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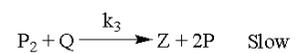
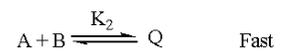
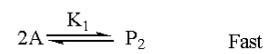
Exported On *	2023/04/03 12:02:32
Title *	Question Paper Answer Key
OES Exam *	GPSC12202226 / Assistant Professors in Government College in Chemistry (Physical)/ Completed / 2023-04-01

1	<b>Question Description</b>	<p>The correct order of arrangement based on the total number of allowed nuclear spin values (<math>m_l</math>) for the following elements are</p> <p>A. <math>^{16}\text{O} &lt; ^{13}\text{C} &lt; ^{35}\text{Cl} &lt; ^{36}\text{Cl} &lt; ^{17}\text{O}</math>          B. <math>^{13}\text{C} &lt; ^{16}\text{O} &lt; ^{17}\text{O} &lt; ^{35}\text{Cl} &lt; ^{36}\text{Cl}</math>          C. <math>^{13}\text{C} &gt; ^{16}\text{O} &gt; ^{17}\text{O} &gt; ^{35}\text{Cl} &gt; ^{36}\text{Cl}</math>          D. <math>^{16}\text{O} &gt; ^{13}\text{C} &gt; ^{35}\text{Cl} &gt; ^{36}\text{Cl} &gt; ^{17}\text{O}</math></p>
	A	A
	B	B
	C	C
	D	D
	E	None of the above
	Correct Answer	A
	Marks	1

2

**Question Description**

A complex reaction occurs by the following steps:



The overall rate of reaction considering steady state approximation is \_\_\_\_\_.

- a)  $k_3[P_2][Q]$       b)  $k_3[P]^2[Q]$       c)  $K_1K_2k_3[A][B]^3$       d)  $K_1K_2k_3[A]^3[B]$

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

D

**Marks**

1

3

<b>Question Description</b>	A molecule exhibits first order fluorescence lifetime of $5 \times 10^{-9}$ s. The total rate constant of all processes for the decay of excited state is $1.2 \times 10^8 \text{ s}^{-1}$ . The quantum yield of fluorescence is _____.
<b>A</b>	0.24
<b>B</b>	1.66
<b>C</b>	2.4
<b>D</b>	4.16
<b>E</b>	None of the above
<b>Correct Answer</b>	B
<b>Marks</b>	1

4	<b>Question Description</b>	The rate constant $k$ of a reaction at $27^{\circ}\text{C}$ is found to be $k = 2.0 \times 10^5 e^{-20}$ . The activation energy of this reaction is _____ $\text{J mol}^{-1}$ .
	<b>A</b>	-20
	<b>B</b>	20
	<b>C</b>	40000
	<b>D</b>	50000
	<b>E</b>	None of the above
	<b>Correct Answer</b>	D
	<b>Marks</b>	1

5	<b>Question Description</b>	Spin-Spin splitting is observed in the NMR spectrum of _____.
	<b>A</b>	$\text{ClCH}_2\text{CH}_2\text{Cl}$
	<b>B</b>	$\text{CH}_3\text{CHO}$
	<b>C</b>	$\text{CH}_3\text{COCH}_3$
	<b>D</b>	<i>cis</i> - $\text{BrCHCHBr}$
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

6

**Question Description**

If an excited species ( $S^*$ ) exhibiting fluorescence transfers its energy to a quencher (Q), then the resonance fluorescence energy transfer ( $E_T$ ) is defined as \_\_\_\_\_. ( $\phi_f$  = quantum yield of fluorescence)

a)  $1 - \frac{\phi_f}{\phi_{f,0}}$

b)  $1 - \frac{\phi_{f,0}}{\phi_f}$

c)  $1 - \frac{\sqrt{\phi_f}}{\phi_{f,0}}$

d)  $1 - \frac{\phi_f}{\sqrt{\phi_{f,0}}}$

A

a

B

b

C

c

D

d

E

None of the above

**Correct Answer**

A

**Marks**

1

7

**Question Description**

Work ( $w$ ) involved in an isothermal reversible expansion from  $V_i$  to  $V_f$  of  $n$  moles of an ideal gas is \_\_\_\_\_. (*symbols retain their standard meaning*)

a)  $w = -nRT \ln(V_f/V_i)$

b)  $w = nRT (V_f/V_i)$

c)  $w = -nRT (V_f/V_i)$

d)  $w = nRT \log(V_f/V_i)$

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

A

**Marks**

1

8

<b>Question Description</b>	The efficiency of a heat engine working between heat reservoirs at temperatures $327^{\circ}\text{C}$ and $27^{\circ}\text{C}$ respectively is _____ %.
<b>A</b>	100
<b>B</b>	75
<b>C</b>	50
<b>D</b>	25
<b>E</b>	None of the above
<b>Correct Answer</b>	C
<b>Marks</b>	1

9

**Question Description**

The wavefunction for one of the states of a simple harmonic oscillator on the x-axis is given by  $\left(\frac{k\mu}{\hbar^2}\right)^{\frac{1}{8}} \left(\frac{1}{8\sqrt{\pi}}\right)^{\frac{1}{2}} (4y^2 - 2)e^{-\frac{y^2}{2}}$ , where  $y = \left(\frac{k\mu}{\hbar^2}\right)^{\frac{1}{4}} x$ .  $k$  is the force constant,  $\mu$  is the reduced mass and other symbols have their usual meaning and is the average position is centred at  $x = 0$ . The nodes for this state will be observed at

- A.  $\pm 0.5 \left(\frac{\hbar^2}{k\mu}\right)^{\frac{1}{4}}$
- B.  $0.125 \left(\frac{\hbar^2}{k\mu}\right)^{\frac{1}{4}}, 0.1.875 \left(\frac{\hbar^2}{k\mu}\right)^{\frac{1}{4}}$
- C.  $\pm 0.707 \left(\frac{\hbar^2}{k\mu}\right)^{\frac{1}{4}}$
- D.  $\pm \infty$

**A**

A

**B**

B

C

C

D

D

10

**Question Description**

According to transition state theory, the temperature-dependence of pre-exponential factor (A) for a reaction between a linear and a non-linear molecule, that forms product through a non-linear transition state, is given as \_\_\_\_.

**Correct Answer**

C

**Marks**

1

B

$T^{-1}$

C

$T^{-1.5}$

D

$T^2$

E

None of the above

**Correct Answer**

C

**Marks**

1

11

## Question Description

A particular chemical process is known to follow the Lindemann mechanism. When the reactant concentration is  $100 \text{ mol L}^{-1}$ , the reaction rate constant reaches 80% of its limiting value at high concentrations. What is the  $\frac{\text{deactivation}}{\text{decomposition}}$  rate constant ratio for this reaction?

A.  $4.0 \times 10^{-2}$

B.  $8.0 \times 10^{-1}$

C.  $2.5 \times 10^1$

D.  $2.0 \times 10^0$

A

A

B

B

C

C

D

D

E

None of the above

Correct Answer

A

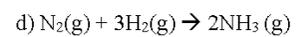
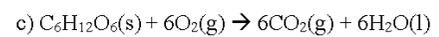
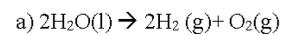
Marks

1

12

**Question Description**

Among the following, the reaction that undergoes decrease in entropy is \_\_\_\_\_.

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

D

**Marks**

1

13	<b>Question Description</b>	The $\text{Na}_2\text{SO}_4$ , $\text{K}_2\text{SO}_4$ , $\text{KCl}$ , $\text{HCl}$ and $\text{HCOONa}$ have molar conductivities at infinite dilution as 260, 308, 150, 426 and 105 $\text{S cm}^{-2} \text{ mol}^{-1}$ at 300 K respectively. Hence, molar conductivity of Formic acid under above conditions at infinite dilution is
	<b>A</b>	531
	<b>B</b>	381
	<b>C</b>	405
	<b>D</b>	429
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

14	<b>Question Description</b>	The rate constant of a first order reaction is $6.0 \times 10^{-1} \text{ min}^{-1}$ . Time required for reactants to reduce to half of its initial concentration is ----- seconds.
	<b>A</b>	65
	<b>B</b>	69
	<b>C</b>	75
	<b>D</b>	100
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

15

**Question Description**

The vapour pressure of a liquefied gas at  $275\text{ K}$  is  $5\text{ atm}$ . If the molar volume of the vapour under these conditions is  $5\text{ L mol}^{-1}$  evaluate the fugacity (rounded to one decimal place) under these conditions. Given universal gas constant is  $8 \times 10^{-2}\text{ L atm mol}^{-1}\text{ K}^{-1}$

**A**

0.1 atm

**B**

1.1 atm

**C**

5.0 atm

**D**

5.7 atm

**E**

None of the above

**Correct Answer**

D

**Marks**

1

16

<b>Question Description</b>	Ca <sup>2+</sup> and Cl <sup>-</sup> has ionic equivalent conductance values of 0.0119 and 0.0076 (Sm <sup>2</sup> mol <sup>-1</sup> ) respectively. The molar conductivity at infinite dilution for CaCl <sub>2</sub> is _____ Sm <sup>2</sup> mol <sup>-1</sup> .
<b>A</b>	0.01355
<b>B</b>	0.0115
<b>C</b>	0.0542
<b>D</b>	0.0271
<b>E</b>	None of the above
<b>Correct Answer</b>	D
<b>Marks</b>	1

17	<b>Question Description</b>	<p>Enthalpy (H) and internal energy (E) for the following reaction, <math>\text{Fe}_2\text{O}_3(\text{s}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{H}_2\text{O}(\text{l})</math> at constant temperature are related as ____.</p> <p>a) <math>\Delta H = \Delta E + 3RT</math>    b) <math>\Delta H = \Delta E - 3RT</math>    c) <math>\Delta H = \Delta E - 1/3 RT</math>    d) <math>\Delta H = \Delta E + RT^3</math></p>
	<b>A</b>	a
	<b>B</b>	b
	<b>C</b>	c
	<b>D</b>	d
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

18

**Question Description**

The variation of excess charge density ( $\rho(r)$ ) around a solvated ion is given by

$$\rho(r) = \frac{z_i e_o}{4\pi} \kappa^2 \left\{ \frac{1}{r} + \frac{\kappa^2 r^2}{2} - \kappa \right\}$$

Where,  $z_i$  is the charge on the ion,  $e_o$  is the electrostatic charge,  $\kappa^{-1}$  is the debye length,  $r$  is the distance from ion. The total charge in the ionic atmosphere exerted by this ion within a distance  $r$  can be given by

- A.  $-z_i e_o \kappa^2 r e^{-\kappa r}$
- B.  $z_i e_o \kappa^2 \left[ \frac{r^2}{2} - \kappa \frac{r^3}{3} + \kappa^2 \frac{r^5}{10} \right]$
- C.  $-\frac{z_i e_o}{4\pi} \kappa^3 r \left[ \frac{r^2}{2} - 1 \right]$
- D.  $z_i^2 e_o \kappa^{-1}$

A

A

B

B

C

C

D

D

E

None of the above

**Correct Answer**

B

**Marks**

1

19	<b>Question Description</b>	In an alkali halide, the vibrational frequency and anharmonicity constant is obtained as $300 \text{ cm}^{-1}$ and 0.0025 respectively. The position ( $\text{cm}^{-1}$ ) of its fundamental mode and first overtone is ____ & ____ respectively.
	A	300, 600
	B	301.5, 604.5
	C	290, 580
	D	298.5, 595.5
	E	None of the above
	<b>Correct Answer</b>	D
	<b>Marks</b>	1

20	<b>Question Description</b>	<p>For a molecule whose dipole moment is <math>\mu</math>, in the presence of an electric field <math>E</math>, the <math>J = 2, K = 1</math> state will split. The expected energies of the various sublevels are</p> <p>A. <math>\pm \frac{\mu E}{2}, 0</math></p> <p>B. <math>\pm \frac{\mu E}{2}, \pm \mu E, 0</math></p> <p>C. <math>\pm \frac{\mu E}{3}, \pm \frac{\mu E}{6}, 0</math></p> <p>D. <math>\pm \frac{\mu E}{3}, 0</math></p>
	A	A
	B	B

<b>C</b>	C
<b>D</b>	D
<b>E</b>	None of the above
<b>Correct Answer</b>	C
<b>Marks</b>	1

21

**Question Description**

A reversible reaction  $A \rightleftharpoons B$ , attains equilibrium with a conversion yield of 75% after 100 mins at 27°C. If the initial concentration of A is 2 M, the concentration of A free of equilibrium left over after 200 mins is \_\_\_\_\_.

**A**

0

**B**

0.05

**C**

0.5

**D**

1

**E**

None of the above

**Correct Answer**

C

**Marks**

1

22

<b>Question Description</b>	A thermodynamic equation that relates the chemical potential to the composition of a mixture is known as _____ equation.
<b>A</b>	Gibbs-Helmholtz
<b>B</b>	Gibbs-Duhem
<b>C</b>	Joule-Thomson
<b>D</b>	Debye-Hückel
<b>E</b>	None of the above
<b>Correct Answer</b>	B
<b>Marks</b>	1

23

**Question Description**

For an aqueous solution maintained at 298 K, the Debye – Huckel limiting law is given by

a)  $\log \gamma_{\pm} = 0.509 |Z_+Z_-| \sqrt{\mu}$

b)  $\log \gamma_{\pm} = 0.509 |Z_+Z_-| \mu$

c)  $\log \gamma_{\pm} = -0.509 |Z_+Z_-| \sqrt{\mu}$

d)  $\log \gamma_{\pm} = -0.509 |Z_+Z_-| \mu^2$

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

C

**Marks**

1

24	<b>Question Description</b>	Among the following, the one which is IR inactive but Raman active is _____.
	<b>A</b>	O <sub>2</sub>
	<b>B</b>	SO <sub>2</sub>
	<b>C</b>	HCl
	<b>D</b>	protein
	<b>E</b>	None of the above
	<b>Correct Answer</b>	A
	<b>Marks</b>	1

25	<b>Question Description</b>	The relative population in two states with energies E <sub>1</sub> and E <sub>2</sub> satisfying Boltzmann distribution is given by $M_1/M_2 = 1.50 \exp.[-(E_1 - E_2)/k_B T]$ . The relative degeneracy of states $g_2/g_1$ is _____.
		a) 1                      b) 2/3                      c) 3/2                      d) 3
	<b>A</b>	a
	<b>B</b>	b
	<b>C</b>	c
	<b>D</b>	d
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

26

**Question Description**

For hydrogen like atom with a nuclear charge 'z', the energy of orbital with principal quantum number 'n' follows the relation

a)  $E_n \propto n^2 z^2$

b)  $E_n \propto -\frac{z^2}{n}$

c)  $E_n \propto -\frac{z}{n}$

d)  $E_n \propto -\frac{z^2}{n^2}$

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

D

**Marks**

1

27

**Question Description**

In nuclear overhauser effect, if the distance between the two nuclei is increased by a factor of two, then the spin relaxation will decrease by a factor of \_\_\_\_.

**A**

4

**B**

16

**C**

32

**D**

64

**E**

None of the above

**Correct Answer**

D

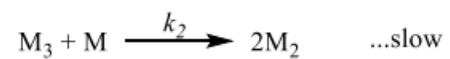
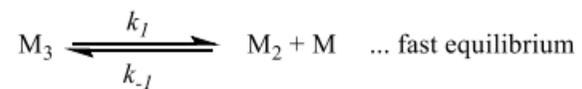
**Marks**

1

28

## Question Description

Consider the following reactions



The overall order for the above chemical reaction is

- |   |                   |
|---|-------------------|
| A | 1                 |
| B | -1                |
| C | 2                 |
| D | 3                 |
| E | None of the above |

Correct Answer A

Marks 1

29

<b>Question Description</b>	The eigen functions of hydrogen atom contains which of the following: I) Legendre polynomials, II) Laguerre polynomials and III) Hermite polynomials.
<b>A</b>	I only
<b>B</b>	I, II
<b>C</b>	I, II, III
<b>D</b>	III only
<b>E</b>	None of the above
<b>Correct Answer</b>	B
<b>Marks</b>	1

30

**Question Description** In the vibrational spectrum of acetylene, the Q-band is observed in \_\_\_\_\_.

**A** C-H symmetric stretching mode

**B** C-C stretching mode

**C** C-H asymmetric stretching mode

**D** C-C bending mode

**E** None of the above

**Correct Answer** B

**Marks** 1

31

**Question Description**

Helmholtz free energy function and internal energy  $U$  are related as \_\_\_\_\_. (Symbols retain their standard meaning)

a)  $U = -T \frac{dF}{dT}$

b)  $U = -T^2 \frac{dF/dT}{dT}$

c)  $U = T^2 \frac{d^2F}{dT^2}$

d)  $U = -T^2 \frac{d^2F}{dT^2}$

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

B

**Marks**

1

32

**Question Description**

The correct criteria for spontaneity in terms of properties of an isolated system is \_\_\_\_.

a)  $(dS)_{U,V} > 0$       b)  $(dS)_{H,P} < 0$       c)  $(dS)_{T,V} < 0$       d)  $(dS)_{T,P} > 0$

**A**

a

**B**

b

**C**

c

**D**

d

**E**

None of the above

**Correct Answer**

A

**Marks**

1

33

**Question Description**

In a simple reaction  $C + D \rightarrow P$ , the rate is doubled when concentration of C is doubled, while the rate increases by four times when D is doubled. The overall order of reaction is \_\_\_\_\_.

**A**

0

**B**

1

**C**

2

**D**

3

**E**

None of the above

**Correct Answer**

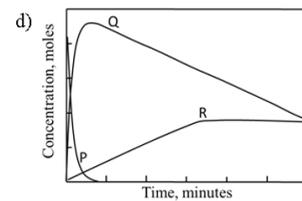
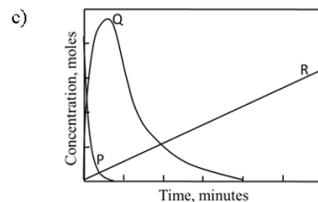
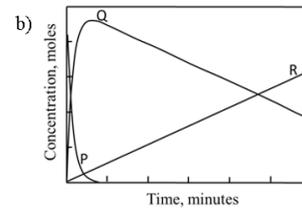
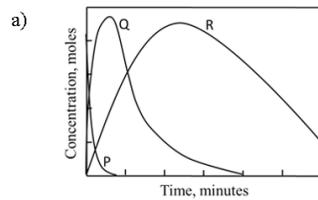
D

**Marks**

1

## Question Description

For the consecutive reaction  $P \rightarrow Q \rightarrow R$ , first reaction is first order and second reaction is zero order. The variations in  $[P]$ ,  $[Q]$  and  $[R]$  with time is best represented by \_\_\_\_\_.



A

c

B

d

C

b

D

a

E

None of the above

Correct Answer

C

Marks

1

35	<b>Question Description</b>	ESR spectrum of Anthracene radical anion exhibits _____ peaks.
	<b>A</b>	5
	<b>B</b>	25
	<b>C</b>	50
	<b>D</b>	75
	<b>E</b>	None of the above
	<b>Correct Answer</b>	D
	<b>Marks</b>	1

36	<b>Question Description</b>	The time independent Schrodinger's equation of a system represents the conservation of _____.
	<b>A</b>	total energy of the system
	<b>B</b>	total potential energy of the system
	<b>C</b>	total kinetic energy of the system
	<b>D</b>	total binding energy of the system in vacuum
	<b>E</b>	None of the above
	<b>Correct Answer</b>	A
	<b>Marks</b>	1

37	<b>Question Description</b>	Selection rule for harmonic oscillator transition is _____.
	<b>A</b>	0
	<b>B</b>	$\pm 1$
	<b>C</b>	0, $\pm 1$
	<b>D</b>	$\pm 1, 2$
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

38	<b>Question Description</b>	A compound of M and X atoms together form a cubic unit cell. M atoms are placed at the corners and body centre position while X atoms are at the face centres of the cube. The molecular formula of the compound is _____.
	<b>A</b>	MX
	<b>B</b>	$\text{MX}_2$
	<b>C</b>	$\text{M}_3\text{X}_2$
	<b>D</b>	$\text{M}_2\text{X}_3$
	<b>E</b>	None of the above
	<b>Correct Answer</b>	D
	<b>Marks</b>	1

39	<b>Question Description</b>	For a first order reaction at 50°C, the ratio of time required from 75% completion to 50% completion of reactant is _____.
	<b>A</b>	0.3
	<b>B</b>	0.6
	<b>C</b>	1.5
	<b>D</b>	2.5
	<b>E</b>	None of the above
	<b>Correct Answer</b>	A
	<b>Marks</b>	1

40	<b>Question Description</b>	An element crystallizes in <i>fcc</i> structure. The number of atoms present per unit cell is _____.
	<b>A</b>	1
	<b>B</b>	2
	<b>C</b>	4
	<b>D</b>	8
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

41	<b>Question Description</b>	In case of CO <sub>2</sub> , the total number of fundamental vibrational modes common in both IR and Raman spectrum are
	<b>A</b>	0
	<b>B</b>	1
	<b>C</b>	2
	<b>D</b>	4
	<b>E</b>	None of the above
	<b>Correct Answer</b>	A
	<b>Marks</b>	1

42	<b>Question Description</b>	The change in the Gibbs free energy of the reaction $C_4H_{10}(g) + 13/2 O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$ is 2746 kJ mol <sup>-1</sup> . If the number of electrons involved are 26, its open circuit voltage is ____.
	<b>A</b>	0.59
	<b>B</b>	1.09
	<b>C</b>	2.02
	<b>D</b>	3.55
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

43

**Question Description**

The wavefunction of an electron is given by  $\sqrt{\frac{3}{2}}\cos(\theta)$ . What fraction of electron charge will be found between  $\theta = 30^\circ$  and  $\theta = 60^\circ$ .

A 0.26

B 0.30

C 0.39

D 0.44

E None of the above

**Correct Answer** A

**Marks** 1

44	<b>Question Description</b>	The absorption spectrum of $O_2$ shows a vibrational structure having second vibrational excited state at $24870\text{ cm}^{-1}$ and a continuum at $56875\text{ cm}^{-1}$ . At the continuum, it dissociates into one ground state atom ( $O_g$ ) and one excited state atom ( $O_e$ ). The energy difference between $O_e$ and $O_g$ is $15125\text{ cm}^{-1}$ . The dissociation energy of ground state of $O_2$ is _____ $\text{cm}^{-1}$ .
	<b>A</b>	9745
	<b>B</b>	16880
	<b>C</b>	41750
	<b>D</b>	47130
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

45

**Question Description**

The nuclear gyromagnetic ratios of a few spin half nuclei are as follows:  $^1H = 5.586$ ,  $^{31}P = 2.263$ ,  $^{13}C = 1.405$ ,  $^{15}N = -0.283$ . Based on this information, match elements in column I with the predicted frequency in Column II for the lowest nuclear spin state transition in the presence of a  $9.4 T$  magnetic field.

	Column I (Isotopes)		Column II (frequency)
1	$^1H$	a	100 MHz
2	$^{31}P$	b	21 MHz
3	$^{13}C$	c	400 MHz
4	$^{15}N$	d	61 MHz
		e	163 MHz

A 1-a, 2-c, 3-d, 4-e

B 1-c, 2-b, 3-a, 4-e

C 1-a, 2-d, 3-c, 4-e

D 1-c, 2-e, 3-a, 4-b

E None of the above

**Correct Answer** D

**Marks** 1

46

**Question Description**

The rate constant of a diffusion controlled bimolecular radical-radical reaction in water (consider viscosity of water =  $0.8 \text{ kg m}^{-1} \text{ s}^{-1}$  at  $27^\circ\text{C}$ ) is -----  $\text{mol}^{-1}\text{m}^3\text{s}^{-1}$ .

**A**

38

**B**

83

**C**

830

**D**

8300

**E**

None of the above

**Correct Answer**

D

**Marks**

1

47

<b>Question Description</b>	The function $\text{Sin}^{-1} x$ is not an acceptable wave function because _____
<b>A</b>	It is not differentiable
<b>B</b>	its first derivative is not continuous
<b>C</b>	it is not a single valued function
<b>D</b>	it does not cover the entire space
<b>E</b>	None of the above
<b>Correct Answer</b>	B
<b>Marks</b>	1

48

<b>Question Description</b>	A reversible expansion of 1 mol of an ideal gas is carried out from 1L to 4L under isothermal condition at 300 K. $\Delta G$ for this process is _____.
<b>A</b>	$-300 R \ln 2$
<b>B</b>	$300 R \ln 2$
<b>C</b>	$-600 R \ln 2$
<b>D</b>	$600 R \ln 2$
<b>E</b>	None of the above
<b>Correct Answer</b>	C
<b>Marks</b>	1

49

<b>Question Description</b>	ESR spectrum of hydrogen atom exhibits _____ peaks.
<b>A</b>	0
<b>B</b>	1
<b>C</b>	2, equal intensity
<b>D</b>	2, unequal intensity
<b>E</b>	None of the above
<b>Correct Answer</b>	C
<b>Marks</b>	1

50

<b>Question Description</b>	A sequential reaction $X \xrightarrow{k_1} Y \xrightarrow{k_2} Z$ , has the rate constants $k_1 = 0.924 \text{ min}^{-1}$ and $k_2 = 0.231 \text{ min}^{-1}$ . After what time would the reaction vessel have the maximum amount of Y?
<b>A</b>	At the beginning of the reaction.
<b>B</b>	After 2 minutes of the start of the reaction
<b>C</b>	After 3 minutes of the start of the reaction
<b>D</b>	After 4 minutes of the start of the reaction
<b>E</b>	None of the above
<b>Correct Answer</b>	B
<b>Marks</b>	1

51

**Comprehension**

Read the passage and answer the questions below:

We can break mountains apart; we can drain the rivers and flood the valleys. We can turn the most luxurious forests into throwaway paper products. We can tear apart the great grass cover of the western plains and pour toxic chemicals into the soil and pesticides onto the fields until the soil is dead and blown away in the wind. We can pollute air with acids, rivers with sewage, the sea with oil—all this with an intoxication with our power for devastation at an order of magnitude beyond all reckoning. We can invent computers capable of processing ten million calculations per second. And why? To increase the volume and speed with which we move natural resources through the consumer economy to the junk pile or waste heap.

**Question Description**

Identify a word or phrase from the options given below which implies “being overcome with”

**A**

reckoning

**B**

magnitude

**C**

intoxication

**D**

luxurious

**E**

None of the above

**Correct Answer**

C

**Marks**

1

**Comprehension**

Read the passage and answer the questions below:

We can break mountains apart; we can drain the rivers and flood the valleys. We can turn the most luxurious forests into throwaway paper products. We can tear apart the great grass cover of the western plains and pour toxic chemicals into the soil and pesticides onto the fields until the soil is dead and blown away in the wind. We can pollute air with acids, rivers with sewage, the sea with oil—all this with an intoxication with our power for devastation at an order of magnitude beyond all reckoning. We can invent computers capable of processing ten million calculations per second. And why? To increase the volume and speed with which we move natural resources through the consumer economy to the junk pile or waste heap.

**Question Description**

Identify from the options provided below, the expression used to convey the damage directly caused to nature and environment

**A**

devastation

**B**

waste heap

**C**

beyond all reckoning

**D**

junk pile

**E**

None of the above

**Correct Answer**

A

**Marks**

1

**Comprehension**

Read the passage and answer the questions below:

We can break mountains apart; we can drain the rivers and flood the valleys. We can turn the most luxurious forests into throwaway paper products. We can tear apart the great grass cover of the western plains and pour toxic chemicals into the soil and pesticides onto the fields until the soil is dead and blown away in the wind. We can pollute air with acids, rivers with sewage, the sea with oil—all this with an intoxication with our power for devastation at an order of magnitude beyond all reckoning. We can invent computers capable of processing ten million calculations per second. And why? To increase the volume and speed with which we move natural resources through the consumer economy to the junk pile or waste heap.

**Question Description**

“To increase the volume and speed with which we move natural resources through the consumer economy to the junk pile or waste heap”. This statement is an indictment of

**A**

superfast computers

**B**

insensitive consumerism

**C**

natural resources

**D**

junk pile or waste heap

**E**

None of the above

**Correct Answer**

B

**Marks**

1

54

**Comprehension**

Read the passage and answer the questions below:

We can break mountains apart; we can drain the rivers and flood the valleys. We can turn the most luxurious forests into throwaway paper products. We can tear apart the great grass cover of the western plains and pour toxic chemicals into the soil and pesticides onto the fields until the soil is dead and blown away in the wind. We can pollute air with acids, rivers with sewage, the sea with oil—all this with an intoxication with our power for devastation at an order of magnitude beyond all reckoning. We can invent computers capable of processing ten million calculations per second. And why? To increase the volume and speed with which we move natural resources through the consumer economy to the junk pile or waste heap.

**Question Description**

From the phrases listed below, select the one which is used in the passage in a non-destructive sense by itself

**A**

drain the rivers

**B**

break mountains

**C**

invent computers

**D**

flood the valleys

**E**

None of the above

**Correct Answer**

C

**Marks**

1

55

**Comprehension**

Read the passage and answer the questions below:

We can break mountains apart; we can drain the rivers and flood the valleys. We can turn the most luxurious forests into throwaway paper products. We can tear apart the great grass cover of the western plains and pour toxic chemicals into the soil and pesticides onto the fields until the soil is dead and blown away in the wind. We can pollute air with acids, rivers with sewage, the sea with oil—all this with an intoxication with our power for devastation at an order of magnitude beyond all reckoning. We can invent computers capable of processing ten million calculations per second. And why? To increase the volume and speed with which we move natural resources through the consumer economy to the junk pile or waste heap.

**Question Description**

Identify from the options given below, the one that indicates “harmful substances, used to protect food crops from destruction”

**A**

toxic chemicals

**B**

pesticides

**C**

sewage

**D**

acids

**E**

None of the above

**Correct Answer**

B

**Marks**

1

56	<b>Question Description</b>	How many Lok Sabha seats belong to Rajasthan?
	<b>A</b>	32
	<b>B</b>	25
	<b>C</b>	30
	<b>D</b>	17
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

57	<b>Question Description</b>	Where is India's first Geological Park going to be built?
	<b>A</b>	Bhopal
	<b>B</b>	Shivpuri
	<b>C</b>	Sagar
	<b>D</b>	Jabalpur
	<b>E</b>	None of the above
	<b>Correct Answer</b>	D
	<b>Marks</b>	1

58	<b>Question Description</b>	On which date is World Anthropology Day observed every year?
	<b>A</b>	February 16
	<b>B</b>	February 12
	<b>C</b>	February 14
	<b>D</b>	February 10
	<b>E</b>	None of the above
	<b>Correct Answer</b>	A
	<b>Marks</b>	1

59	<b>Question Description</b>	What is the country of origin for ULTRASAT, the first telescope mission?
	<b>A</b>	Iran
	<b>B</b>	Iraq
	<b>C</b>	Israel
	<b>D</b>	India
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

60	<b>Question Description</b>	Which countries lead the International Biofuels Alliance?
	<b>A</b>	India, Brazil, and the United States
	<b>B</b>	India, Germany, and France
	<b>C</b>	Brazil, UAE, Nepal
	<b>D</b>	USA, Bhutan, India
	<b>E</b>	None of the above
	<b>Correct Answer</b>	A
	<b>Marks</b>	1

61	<b>Question Description</b>	With the help of ISRO, in which city of Bhutan was the ground station of the India-Bhutan satellite established?
	<b>A</b>	Paro
	<b>B</b>	Punakha
	<b>C</b>	Thimphu
	<b>D</b>	Jakar
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

62	<b>Question Description</b>	Ms. Medha Patkar is closely associated with the
	<b>A</b>	Tehri project
	<b>B</b>	Enron project
	<b>C</b>	Sardar Sarovar project
	<b>D</b>	Dabhol project
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

63	<b>Question Description</b>	Which state defeated Maharashtra to win the Senior Women's 13th National Hockey Championship 2023?
	<b>A</b>	Uttar Pradesh
	<b>B</b>	Madhya Pradesh
	<b>C</b>	Himachal Pradesh
	<b>D</b>	Arunachal Pradesh
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

64	<b>Question Description</b>	On which state highway was the world's first bamboo crash barrier installed?
	<b>A</b>	Rajasthan
	<b>B</b>	Assam
	<b>C</b>	Maharashtra
	<b>D</b>	Gujarat
	<b>E</b>	None of the above
	<b>Correct Answer</b>	C
	<b>Marks</b>	1

65	<b>Question Description</b>	When is World Unani Day observed every year?
	<b>A</b>	February 10
	<b>B</b>	February 11
	<b>C</b>	February 05
	<b>D</b>	February 08
	<b>E</b>	None of the above
	<b>Correct Answer</b>	B
	<b>Marks</b>	1

66

**Question Description**

Find missing numbers?

36	6	9	15
88	11	9	?
120	?	6	18

**A**

54,41

**B**

17,82

**C**

17,10

**D**

96,13

**E**

None of the above

**Correct Answer**

C

**Marks**

1

67

**Question Description**

**Directions: Read the following information carefully and answer the questions given beside.**

Certain number of persons (that does not exceed 15) are standing in a straight linear row facing towards the north. 5 persons stand between B and E, who is third to the left of A. U is to the right of A. Not more than 3 persons stand between U and T. B is third to the left of U. I is fifth to the right of T. 2 persons stand between E and F, who is sitting at the extreme left end of the row.. Three persons stand between A and L, who is towards the right of E.

**What is the position of E with respect to L?**

**A** 4th to the left

**B** 7th to the left

**C** 6th to the right

**D** 5th to the left

**E** None of the above

**Correct Answer** B

**Marks** 1

68

**Question Description**

Directions: Read the following information carefully and answer the questions given beside.

In a city, SRK Mall was to the north-west of Cosmos Mall. Shanti Mall was in the east of SRK Mall which was towards the south of TDI Mall. Saket Mall was towards the south-west of Shanti Mall such that it was situated towards the east of Cosmos Mall. DB Mall was 20 km towards the north of Cosmos Mall, which was 4 times the distance between Cosmos Mall and Saket Mall. Rajan Mall was the mid point between SRK Mall and Shanti Mall and also Cosmos Mall and DB Mall. The distance between TDI Mall and SRK Mall was half of the distance between DB Mall and Rajan Mall.

If the straight distance between the SRK Mall and the Shanti Mall is 14 km, what total distance one needs to cover if one travels from SRK Mall to Saket Mall via Rajan Mall and Cosmos Mall?

A 16km

B 20km

C 21km

D 22km

E None of the above

**Correct Answer** D

**Marks** 1

69

**Question Description**

Choose the pair that best represents a similar relationship to the one expressed in the original pair of words.  
DELTOID : MUSCLE

**A**

radius : bone

**B**

brain : nerve

**C**

tissue : organ

**D**

blood : vein

**E**

None of the above

**Correct Answer**

A

**Marks**

1

70

**Question Description**

Direction: In each of the following question, there is a certain relationship between two given pair on both side of ':' . One word is given on another side of ':' while another word is to be found from the given options, having the same relation with this word as the words of the given pair . Choose the correct word from the following options..

SHI : RIJ :: QJK : ?

**A**

TDE

**B**

PKL

**C**

UGH

**D**

VPQ

**E**

None of the above

**Correct Answer**

B

**Marks**

1

71

**Question Description**

Directions: Read the following information carefully and answer the questions given beside.

G is the mother of F, who is the spouse of D. M is the daughter of D, who is the only brother of C. E is the son of G, who is married to H. A is the niece of C, who has no sister and is unmarried. T is the father of D and has no daughter. V is the sister-in-law of F. G has only two children. M is the granddaughter of O.

How is F's mother-in-law related to T?

**A**

Sister

**B**

Father

**C**

Wife

**D**

Brother

**E**

None of the above

**Correct Answer**

C

**Marks**

1

**Question Description**

**Directions: Read the following information carefully and answer the questions given beside.**

In a certain code language “hunger and poverty remain” is coded as “ner gup jil mub”, “people count poverty records” is coded as “abc gup xyz def” , “count remain unchanged records” is coded as “buf ner def xyz”, “people and poverty rate” is coded as “abc mub for gup”.

**What is the code for "poverty unchanged"?**

**A**

buf jil

**B**

buf ner

**C**

ner gup

**D**

gup buf

**E**

None of the above

**Correct Answer**

D

**Marks**

1

73

**Question Description**

Direction: In each of the following question, there is a certain relationship between two given pair on both side of '::'. One word is given on another side of '::' while another word is to be found from the given options, having the same relation with this word as the words of the given pair . Choose the correct word from the following options.

pongee : Silk : : Shallot : ?

**A**

Boat

**B**

Building

**C**

Ship

**D**

Stream

**E**

None of the above

**Correct Answer**

A

**Marks**

1

74

**Question Description**

**Direction:** In each of the following question, there is a certain relationship between two given pair on both side of '::<' . One part is given on another side of '::<' while another part is to be found from the given options, having the same relation with this part as the parts of the given pair . Choose the correct part from the following options.

91 : ? :: 64 : 54

**A**

63

**B**

101

**C**

32

**D**

70

**E**

None of the above

**Correct Answer**

A

**Marks**

1

75

**Question Description**

Directions : Each of the following consists of a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statements are sufficient to answer the question.

A teacher wrote a meaningful English word on the black-board. Find the exactly middle letter of the 5 letter word?

Statement I : The first and last letter of the word is 'E'. The second and fourth letters of the word are consecutive letters in English alphabet series. R is adjacent to A.

Statement II : The first and last vowel is same. Only one letter is placed between A and E. S is written after R. The vowels are placed at odd numbered positions.

**A**

If the data in statement I is sufficient to answer the question

**B**

If the data in statement II is sufficient to answer the question.

**C**

If the data in either statement I or statement II is sufficient to answer the question.

**D**

If the data in both statement I and statement II is necessary to answer the question.

**E**

None of the above

**Correct Answer****C****Marks****1**