: 2**Q27**

The value of inductance L for which the current is maximum in a series LCR AC circuit with $C = 10 \mu\text{F}$ and $\omega = 1000 \text{ s}^{-1}$ is $(20 \times n) \text{ mH}$, $n = ?$

Answer: 5**Q28**

Questions with Answer Keys

If masses of the plates are $2m$ and m and their edges are a and $2a$ respectively, then the distance between the centre of mass of the system and the point O is (value of a is 7 m)



Answer: 7

Q29

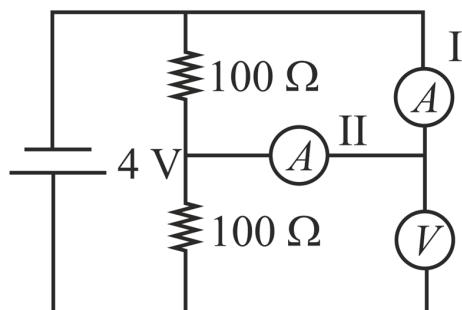
In Young's double-slit experiment, the intensities at two points P_1 and P_2 on the screen are I_1 and I_2 , respectively. If P_1 is located at the central bright fringe and P_2 is located at a distance equal to a quarter of fringe width from P_1 , then $\frac{I_1}{I_2}$ is

Answer: 2

Q30

In the figure, the ammeter (I) reads a current of 10 mA, while the voltmeter reads a potential difference of 3 V. The ammeters are identical, and the internal resistance of the battery is negligible (consider all ammeters and voltmeters as non-ideal).

The resistance of the ammeter is, $m \times 10^2 \Omega$. What is the value of m ?



Answer: 1

Q31

An alkene (A) on ozonolysis gives a mixture of two carbonyl compounds. Mixture on Clemmensen reduction gives just one alkane (B). (B) is the lowest alkane which in pure form can not be prepared by standard Wurtz method. (A) is

Questions with Answer Keys(1) $\text{MeCH} = \text{CHMe}$ (2) $\text{MeCH}_2\text{CH} = \text{CMe}_2$ (3) $\text{MeCH}_2\text{CH}_2\text{CH}_2\text{CH} = \text{CEt}_2$ (4) $\text{MeCH}_2\text{CH}_2\text{CH} = \text{C(Me)Et}$ **Answer: (2)****Q32**Consider the following standard electrode potentials (E° in volts) in aqueous solution:

Element	M^{3+}/M	M^+/M
Al	-1.66	+0.55
Tl	+1.26	-0.34

Based on these data, which of the following statement is correct?

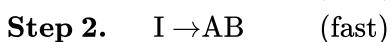
(1) Tl^+ is more stable than Al^{3+} (2) Al^+ is more stable than Al^{3+} (3) Tl^{3+} is more stable than Al^{3+} (4) Tl^+ is more stable than Al^+ **Answer: (4)****Q33**

An electron practically at rest, is initially accelerated through a potential difference of 100 volts. It then has a de Broglie wavelength $= \lambda_1 \text{\AA}$. It then get retarded through 19 volts and then has a wavelength $\lambda_2 \text{\AA}$. It further retardation through 32 volts changes the wavelength to λ_3 . What is the value of $\frac{\lambda_3 - \lambda_2}{\lambda_1}$?

(1) $\frac{20}{41}$ (2) $\frac{10}{63}$ (3) $\frac{20}{63}$ (4) $\frac{10}{41}$ **Answer: (3)****Q34**

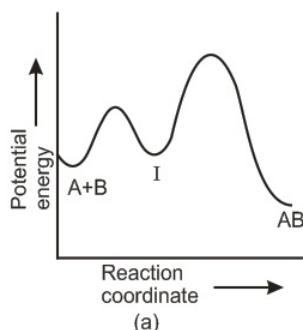
Questions with Answer Keys

For an exothermic reaction, following two steps are involved.

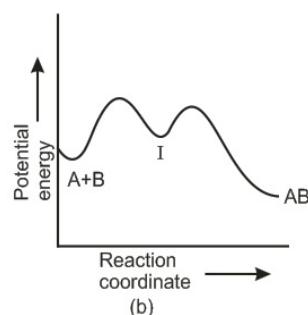


Which of the following graphs correctly represent this reaction ?

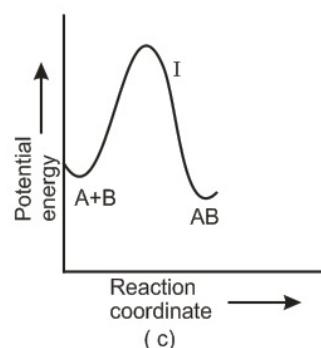
(1)



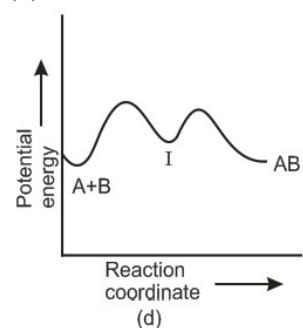
(2)



(3)

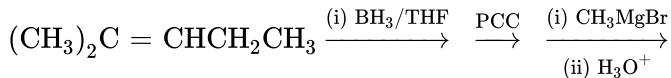


(4)



Questions with Answer Keys**Answer: (2)****Q35**

What is the final product of the reaction?



- (1) 2,3-dimethyl pentan-3-ol
- (2) 2,4-dimethyl pentan-3-ol
- (3) 2,3-dimethyl pentan-2-ol
- (4) 2,2-dimethyl pentan-3-ol

Answer: (1)**Q36**

The test that is done for the differentiation of primary amines from secondary and tertiary amine is:

- (1) Hell-Volhard Zelinsky reaction
- (2) Tollen's reagent
- (3) Azo dye test
- (4) Carbylamine test |

Answer: (4)**Q37**

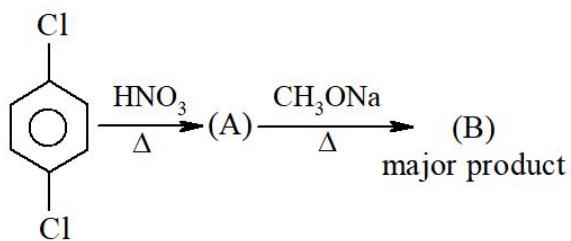
25 mL of household bleach solution was mixed with 30 mL of 0.50 M KI and 10 mL of 4 N acetic acid. In the titration of the liberated iodine, 48 mL of 0.25 N $\text{Na}_2\text{S}_2\text{O}_3$ was used to reach the end point. The molarity of the household bleach solution is

- (1) 0.24 M
- (2) 0.48
- (3) 0.024 M
- (4) 0.96 M

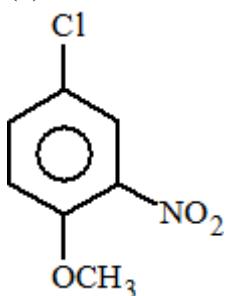
Answer: (1)

Questions with Answer Keys

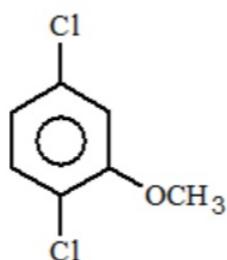
Q38



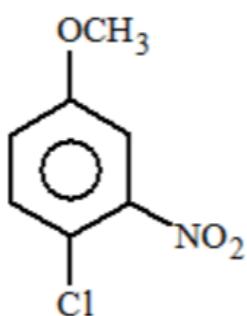
(1)



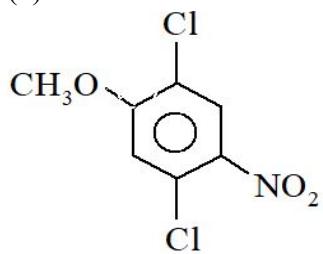
(2)



(3)



(4)



Questions with Answer Keys

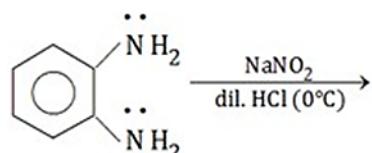
Answer: (1)**Q39**

What is the freezing point of a solution that contains 10.0 g of a glucose ($C_6H_{12}O_6$) in 100 g of H_2O ? $K_f = 1.86^\circ C/m$.

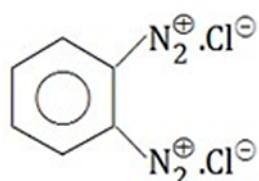
- (1) $-0.186^\circ C$
- (2) $+0.186^\circ C$
- (3) $-0.10^\circ C$
- (4) $-1.03^\circ C$

Answer: (4)**Q40**

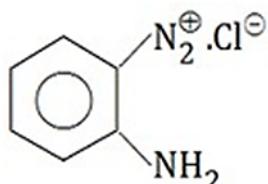
The major product of the reaction is



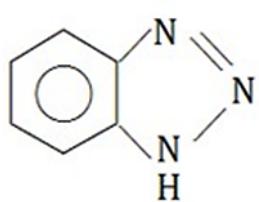
(1)



(2)

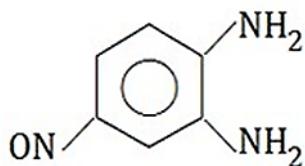


(3)



Questions with Answer Keys

(4)

**Answer: (3)****Q41**

2-propanol will be the product of which one of the following reactions? Multiple can be true.

- I. $\text{CH}_2 = \text{CH} - \text{CH}_3 + \text{H}_2\text{O} \xrightarrow{\text{H}^+}$
- II. $\text{CH}_3 - \text{CHO} \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) CH}_3\text{Mgl}}$
- III. $\text{CH}_2\text{O} \xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) C}_2\text{H}_5\text{Mgl}}$
- IV. $\text{CH}_2 = \text{CH} - \text{CH}_3 \xrightarrow{\text{Neutral KMnO}_4}$

- (1) I and II
- (2) II and III
- (3) I and III
- (4) II and IV

Answer: (1)**Q42**

The standard enthalpy of formation (ΔH_f°) at 298 K for methane, $\text{CH}_4(\text{g})$ is $-78.4 \text{ kJ mol}^{-1}$. The additional information required to determine the average energy for C – H bond formation would be

- (1) The dissociation energy of H_2 and enthalpy of sublimation of carbon
- (2) Latent heat of vaporisation of methane
- (3) The first four ionisation energies of carbon and electron gain enthalpy of hydrogen
- (4) The dissociation energy of hydrogen molecule, H_2

Answer: (1)**Q43**

Questions with Answer Keys

Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii? (Numbers in the parenthesis are atomic numbers).

- (1) Zr (40) and Nb (41)
- (2) Zr (40) and Hf (72)
- (3) Zr (40) and Ta (73)
- (4) Ti (22) and Zr (40)

Answer: (2)

Q44

Match List - I with List - II. List II indicate magnetic moment of central metal atom.

List-I		List-II	
(a)	$[\text{Fe}(\text{CN})_6]^{3-}$	(i)	5.92 BM
(b)	$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(ii)	0 BM
(c)	$[\text{Fe}(\text{CN})_6]^{4-}$	(iii)	4.90 BM
(d)	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	(iv)	1.73 BM

Choose the correct answer from the options given below.

- (1) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)
- (2) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
- (3) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
- (4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

Answer: (4)

Q45

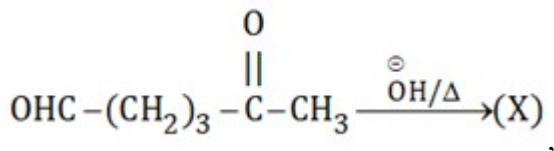
Which of the following statement is true about hydrogen bonding?

- (1) Cl and N have comparable electronegativities yet there is no H-bonding in HCl because size of Cl is large
- (2) Intermolecular H-bonding results in decrease in melting point and boiling point
- (3) Ice has maximum density at 0 ° C due to H-bonding
- (4) The magnitude of hydrogen bonding is more in gaseous HF than in liquid HF

Questions with Answer Keys

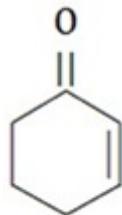
Answer: (1)**Q46**

In the given reaction,



the major product 'X' will be

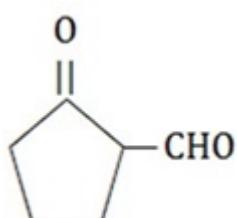
(1)



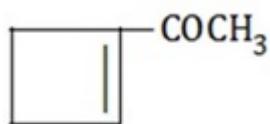
(2)



(3)



(4)

**Answer: (1)****Q47**

The simultaneous solubility of AgCN ($K_{\text{sp}} = 2.5 \times 10^{-6}$) and AgCl ($K_{\text{sp}} = 1.6 \times 10^{-10}$) in 1 M NH_3 (aq) are respectively

Given $K_f[\text{Ag}(\text{NH}_3)_2]^+ = 10^7$

Questions with Answer Keys

- (1) 1.58×10^{-3} , 1.26×10^{-5}
(2) 0.04, 6.25×10^{-8}
(3) 5.58×10^{-8} , 0.037
(4) 0.037, 5.78×10^{-8}

Answer: (4)

Q48

Assertion: The majority of noble gas compounds are those of xenon (Xe).

Reason: Xenon has the lowest ionization enthalpy and can be easily oxidized by oxidizing agents like oxygen and fluorine

- (1) Assertion and reason are correct, and reason is the correct explanation of assertion.
(2) Assertion and reason are correct, and reason is not the correct explanation of assertion
(3) Assertion is correct, reason is wrong
(4) Assertion is wrong, reason is correct

Answer: (1)

Q49

Consider the acidity of the carboxylic acids.

- (i) PhCOOH
(ii) o – NO₂ C₆H₄ COOH
(iii) p – NO₂ C₆H₄ COOH
(iv) m – NO₂ C₆H₄ COOH

Which of the following order is correct?

- (1) i > ii > iii > iv
(2) ii > iv > iii > i
(3) ii > iv > i > iii
(4) ii > iii > iv > i

Answer: (4)

Q50

Questions with Answer Keys

Given the electronic configurations of few elements. Select the incorrect Match:

1.	$1s^2 2s^2 2p^5$	Most electronegative element in the periodic table
2.	$1s^2 2s^2 2p^3$	An element belonging to 3 rd period and 5 th group
3.	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$	A d-block element
4.	$1s^2 2s^2 2p^6 3s^2 3p^6$	An element from 18 th group

- (1) 1 and 4 only
- (2) 2 only
- (3) 1, 2 and 3
- (4) All are the incorrect matches.

Answer: (2)

Q51

Copper sulphate solution (250 mL) was electrolysed using a platinum anode and a copper cathode. A constant current of 2 mA was passed for 16 min. It was found that after electrolysis the absorbance of the solution was reduced to 50% of its original value. Concentration of copper sulphate in the solution to begin with is $x \times 10^{-5}$. Find the value of x (mark answer to nearest integer)

Answer: 8

Q52

If the pK_a of acetic acid and pK_b of NH₄OH are 4.76 and 4.75 respectively, what will be the pH of ammonium acetate solution? (mark answer to nearest integer)

Answer: 7

Q53

How many of the following are obtained on heating Potassium permanganate?

K₂MnO₄, MnO₂, O₂, Mn₂O₃

Answer: 3

Q54

The hydrated salt Na₂SO₄ · nH₂O loses all water of crystallization on heating and is reduced to 44.1% of its original weight. Therefore, the value of n is (roundoff value to n to nearest integer)

Questions with Answer Keys**Answer: 10****Q55**

$C_5H_{10}O$ is a carbonyl compound. The number of structural isomers possible for this molecular formula are

Answer: 7**Q56**

The number of paramagnetic species among the following is

O_2 , CO , N_2 , C_2 , CsO_2 , BaO_2 , CO_2

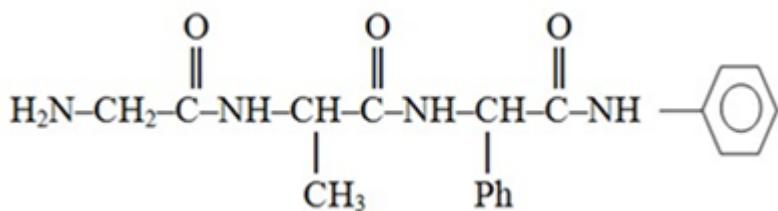
Answer: 2**Q57**

During the nuclear explosion, one of the products is ^{90}Sr with half life of 6.93 years. If 1 μ g of ^{90}Sr was absorbed in the bones of a newly born baby in place of Ca, how much time (in years) is required to reduce it by 90%, if it is not lost metabolically?

Report your answer by rounding it up to a nearest whole number.

Answer: 23**Q58**

The number of peptide bond(s) in the following molecule is

**Answer: 2****Q59**

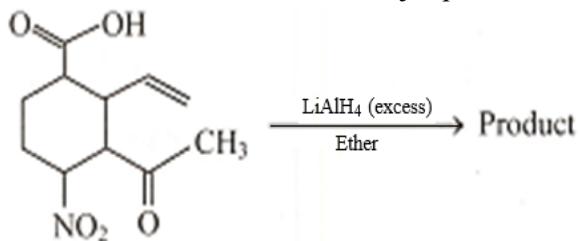
Calculate the final temperature of the gas, if one mole of an ideal gas is allowed to expand reversibly and adiabatically from a temperature of $27^\circ C$ and the work done during the process is 3 kJ .

Given ($C_V = 20 \text{ J/K}$) (mark answer in Kelvin)

Answer: 150

Questions with Answer Keys**Q60**

The number of π bonds in the major product will be _____.

**Answer: 1****Q61**

If $\frac{dy}{dx} = f(x) + \int_0^1 f(x)dx$, then the equation of the curve $y = f(x)$ passing through (0, 1) is

(1) $f(x) = \frac{2e^x - e + 1}{3 - e}$

(2) $f(x) = \frac{3e^x - 2e + 1}{2(2 - e)}$

(3) $f(x) = \frac{e^x - 2e + 1}{e + 1}$

(4) none of these

Answer: (1)**Q62**

Let S be the set of 6-digit numbers $a_1a_2a_3a_4a_5a_6$ (all digits distinct)

Where $a_1 > a_2 > a_3 > a_4 < a_5 < a_6$. Then $n(S)$ is equal to

(1) 210

(2) 2100

(3) 4200

(4) 42

Answer: (2)**Q63**

The mean and variance of 20 observations are found to be 10 and 4 respectively. On rechecking, it was found that an observation 8 is incorrect. If the wrong observation is omitted, then the correct variance is

Questions with Answer Keys

(1) 7

(2) $\frac{100}{19}$ (3) $\frac{1400}{361}$ (4) $\frac{1440}{361}$ **Answer: (4)**

Q64

If A and B are matrices with 24 and 40 elements respectively, then the number of possible orders of A and B such that AB is defined is

(1) 2

(2) 3

(3) 4

(4) 8

Answer: (3)

Q65

The lines $L_1 : x = y = z$, $L_2 : x = \frac{y}{2} = \frac{z}{3}$ and a line L_3 is passing through $(1, 1, 1)$ form a triangle of area $\sqrt{6}$ units, $(1, 1, 1)$ being one of the vertices of the triangle. Then the point of intersection of the L_3 with L_2 is

(1) $(1, 2, 3)$ (2) $(2, 4, 6)$ (3) $\left(\frac{4}{3}, \frac{8}{3}, 4\right)$ (4) $(1, 5, 7)$ **Answer: (2)**

Q66

If $\int_{\frac{1}{4}}^{\frac{3}{4}} \frac{\frac{\pi}{2} + \cos^{-1} x}{2 \sin^{-1} x + 3 \cos^{-1} x + \cos^{-1}(1-x)} dx = k$, then k is equal to

(1) 0.25

Questions with Answer Keys

(2) 0.5

(3) 1.5

(4) 1.25

Answer: (1)**Q67**

An urn contains 3 red, 4 green and certain number of white balls. Two balls are drawn simultaneously and found to be of different colour. If the chance that none of them was a white ball is $\frac{2}{9}$, then number of white balls is equal to -

(1) 3

(2) 4

(3) 6

(4) 8

Answer: (3)**Q68**

Let $f(x)$ be defined for all $x \in R$ such that $\lim_{x \rightarrow 0} \left[f(x) + \ln\left(1 - \frac{1}{e^{f(x)}}\right) - \ln(f(x)) \right] = 0$ then $\lim_{x \rightarrow 0} f(x)$ is equal to

(1) 0 |

(2) 1

(3) e

(4) $1/e$ **Answer: (1)****Q69**

Let $f(x) = x^2 + \lambda x + \mu \cos x$, λ being an integer and μ a real number. The number of ordered pairs (λ, μ) for which the equations $f(x) = 0$ and $f(f(x)) = 0$ have the same (non empty) set of real roots is

(1) 4 |

(2) 6

Questions with Answer Keys

(3) 8

(4) None of these

Answer: (1)

Q70

If the function $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = |x|(x - \sin x)$, then which of the following statements is TRUE?

- (1) f is one-one, but NOT onto
- (2) f is onto, but NOT one-one
- (3) f is BOTH one-one and onto |
- (4) f is NEITHER one-one NOR onto

Answer: (3)

Q71

If $z_1^2 + |z_1| = z_2^2 + |z_2| = z_3^2 + |z_3| = 0$ ($z_1 \neq z_2 \neq z_3$) and z_1, z_2 and z_3 are the roots of equation $ax^3 + bx^2 + x + c = 0$; then-

- (1) $a = 1$
- (2) $b = -1$
- (3) $a = -1$
- (4) $b = 1$

Answer: (1)

Q72

If the image of the point $M(\lambda, \lambda^2)$ on the line $x + y = \lambda^2$ is $N(0,2)$, then the sum of the squares of all the possible values of λ is equal to

- (1) 5
- (2) 2
- (3) 1
- (4) 4

Questions with Answer Keys**Answer: (1)**

Q73

The coefficient of x^5 in the expansion of $(1+x)^{21} + (1+x)^{22} + \dots + (1+x)^{30}$ is

- (1) ${}^{51}C_5$
- (2) ${}^{31}C_5 - {}^{21}C_5$
- (3) ${}^{31}C_6 - {}^{21}C_6$
- (4) ${}^{30}C_5 + {}^{20}C_5$

Answer: (3)

Q74

The area (in sq. units) bounded by $y = 2^x$ and $y = 2x - x^2$ from $x = 1$ to $x = 2$ is $k \log_2 e - m$, then the value of $\left| \frac{k}{m} \right|$ is equal to

- (1) 3
- (2) 2
- (3) 4
- (4) 1

Answer: (1)

Q75

If $(2, 4)$ is interior point of the circle $x^2 + y^2 - 6x - 10y + \lambda = 0$ and the circle does not cut the coordinate axes, then $\lambda \in$

- (1) $(25, 34)$
- (2) $(9, 32)$
- (3) $(25, 32)$
- (4) $(4, 25)$

Answer: (3)

Questions with Answer Keys**Q76**

If \vec{a} , \vec{b} and \vec{c} are three mutually perpendicular unit vectors and \vec{d} is a unit vector which makes equal angles with \vec{a} , \vec{b} and \vec{c} then the value of $|\vec{a} + \vec{b} + \vec{c} + \vec{d}|^2$

(1) $4 + 2\sqrt{2}$

(2) $4 + 2\sqrt{3}$

(3) $2 + \sqrt{5}$

(4) $3 + \sqrt{5}$

Answer: (2)**Q77**

If $p\lambda^4 + q\lambda^3 + r\lambda^2 + s\lambda + t = \begin{vmatrix} \lambda^2 + 3\lambda & \lambda - 1 & \lambda + 3 \\ \lambda^2 + 1 & 2 - \lambda & \lambda - 3 \\ \lambda^2 - 3 & \lambda + 4 & 3\lambda \end{vmatrix}$, then p is equal to

(1) -5

(2) -4

(3) -3

(4) -2

Answer: (2)**Q78**

If $a_1, a_2, a_3 \dots a_n$ are in A.P and if $1 + 2x$ is the arithmetic mean of a_1, a_n and $1 - x^2$ is the arithmetic mean of $\frac{1}{a_1 a_n}, \frac{1}{a_2 a_{n-1}}, \frac{1}{a_3 a_{n-2}}, \dots, \frac{1}{a_n a_1}$ and $1 + x^2$ is the AM of $\frac{1}{a_1}, \frac{1}{a_2}, \frac{1}{a_3}, \dots, \frac{1}{a_n}$ then value of x may be

(1) 1

(2) $\sqrt{2} - 1$

(3) $\sqrt{2}$

(4) 0

Answer: (4)**Q79**

Questions with Answer Keys

Number of real roots of the equation $\frac{e^x}{x^2} = 5 - x$ is -

(1) 1

(2) 2

(3) 3

(4) 0

Answer: (3)**Q80**

On a coordinate plane, ellipse $C_1 : \frac{x^2}{a_1^2} + \frac{y^2}{b_1^2} = 1$ ($a_1 > b_1 > 0$) and hyperbola $C_2 : \frac{x^2}{a_2^2} - \frac{y^2}{b_2^2} = 1$ ($a_2, b_2 > 0$) has the same focus point F_1, F_2 . Point P is the intersection point of C_1 and C_2 in the first quadrant and $|F_1F_2| = 2|PF_2| \cdot e_1$ is the eccentricity of C_1 and e_2 is the eccentricity of C_2 . Find the range of $e_2 - e_1$.

(1) $(\frac{1}{3}, \infty)$ (2) $(\frac{1}{2}, \infty)$ (3) $[\frac{1}{3}, \infty)$ (4) $[\frac{1}{2}, \infty)$ **Answer: (2)****Q81**

If $\int_{-n}^n \frac{3\{x\}+1}{\{3x\}+1} dx = 6 \ln(4e^2)$, then find the value of n .

[Note: $\{k\}$ denotes the fractional part function of k .]

Answer: 6**Q82**

In a village of 1000 inhabitants, there are three newspapers P, Q and R in circulation. Each of these papers is read by 500 persons. Papers P and Q are read by 250 persons, papers Q and R are read by 250 persons, papers R and P are read by 250 persons. All the three papers are read by 250 persons. Then the number of persons who read no newspaper at all, is

Answer: 0

Questions with Answer Keys**Q83**

Let f be real function defined on R (the set of real numbers) such that

$f'(x) = 100(x - 1)(x - 2)^2(x - 3)^3 \dots (x - 100)^{100}$, for all $x \in R$. If g is function defined on R such that $\int_a^x e^{f(t)} dt = \int_0^x g(x - t) dt + 2x + 3$, If sum of all the value of x for which $g(x)$ has a local extremum be λ then find λ

Answer: 2500

Q84

a, b, c, d are in GP and are in ascending order such that $a + d = 112$ and $b + c = 48$. If the GP is continued with a as the first term, then the sum of the first six term is

Answer: 1456

Q85

Given A and B are two non singular matrices such that $A \neq I$, $B^6 = I$ and $BA^3 = AB$, then the least value of m for which $A^m = I$ is K. Then K is (where I is identity matrix) Given ($m \in N$)

Answer: 728

Q86

If \bar{a}, \bar{b} are vectors perpendicular to each other & $|\bar{a}| = 2, |\bar{b}| = 3$, and \bar{c} is a vector such that $\bar{c} \times \bar{a} = \bar{b}$ then the least value of $2|\bar{c} - \bar{a}| =$

Answer: 3

Q87

The remainder when $(2024)^{2024}$ is divided by 17 is

Answer: 1

Q88

The angle between the lines whose direction cosines are given by $3l + 4m + 5n = 0, l^2 + m^2 - n^2 = 0$ is (Mark acute angle in degree as answer)

Answer: 0

Questions with Answer Keys**Q89**

$f : \mathbb{N} \rightarrow \mathbb{R} - \{0\}$, such that $f(1) + f(2) + \dots + f(n) = f(n) \cdot f(n+1), \forall n \in \mathbb{N}$.

Let $f(2) + f(4) + f(6) + \dots + f(100) = a$ and $s(n)$ denote the sum of digits of n then $s(s(a))$ is

Answer: 6

Q90

The number of ways of distributing 20 identical marbles among three children so that each gets atleast one and no two get the same number is

Answer: 144
