Wings

Physical Chemistry_Revision_Set II

DATE: 08-01-2022 **TIME:** 200mins

1 **Mean free path of molecules in a rigid container will be**

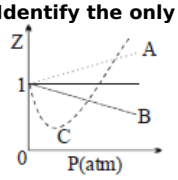
Correct Options:

(C) unchanged on changing temperature

Solution:

conceptual

2 **The given graph represents the variation of Z (compressibility factor = $\frac{PV}{nRT}$)versus P, for three real gases A, B and C. Identify the only incorrect statement.**



Correct Options:

(B)
for the gas B, b = 0 and its dependence on P is linear at all pressure

Solution:

$$\left(P+\frac{an^2}{v^2}\right)(v) = nRT$$

$$PV+\frac{an^2}{V} = nRT$$

above eq^n does not varity the statement (B) $\rightarrow$ incorrect

$$\frac{PV}{nRT}+\frac{an}{RTV} = 1$$

$$Z=1-\frac{an}{RTV}$$

3 The equilibrium constant for the reaction $N_2(g)+O_2(g) \rightleftharpoons 2NO(g)$ at temperature (T) is 4×10^{-4}. The value of K_c for the reaction $NO(g) \rightleftharpoons \frac{1}{2} N_2(g) + \frac{1}{2} O_2(g)$ at the same temperature is:

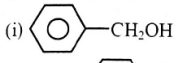
Correct Options:

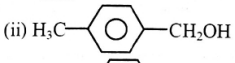
(B) 50

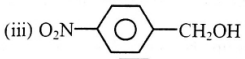
Solution:

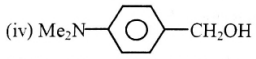
B

4 **Q.89** Correct order of the reactivity of the given alcohols towards the substitution with ($NaBr + H_2SO_4$) :

(i) 

(ii) 

(iii) 

(iv) 

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

Correct Options:

(B) 2

Solution:

2

5 **The pH of the solution containing 0.1 M HCl and 0.1 M CH3COOH is**

Correct Options:

(A) 1

Solution:

A

6 **If the solubility of lithium sodium hexafluoroaluminate is ‘s’ mole/lit, than its solubility product will be**

Correct Options:

(D) $2916s^8$

Solution:

$$Li_3Na_3(AlF_6)_2 \rightleftharpoons \underset{3s}{3Li^+} + \underset{3s}{3Na^+} + \underset{2s}{2AlF_6^{3-}}$$

$$K_{sp} = (3s)^3 (3s)^3 (2s)^2$$
$$= 2916\, s^8$$

7 **The solubility product of a salt having general formula MX_2, in water is : 4×10^{-12}. The concentration of M^{2+} ions in the aqueous solution of the salt is -**

Correct Options:

(A) 1.0×10^{-4}M

Solution:

.

8 **The mass of CO_2 that must be mixed with 20 g of oxygen such that 27 ml of a sample of the resulting mixture contains equal number of molecules of each gas**

Correct Options:

(B) 27.5 g

Solution:

$n_1 = n_2$

x / 44 = 20/32

x = 27.5 gm

9 **A liquid is in equilibrium with its vapours at boiling point. On the average the molecules in two phases have same**

Correct Options:

(B) Kinetic energy

Solution:

K.E. of gas and liquid molecules at any temperature is given by $\frac{3}{2}$RT. At equilibrium both have same T and thus same K.E.

10 **STATEMENT – 1**
Greater the value of van der Waal's constant 'a' greater is the liquification of the gas.
STATEMENT – 2
'a' directly measures the magnitude of attractive forces between the molecules.

Correct Options:

(A)
Statement – 1 is True, Statement – 2 is True; Statement – 2 is a correct explanation for Statement – 1.

Solution:

Considering the attractive force pressure in ideal gas equation (PV = nRT) is corrected by introducing factor of $\frac{an^2}{V^2}$ where a is van der Waal constant.

11 **If HA + NaOH --> NaA + H2O ΔH = – 12 kcal and HB + NaOH --> NaB + H_2O ΔH = –11 kcal then equimolar solution of which acid has higher pH-**

Correct Options:

(B) HB

Solution:

.

12 **The buffer solution of 100 ml having a pH value 4 when added to 1 ml dilute HCl, then the pH of buffer solution**

Correct Options:

(B) Does not change

Solution:

pH does not change on addition of some concentration of HCl.

13 **What fraction of an indicator Hln is in the basic form at a pH of 6 if pK_a of the indicator is 5 ?**

Correct Options:

(C) $\frac{10}{11}$

Solution:

.

14 **Dissociation constant of mono basic acids A, B, C and D are 6 x 10-4 , 5 x 10-5 , 3.6 x 10-6 and 7 x 10-10 respectively. The pH values of their 0.1M aqueous solution are in the order**

Correct Options:

(A) D> C > B > A

Solution:

Concentration of Solutions are same therefore [H^+] depends only on Dissociation constant.

15 **A 50 ml sample of a hydrogen-oxygen mixture was placed in a gas burette at 18°C and confined at 1 atm. A spark was passed through the sample so that the formation of water could go to completion. The resulting pure gas had a volume of 10 ml at atmospheric pressure. The initial mole fraction of hydrogen in the mixture would be**

Correct Options:

(C) 0.734 or 0.534

Solution:

conceptual

16 **1 litre flask contains nitrogen along with a drop or two of water at 40^{o} C, the total pressure being 760 Torr. If all the contents are transfered to another flask of 0.5L at the same temperature. The pressure setup in the second flask will be (aqueous tension at 40o C=55 torr)**

Correct Options:

(B) 1465 torr

Solution:

Final pressure =

$P_2(\text{dry gas}) + \text{aq Tension}$

$P_1(\text{dry gas}).V_1 = P_2(\text{dry gas}).V_2$

Note: aq. Tension is independent of volume, depends on temperature.

17 **A volume V of a gas at a temperature T_1 and a pressure P is enclosed in a sphere. It is connected to another sphere of volume V/2 by a tube and stopcock. The second sphere is initially evacuated and the stopcock is close. If the stopcock is opened the temperature of the gas in the second sphere becomes T_2. The first sphere is maintained at a temperature T_1. What is the final pressure P_1 within the apparatus?**

Correct Options:

(A) $\frac{2PT_2}{2T_2 + T_1}$

Solution:

$n_1 + n_2 = n_f$

18

What is the equilibrium constant expression for the reaction

$P_4(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$

Correct Options:

(C) $K_c = 1/[O_2]^5$

Solution:

$K_c = 1/[O_2]^5$

19 **The solubility products of $Al(OH)_3$ and $Zn(OH)_2$ are 8.5×10^{-23} and 1.8×10^{-14} at room temperature. If the solution contains Al^{3+} and Zn^{2+} ions, the ion first precipitated by adding NH_4OH is –**

Correct Options:

(A) Al^{3+}

Solution:

CONCEPTUAL

20 Assuming 100% ionization, which will have maximum pH?

Correct Options:

(C) 0.01M $(NH_4)_3PO_4$

Solution:

conceptual

21 The Lassaigne's extract is boiled with conc. HNO_3 while testing for halogens. By doing so it:

Correct Options:

(B) decomposes Na2S and NaCN, if formed

Solution:

conceptual

22 At which of the following four conditions, the density of an ideal gas will be maximum?

Correct Options:

(B) 273 K and 2 atm

Solution:

B

23 If for two gases of molecular weights M_A and M_B at temperature T_A and T_B, $T_AM_B = T_BM_A$, then which property has the same magnitude for both the gases.

Correct Options:

(D) V_{rms}

Solution:

i) density of a gas (ρ) = $\frac{PM}{RT}$

Since $\frac{M_B}{T_B} = \frac{M_A}{T_A}$, ∴ at the same pressure $\rho_A = \rho_B$.

But if pressure is different then $\rho_A \neq \rho_B$.

ii)Pressure of the gases would be equal if their densities are equal other wise not.

3. KE per mol = $\frac{3}{2}RT$

∴It will be different for the two gases.

4.Vrms = $\sqrt{\frac{3RT}{M}}$, since $\frac{T_A}{M_A} = \frac{T_B}{M_B}$; Vrms of A = Vrms of B

24 A gas at a pressure of 5.0 atm is heated from 0º to 546ºC and simultaneously compressed to one-third of its original volume. Hence final pressure is:

Correct Options:

(C) 45.0 atm

Solution:

5 x V = n x R x 273--------(1)

P x (V/3) = n x R x 819-----(2)

By solving P = 45 atm

25

A solution which is 10^{-3} M each in Mn^{2+}, Fe^{2+}, Zn^{2+} and Hg^{2+} is treated with 10^{-16} M sulphide on ion. If K_{sp} of MnS, FeS, ZnS and HgS are 10^{-15}, 10^{-23}, 10^{-20} and 10^{-54} respectively which one will precipitate first:

Correct Options:

(C) HgS

Solution:

Which requires least number of sulphide ion, that will ppt.

26 **The solubility products of $Al(OH)_3$ and $Zn(OH)_2$ are 8.5×10^{-23} and 1.8×10^{-14} respectively. If NH_4OH is added to a solution containing Al^{3+} and Zn^{2+} ions, then substance precipitated first is:**

Correct Options:

(A) $Al(OH)_3$

Solution:

CONCEPTUAL

27

The solubility product of $BaCrO_4$ is $2.4\ 10^{-10}\ M^2$. The maximum concentration of $Ba(NO_3)_2$ possible without precipitation in a 6×10^{-4} M K_2CrO_4 solution is-

Correct Options:

(A) 4×10^{-7}M

Solution:

.

28 **A solution with pH = 2 is more acidic than the one with pH = 6 by a factor of**

Correct Options:

(D)

Solution:

$$[H^+]_1 = 10^{-2}$$
$$[H^+]_2 = 10^{-6}$$
$$\therefore \text{ factor} = \frac{[H^+]_1}{[H^+]_2} = 10^4$$

29 **Dry ice is solid carbon dioxide. A 0.050g sample of dry ice is placed in an evacuated 4.6 L vessel at 30°C. Calculate the pressure inside the vessel after all the dry ice has been converted to CO_2 gas.**

Correct Options:

(D) 6.14×10^{-3} atm

Solution:

D

30 **Which of the following represents the avogadro number**

Correct Options:

(D)
Number of molecules present in one mole of gas at any temp. and pressure

Solution:

.

31 Which of the following will shift the reaction $PCl_3 + Cl_2 \rightleftharpoons PCl_5$ to the left side :

[1] Addition of PCl_5 [2] Increase in pressure

[3] Decrease in temperature [4] Catalyst

Correct Options:

(A) (A)

Solution:

.

32 **The solubility in water of a sparingly soluble salt AB2 is 1.0×10^{-5} mol L^{-1}. Its solubility product will be**

Correct Options:

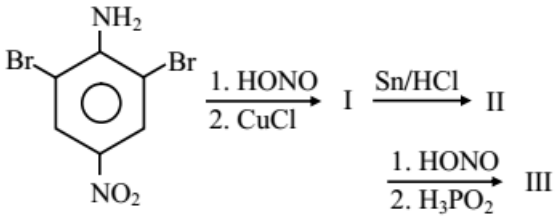
(C) 4×10^{-15}

Solution:

.

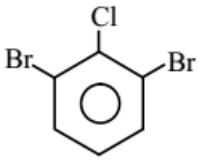
33

निम्न अभिक्रिया अनुक्रम में प्राप्त अंतिम उत्पाद (III) है

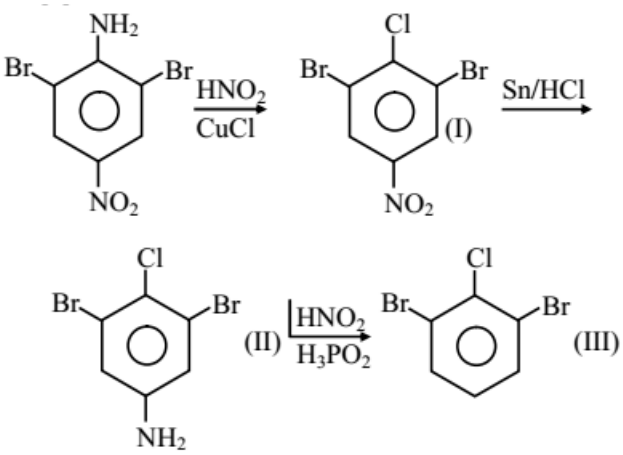


Correct Options:

(C)



Solution:



34 **100 mL solution of pH = 6 is diluted to 1000 mL. Resulting solution has pH :**

Correct Options:

(B) 6.79

Solution:

conceptual

35 The addition of solid sodium carbonate to pure water causes

Correct Options:

(B) An increase in P^H

Solution:

.

36 A gas causes heating effect when allowed to expand at room temperature, it shows heating effect because

Correct Options:

(B)
a gas has inversion temperature
much below room temperature

Solution:

If a gas is allowed to expand above its inversion temperature it causes heating effect.

37 500 mL of nitrogen at 27°C is cooled to –5°C at the same pressure. The new volume becomes

Correct Options:

(B) 446.66 mL

Solution:

B

38 How much should the pressure be increased in order to decrease the volume of a gas by 5% at a constant temperature?

Correct Options:

(B) 5.26%

Solution:

$P_1V_1 = P_2V_2$

39 The temperature of a sample of gas is raised from 127°C to 527°C. The average kinetic energy of the gas.

Correct Options:

(B) Is doubled

Solution:

Initial temperature = 127°C = 400 K
Final temperature = 527°C = 800 K

Since $\bar{KE} \propto T$, when temperature is doubled, KE is doubled.

40 Among the following. the alkene on ozonolysis giving rise to only one aldehyde as the product is:

Correct Options:

(C) 2-Butene

Solution:

-

41 **Which of the following expressions is/are not true ?**

Correct Options:

(D)
$[H^+] = [OH^-] = 10^{-7}$ M for neutral solution at all tempretures

Solution:

.

42 **Which of the following not function as buffer solution?**

Correct Options:

(A) $NaOH + NH_4OH$

Solution:

conceptual

43 The equilibrium constant, K_p for the reaction,
$PCl_5 \rightleftharpoons PCl_3 + Cl_2$ is 1.6 at 200°C
The pressure at which PCl_5 will be 50% dissociated at 200°C is

Correct Options:

(B) 4.8 atm

Solution:

-

44 **The pK_a of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA, in which 50% of the acid is ionized, is :**

Correct Options:

(A) 9.5

Solution:

For acidic buffer, $pH = pK_a + \frac{[A^-]}{[HA]}$ When the acid is 50% ionised, $[A^-] = [HA]$ or $pH = pK_a + \log 1$ or $pH = pK_a$given, $pK_a = 4.5$ ⇒ pH = 4.5 ⇒ pOH = 14 – 4.5 = 9.5.

45 **In acidic medium phenolphthalein exists in the form of**

Correct Options:

(A) Benzenoid

Solution:

conceptual

46 **At 27°C a sample of ammonia gas exerts a pressure of 5.3 atm. What is the pressure when the volume of the gas is reduced to one-tenth of the original value at the same temperature?**

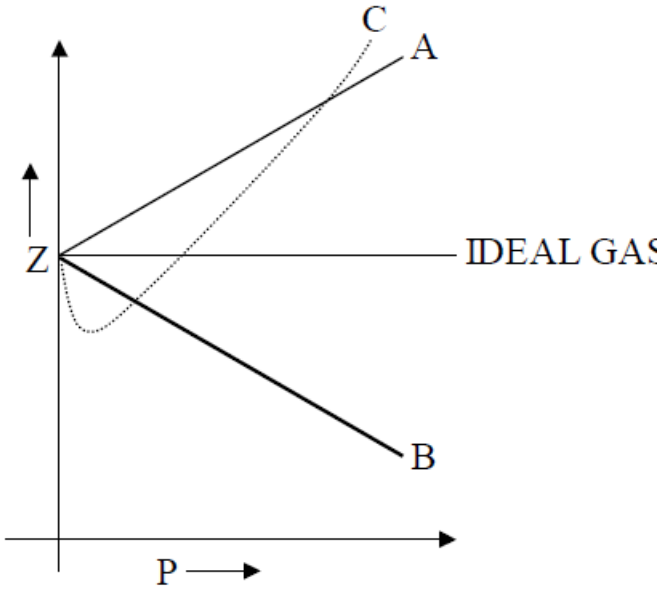
Correct Options:

(C) 53 atm

Solution:

C

47



$$\text{where } Z = \frac{PV}{nRT},$$

a = Van der Waal's constant for pressure correction
b = Van der Waal's constant for volume correction
Pick the only incorrect statement

Correct Options:

(D)
slope for all three gases at high pressure is positive.

Solution:

conceptual

48 ***A flask containing 12 g of a gas of relative molecular mass 120 at a pressure of 100 atm was evacuated by means of a pump until the pressure was 0.01 atm. Which of the following is the best estimate of the number of molecules left in the flask***

$$(N_0 = 6\times10^{23}\,mol^{-1}).$$

Correct Options:

(B) 6×10^{18}

Solution:

$$P_1 = \frac{n_1}{V}RT \quad \text{and} \quad P_2 = \frac{n_2}{V}RT \quad , \qquad \text{Since V and T remain constant hence } \frac{n_1}{n_2} = \frac{P_1}{P_2}$$

$$n_2 = n_1 \times \frac{P_2}{P_1} = \frac{12}{120} \times \frac{0.01}{100} = 10^{-5} \Rightarrow \text{Number of molecules left in the flask} = n_2 \times N_0 = 6\times10^{18}$$

49

Which will make basic buffer?

Correct Options:

(D) $100\,mL\,of\,0.1\,M\,HCl + 200\,mL\,of\,0.1\,M\,NH_4OH$

Solution:

50 **if the concentration of C at equilibrium is increased by a factor of 2, it will cause the equilibrium concentration of B to change to**

In a system $A(s) \rightleftharpoons 2B(g) + 3C(g)$,

Correct Options:

(D)

$\frac{1}{2\sqrt{2}}$ times the original value

Solution:

conceptual

51 **The pH of 10^{-8} M HCl is**

Correct Options:

(C) Between 6 and 7

Solution:

conceptual

52 **The solubility of sparingly soluble substance AgCl can be increased by the addition of**

Correct Options:

(C) Both a and b

Solution:

CONCEPTUAL

53 **Which of the following solution will have pH close to 1?**

Correct Options:

(D)

75 ml of $\frac{M}{5}$ HCl + 25 ml of $\frac{M}{5}$ NaOH

Solution:

conceptual

54 **Chlorex which is a good solvent for aromatic impurities is:**

Correct Options:

(B) dichlorodiethyl ether

Solution:

dichlorodiethyl ether

55 **The solubility of Fe(OH)3 would be maximum in-**

Correct Options:

(D) 0.1 M H_2SO_4

Solution:

.

56 **The correct order of increasing [H3O+] in the following aqueous solution is –**

Correct Options:

(C)
0.01 M $NaNO_2$< 0.01 M NaCl <
0.01 M H_2S < 0.01 M H_2SO_4

Solution:

CONCEPTUAL

57 **STATEMENT - 1**
He and H2 always show positive deviation at 0°C in PV vs P graph.
STATEMENT - 2
Boyle temperature of both these gases are much below than 0°C.

Correct Options:

(A)
Statement – 1 is True, Statement – 2 is True; Statement – 2 is a correct explanation for Statement – 1.

Solution:

conceptual

58 **At STP, a container has 1 mole of Ar, 2 moles of CO_2, 3 moles of O_2 and 4 moles of N_2. Without changing the total pressure if one mole of O_2 is removed, the partial pressure of O_2 :**

Correct Options:

(A) is changed by about 26 %

Solution:

$$\frac{P_1}{P_2} = \frac{3/10P_T}{2/9P_T}$$

$P = XP_T$

$$= \frac{P_1}{P_2} = \frac{2.7}{2}$$

$$\Rightarrow \quad \frac{P_1 - P_2}{P_1} \times 100 = \frac{\frac{2.7}{2}P_2 - P_2}{P_2} \times 100$$

26 %
Partial pressure of O_2 is changed by about 26%

59 **If for two gases of molecular weights M_A and M_B at temperature T_A and T_B, $T_AM_B = T_BM_A$, then which property has the same magnitude for both the gases :**

Correct Options:

(D) r.m.s. speed

Solution:

CONCEPTUAL

60

A weak acid, HA, has a K_a of 1.00×10^{-5}. If 0.100 mol of this acid is dissolved in one litre of water, the percentage of acid dissociated at equilibrium is closest to

Correct Options:

(A) 1.00%

Solution:

61 **Statement–1: Aqueous solution of $FeCl_3$ is acidic.**
Statement–2 : $FeCl_3$ hydrolysis in water to form acidic solution

Correct Options:

(A)
STATEMENT–1 is True, STATEMENT–2 is True; STATEMENT–2 is a correct explanation for STATEMENT–1

Solution:

$$FeCl_3 + 3H_2O \longrightarrow Fe(OH)_3 + 3HCl$$

62 **The pH of 0.016 M NaOH solution is**

Correct Options:

(B) 12.204

Solution:

.

63 **Dissociation constant of two acids HA & HB are respectively 4×10^{-10} & 1.8×10^{-5} whose pH value will be higher for a given molarity:**

Correct Options:

(A) HA

Solution:

$HA \rightleftharpoons H^+ + A^-$

$HB \rightleftharpoons H^+ + B^-$

for HA

$K_{a_1} = \alpha^2 C$

$\alpha_1^2 = \sqrt{\frac{K_{a_1}}{C}} = \sqrt{\frac{4 \times 10^{-10}}{C}}$

$\alpha^1 = 2 \times 10^{-5}$ for C = 1 M

Similarly $\Rightarrow [H^+] = C\alpha = 2 \times 10^{-5} \Rightarrow pH = 4.7$

for HB, $\alpha 22 = \sqrt{\frac{K_{a_2}}{C}}$

$= \sqrt{\frac{1.8 \times 10^{-5}}{C}}$ for C = 1M

$\alpha^2 = 4.2 \times 10^{-3} \Rightarrow [H^+] = C\alpha = 4.2 \times 10^{-3}$

$pH = -\log (4.2 \times 10^{-3}) = 2.37$

64 **STATEMENT – 1**
A mixture of the solutions of a weak acid and its sodium salt acts as a buffer solution.
STATEMENT – 2
The pH of the solution does not change substantially when small amount of acid or base is added to the buffer.

Correct Options:

(B)
Statement – 1 is True, Statement – 2 is True; Statement – 2 is NOT a correct explanation for Statement – 1.

Solution:

Acidic buffer solution ($CH_3COOH + CH_3COONa$). Buffer solution shows resistance in change in pH by the addition of small amount of acid or base.

65

For the reaction, $[Ag(CN)_2]^- \rightleftharpoons Ag^+ + 2CN^-$,

the equilibrium constant at 25º is 4×10^{-19}. If a solution is 0.1 M in KCN and 0.03 M in $AgNO_3$ originally, at equilibrium, the concentration of Ag^+ is

Correct Options:

(B) 7.5×10^{-18} M

Solution:

CONCEPTUAL

66 **pH of a mixture which is 0.1 M in CH_3COOH and 0.05 M in $(CH_3COO)_2Ba$ is [pK_a of CH3COOH = 4.74]**

Correct Options:

(A) 4.74

Solution:

CONCEPTUAL

67 **10 gm of a gas at 1 atm and 273 K occupies 5 litres. The temperature at which the volume becomes double for the same mass of gas at the same pressure is:**

Correct Options:

(C) 273°C

Solution:

C

68 **Equal weights of ethane and hydrogen are mixed in an empty container at 25 ºC . Total pressure exerted by hydrogen is :**

Correct Options:

(D) 15 : 16

Solution:

CONCEPTUAL

69

Dipole-induced dipole interactions are present in which of the following pairs?

Correct Options:

(A) HCl and He atoms

Solution:

(a) : HCl is polar ($\mu \neq 0$) and He is non-polar ($\mu = 0$) gives dipole-induced dipole interactions.

70 **STATEMENT - 1**

At an equilibrium A(g) + 2B(g) $\rightleftharpoons$ C(g) if substantial amount of water is added to the mixture and stated that only A(g) gets dissolved to a certain extent in water then equilibrium shifts towards forward direction.
STATEMENT - 2
On decreasing the volume of reaction mixture and keeping rest of things same the equilibrium shifts to a direction having less number of gaseous molecules.

Correct Options:

(D)
Statement – 1 is False, Statement – 2 is True.

Solution:

conceptual

71

47. Which of the following is correct option for free expansion of an ideal gas under adiabatic condition?
(a) q=o, ΔT<0 , w ≠ 0 (b) q=0, ΔT ≠ 0 , w=0
(c) q≠ 0 , ΔT=0, w=0 (d) q=0, ΔT=0, w=0

Correct Options:

(D) 4

Solution:

4

72 **What is the pH of the resulting solution when equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed?**

Correct Options:

(C) 12.65

Solution:

.

73 **The pK_a of acetysalicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about 2 – 3 and the pH in the small intestine is about 8. Aspirin will be**

Correct Options:

(D)
ionised in the small intestine and
almost unionised in the stomach

Solution:

CONCEPTUAL

74

In a saturated solution of the sparingly soluble strong electrolyte $AgIO_3$ (molecular mass = 283) the equilibrium which sets in is - $AgIO_3 \rightleftharpoons Ag^+_{(aq)} + IO^-_{3(aq)}$ **If the solubility product constant K_{sp} of $AgIO_3$ at a given temperature is 1.0×10^{-8}, what is the mass of $AgIO_3$ contained in 100 ml of its saturated solution ?**

Correct Options:

(B) 2.83×10^{-3} g

Solution:

.

75 If a solution has a pOH value of 14 at 25^0C , H^+ concentration should be

Correct Options:

(C) 1

Solution:

C

76 **A certain buffer solution contains equal concentration of X^- and HX. The Kb for X^- is 10^{-10}. The pH of the buffer is**

Correct Options:

(A) 4

Solution:

$$K_b = \frac{[OH^-][HX]}{[X^-]}$$

HX ⇌ $H^+ + X^-$

Hence $K_a = 10^{-4}$

Now as $[X^-]=[HX]$, $pH=pK_a=4$.

$$X^- + H_2O \rightleftharpoons OH^- + HX \quad K_a=\frac{[H^+][X^-]}{[HX]} \quad \therefore K_a \times K_b=[H^+][OH^-]=K_w=10^{-14}$$

77 **To determine the value of R, which of the PV value is considered to be equal for every gas at 273 K ?**

Correct Options:

(B) $\lim_{P\to 0}(PV_m)$

Solution:

$\lim_{P\to 0}(PV_m)$ = 2271.099 KPa dm3 is same for all gases at 273 K

78 **Chemical equilibrium is dynamic in nature because**

Correct Options:

(D)
Both forward and backward reactions occur at all times with same speed

Solution:

.

79 The critical temperature of a substance is -

Correct Options:

(B)
The temperature above which a substance can exist only as a gas

Solution:

B

80 **A real gas at a very high pressure occupies**

Correct Options:

(A)
more volume that that of an ideal gas under identical conditions

Solution:

at a very high pressure Z > 1

81 **A cylinder provided with a piston has some PCl_5 which is in equilibrium with PCl_3 and Cl_2. The system is compressed with the help of piston. Indicate the correct statement :**

Correct Options:

(C)
PCl_3 and Cl_2 will combine to form PCl_5

Solution:

eq shifts in backward direction

82 **0.1 millimole of $CdSO_4$ are present in 10 mL acid solution of 0.08 N HCl. Now H_2S is passed to precipitate all the Cd^{2+} ions. The pH of the solution after filtering off precipitate, boiling off H_2S and making the solution 100 mL by adding H_2O is-**

Correct Options:

(A) 2

Solution:

.

83 **Let K_w at 100°C be 5.5 × 10^{-13} M^2. If an aqueous solution at this temperature has pH = 6.2. Its nature will be**

Correct Options:

(B) alkaline

Solution:

$pK_w = 12.26$

∴ Condition of neutrality pH = 6.13

Thus, pH = 6.2 > 6.13

Means alkaline

84 **The pH of 0.1 M aqueous solutions of the following compounds increases in the order**

Correct Options:

(B)

$HCl < NH_4Cl < NaCl < NaCN$

Solution:

HCl = acidic
NH_4Cl salt of a strong acid weak base
NaCl = salt of strong acid strong base
NaCN = salt of strong base and weak acid
∴ pH order
$HCl < NH_4Cl < NaCl < NaCN$

85 **What is the hydronium ion concentration of a 0.25 M HA solution? (Ka =** 4×10^{-8} **)**

Correct Options:

(A) 10-4

Solution:

A

86 **The ionization constant of ammonium hydroxide is 1.77 × 10^{-5} at 298 K. Hydrolysis constant of ammonium chloride is**

Correct Options:

(D) 5.65×10^{-10}

Solution:

.

87 **The heat of vaporisation of benzene is 7353 cal mol^{-1} . The approximate bpt. of benzene is**

Correct Options:

(A) 77.1^0 C

Solution:

88 **If 25 ml of 0.25 M NaCl solution is diluted with water to a volume of 500ml.the new concentration of the solution is**

Correct Options:

(B) 0.0125 M

Solution:

25 x 0.25 = 500 x Y

Y = 25 x 0.25 / 500 = 0.0125M

89

250 ml of an aqueous solution of glucose contains 9 g of glucose. The molarity of the solution is:

Correct Options:

(C) 0.2

Solution:

$$M=\frac{Moles/litre}{molmass}=\frac{\frac{9}{250}*1000}{180}=0.2$$

90

Correct order of IE :-

Correct Options:

(C) Cu > Ag < Au

Solution:

Cu > Ag < Au

91

It is found that 0.1 M solution of three sodium salts NaX, NaY and NaZ gave pH 7.0, 9.0 and 11.0 respectively. The correct order of increasing strength of acid HX, HY, HX is

Correct Options:

(C) HZ < HY < HX

Solution:

CONCEPTUAL

92

Consider the following statements

1. Isotonic solutions have the same molar concentration at a given temperature

2. The molal elevation constant K_b is a characteristic of a solvent, and is independent of the solute added

3. The freezing point of a 0.1 M aqueous KCl solution is more than that of a 0.1 M aqueous $AlCl_3$ solution.

Which of these statements is correct?

Correct Options:

(D) 1, 2 and 3

Solution:

93

The osmotic pressure of a dilute solution is directly proportional to the

Correct Options:

(B) Ionic concentration

Solution:

.

94

12.2 g of benzoic acid (m.w.= 122) in 100 g benzene has depression in freezing point 2.6K; K_f = 5.2 K kg/mol. If there is 100% polymerization, number of molecules of benzoic acid in associated state is :

Correct Options:

(B) 2

Solution:

$\Delta T_f = i\ K_f\ m$

$i = 1- \alpha + \alpha/n$

95 **Which of the following is low boiling azeotropic mixture :**

Correct Options:

(D) $C_6H_6 + CCl_4$

Solution:

$C_6H_6 + CCl_4$

96 **Among the following, that does not form an ideal solution is**

Correct Options:

(B) C_2H_5Cl and C_6H_5OH

Solution:

.

97 $[H_3O^+]$ in 0.1 M H_2SO_4 at two stages $H_2SO_4 \rightleftharpoons H^+ + HSO_4^-$ $HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$ are :

Correct Options:

(D) 0.1 M, < 0.1 M

Solution:

CONCEPTUAL

98 **STATEMENT – 1**
If hydration energy is greater than lattice energy the solid dissolves in liquid.
STATEMENT – 2
The solubility of a solid in liquid depends upon lattice energy and hydration energy.

Correct Options:

(A)
Statement – 1 is True, Statement – 2 is True; Statement – 2 is a correct explanation for Statement – 1.

Solution:

Lattice energy is the amount of energy required to dissociate one mole of an ionic crystal into its ions and hydration energy is the amount of energy released when one mole of ions undergo hydration. So for the solubility of a solid in liquid, hydration energy must be greater than lattice energy.

99 **The mineral atacamite (A) is $[CuCl_2.xCu(OH)_2]$. 45.05 mL of 0.5089 M HCl were required to react completely with 1.6320 g of A. Hence, x is (mol. Wt of A = 427):**

Correct Options:

(B) 3

Solution:

45.05 mL of 0.5089 M HCl = 45.05 × 0.5089 millimol = 0.023 mol HCl

Also, 1.6320 g. A = $\frac{1.6320}{427} = 3.822 \times 10^{-3}$ mol A

= $2 \times 3.822 \times 10^{-3} \times$ x mol of OH^-

= 0.023 mol HCl

$\therefore 2 \times 3.822 \times 10^{-3} x = 0.023$ or x = 3

100 **When 200g of 10% solution was cooled part of the solute precipitated and the concentration of solution become 6% . The mass of the precipitated solute is**

Correct Options:

(B) 8.5 g

Solution:

101 **5% solution of sucrose is isotonic with 1% solution of a compound 'A' then the molecular weight of compound 'A' is**

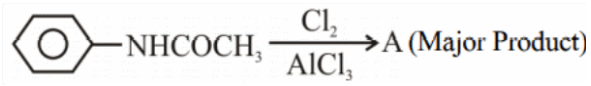
Correct Options:

(B) 68.4

Solution:

.

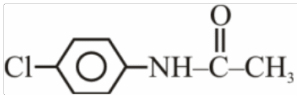
102



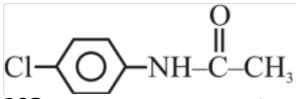
The major Product A will be :-

Correct Options:

(C)



Solution:



103 एक संकुल यौगिक $[MA_8]$ के 0.001 मोलल जलीय विलयन का हिमांक -0.0054°C है। मान लो कि यौगिक 100% आयनीकृत होता है और H_2O के लिये $K_f = 1.86\ km^{-1}$ है। निम्नलिखित में से कौन यौगिक को सही प्रदर्शित कर रहा है।

Correct Options:

(C) $[MA_6]A_2$

Solution:

C

104 **0.06% (w/v) aqueous solution of urea is isotonic with**

Correct Options:

(D) 0.01 M glucose solution

Solution:

-

105 **Which of the following salts undergoes hydrolysis?**

Correct Options:

(A) CH_3COONa

Solution:

.

106 **The total concentration of dissolved particles inside red blood cells is approximately 0.30 M and the membrane surrounding the cells is semipermeable. What would be the osmotic pressure (in atmosphere) inside the cells become if the cells were removed from the blood plasma and placed in pure water at 298 K?**

Correct Options:

(A) 7.34 atm

Solution:

Π = CRT

= 0.3 x 0.0821 x 298 = 7.339 atm

107 **STATEMENT - 1**
Gold sol is a Lyophobic sol.
STATEMENT - 2
Gold sol is a positive sol.

Correct Options:

(C) STATEMENT–1 is True, STATEMENT–2 is False

Solution:

Gold sol is a negative sol

108 **In a mixture of weak acid and its salt with strong base, the ratio of concentration of salt to acid is increased ten times the pH of the solution**

Correct Options:

(D) Increases by 1.

Solution:

conceptual

109

If 96g of sulphur reacts with 32g of oxygen to form sulphur dioxide. Calculate moles of excess reagent left in the reaction

S + O → SO_2

Correct Options:

(C) 2 mole

Solution:

2 mole

110

The molarity of the solution containing 7.1 g of Na_2SO_4 in

100 ml of aqueous solution is

Correct Options:

(B) 0.5 M

Solution:

111 **What is the activation energy for the decomposition of N_2O_5 as**

$$N_2O_5 \longrightarrow 2NO_2 + \frac{1}{2}O_2 \ ?$$

If the values of the rate constants are 3.45×10^{-5} and 6.9×10^{-3} at 27ºC and 67ºC respectively

Correct Options:

(D) 112.5 kJ

Solution:

$k=Ae^{-(E_a/RT)}$

112

Which of the following is incorrect statement ?

Correct Options:

(D) Clear solution of $Ca(OH)_2$ is called milk of lime

Solution:

Clear solution of $Ca(OH)_2$ is called milk of lime

113

Adiabatic reversible expansion of a gas is represented by -

Correct Options:

(B) $\left(\frac{T_1}{T_2}\right)=\left(\frac{P_1}{P_2}\right)^{\frac{\gamma-1}{\gamma}}$

Solution:

.

114

How many electrons can fit in the orbital for which $n = 3$ and $l = 1$?

Correct Options:

(A) 2

Solution:

(a) : For $n = 3$ and $l = 1$, the subshell is $3p$ and a particular $3p$ orbital can accommodate only 2 electrons.

115

Consider following two reactions

$$A \longrightarrow Product \longrightarrow -\frac{d[A]}{dt} = k_1[A]^o$$

$$B \longrightarrow Product \longrightarrow -\frac{d[B]}{dt} = k_2[B]$$

Units of k_1 and k_2 are expressed in terms of molarity (mol L^{-1}) and time (sec^{-1}) as –

Correct Options:

(D) M sec^{-1}, sec^{-1}

Solution:

(D). $A \rightarrow product \Rightarrow -\frac{d[A]}{dt} = k_1[A]^\circ \Rightarrow$ zero order

$$B \rightarrow product \Rightarrow -\frac{d[B]}{dt} = k_2[A] \Rightarrow 1^{st} \text{ order}$$

For zero order $\Rightarrow$ mol L^{-1} $time^{-1}$ = M sec^{-1}

For 1^{st} order $\Rightarrow$ $time^{-1}$ or sec^{-1}

116 **For a first order reaction A → P, the temperature (T) dependent rate constant (k) was found to follow the equation log k = – (2000) 1/T + 6.0. The preexponential factor A and the activation energy E_a, respectively, are**

Correct Options:

(D)
$1.0 \times 10^6\ s^{-1}$ and 38.3 kJ mol^{-1}

Solution:

$A \rightarrow P$, a first order reaction equation of first order

$$\log K = \log_{10} A - \frac{E_a}{2.303RT}$$

Given equation is

$$\log K = 6.0 - \frac{2000}{T}$$

Equating eqs. (1) and (2)

$\log_{10} A = 6$ or $A = 10^6$ or $1.0 \times 10^6\ S^{-1}$

$$\frac{E_a}{2.303R} = 2000$$

$E_a = 2000 \times 2.303 \times R$
$= 2000 \times 2.303 \times 8.314 \times 10^{-3}$ kJ mol^{-1} = 38.3 kJ mol^{-1}

117

Consider the reaction :

$$N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$$

The equality relationship between

$\frac{d[NH_3]}{dt}$ and $-\frac{d[H_2]}{dt}$ is

Correct Options:

(C)

$$+\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$$

Solution:

118 **The formal charge and P-O bond order in PO_4^{3-} respectively are**

Correct Options:

(B) -0.75, 1.25

Solution:

-0.75, 1.25

119 **The isotope used to remove the brain tumours and treatment of cancer is**

Correct Options:

(D) C0-60

Solution:

C0-60

120 **In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C, the rate of reaction will become**

Correct Options:

(D) 512 times

Solution:

-

121 **Which one of the following series contains electrophiles only :**

Correct Options:

(C) $AlCl_3, SO_3, \overset{+}{N}O_2$

Solution:

$AlCl_3, SO_3, \overset{+}{N}O_2$

122 The correct difference between first and second order reactions is that

Correct Options:

(B) the half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second-order reaction does depend on $[A]_0$

Solution:

123 **If the equilibrium constant for a reaction is 10, then the value of DG° will be (R = 8JK^{-1}mol^{-1}, T = 300 K)**

Correct Options:

(B) –5.527 KJ mol^{-1}

Solution:

.

124 **The number of unpaired electrons in Cu^+**

Correct Options:

(C) 0

Solution:

-

125 **i) . a = 15 kJ mol^{-1}; ΔDH = –70 kJ mol^{-1}ii) Ea = 30 kJ mol^{-1}; ΔDH = –15 kJ mol^{-1}iii) Ea = 60 kJ mol^{-1}; ΔDH = +20 kJ mol^{-1} If above reactions are at same frequency factor then fastest and slowest reactions are**

Correct Options:

(B) 'i' is fastest, 'iii' is slowest

Solution:

-

126 **The rate of the simple reaction**

$2NO + O_2 \longrightarrow 2NO_2$

when the volume of the reaction vessel is doubled–

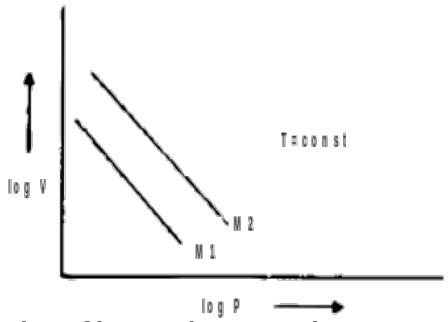
Correct Options:

(B) rate reduce to one-eights of its initial rate

Solution:

rate=(1/volume)^3

127



For same mass of two different ideal gases of molecular weights M_1 and M_2.

Plots of log V vs log P at a given constant temperature are shown. Identify the correct option :

Correct Options:

(A) $M_1 > M_2$

Solution:

128 **STATEMENT – 1**
The value of n for a line is Balmer series of hydrogen spectrum having the highest wavelength 4 and 6
STATEMENT – 2
For Balmer series of hydrogen spectrum the value of n1 is 2 and n2 is 3,4,5 etc.

Correct Options:

(D)
Statement – 1 is False, Statement – 2 is True.

Solution:

We know that the line in Balmer series of hydrogen spectrum the highest wavelength of lowest energy is between $n_1 = 2$ and $n_2 = 3$. And for Balmer series of hydrogen spectrum, the value of $n_1 = 2$ and $n_2 = 3, 4, 5$.

129 **What is the value of angular momentum of an electron revolving inside H-atom with an energy – 3.4 eV**

Correct Options:

(A) $2.1 \times 10^{-34}\ Js^{-1}$

Solution:

CONCEPTUAL

130 **For homogeneous gas reaction $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$. The equilibrium constant Kc has the unit of -**

Correct Options:

(A) $(\text{concentration})_1$

Solution:

$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$

at equ. x x x x

$K_c = \frac{(x)^4 \times (x)^6}{(x)^4 \times (x)^5}$ (x) = concentration

$K_c = (x)$

131 **Which of the following rate law has an overall order of 0.5 for reaction involving substances X, Y and Z?**

Correct Options:

(C) rate = $K(C_x)^{1.5}(C_y)^{-1}(C_z)^0$

Solution:

CONCEPTUAL

132 **For hypothetical reversible**

$1/2A_2(g) + 3/2B_2(g) \rightarrow AB_3(g)$; DH = –20KJ if standard entropies of A_2,B_2 and AB_3 are 60, 40 and 50 JK^{-1} respectively. The above reaction will be in equilibrium at -

Correct Options:

(B) 500 K

Solution:

.

133 **The first use of quantum theory to explain the structure of atom was made by**

Correct Options:

(B) Bohr

Solution:

CONCEPTUAL

134 **Which one of the following molecules contain no π -bond?**

Correct Options:

(B) H_2O

Solution:

H_2O

135 **Consider an endothermic reaction X → Y with the activation energies E_b and E_f for the backward and forward reactions, respectively.**
In general

Correct Options:

(A) $E_b < E_f$

Solution:

-

136 **STATEMENT - 1**
The Arrhenius equation explains the ttemperature dependence of rate of a chemical reaction.
STATEMENT - 2
Plots of log K versus 1/T are linear and the energy of activiation is obtained from such plots.

Correct Options:

(A)
Statement – 1 is True, Statement – 2 is True; Statement – 2 is a correct explanation for Statement – 1.

Solution:

CONCEPTUAL

137 **STATEMENT – 1**
Instantaneous rate of reaction is equal to dx/dt
.
STATEMENT – 2
It is the rate of reaction at any particular instant of time.

Correct Options:

(B)
Statement – 1 is True, Statement – 2 is True; Statement – 2 is NOT a correct explanation for Statement – 1.

Solution:

Instantaneous rate of a reaction is equal to small change in conc. (dx) during a small interval of time (dt) at that particular instant of time divided by the time interval.

138 **Five moles of an ideal gas at 1 bar and 298 K is expanded into vacuum to double the volume. The work done is :**

Correct Options:

(A) zero

Solution:

.

139

STATEMENT - 1

$\frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$ can be used to determine the wavelength of an electron in an orbit.

STATEMENT - 2

Wavelength associated with an electron is given by $\lambda = \frac{h}{\sqrt{2mKE}}$

Correct Options:

(D)
Statement – 1 is False, Statement – 2 is True.

Solution:

Statement I is incorrect as it can be used to determine the wavelength for an electronic transition but statement II is correct.

140 **The quantum number which specifies thelocation as well as energy is**

Correct Options:

(A) principal quantum number

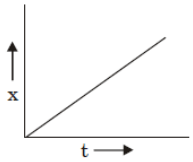
Solution:

-

141

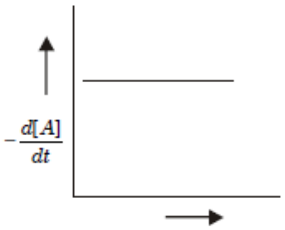
The graph between $-\frac{d[A]}{dt}$ and time will be of the type

time 't' for A → B is given below



Correct Options:

(C)



Solution:

-

142 **Rate of reaction can be expressed by Arrhenius equation as $k = Ae^{-E/RT}$, In this equation, E represents**

Correct Options:

(A)
the energy below which colliding
molecules will not react

Solution:

the energy below which colliding molecules will not react

143

Statement-I : Down the group solubility of IIA group hydroxides increases

Statement-II : Down the group in IIA group hydroxides, decrease in lattice enthalpy is more than decrease in hydration enthalpy

Correct Options:

(A) I and II are true

Solution:

I and II are true

144

For which of the following change ΔH ≠ ΔE?

Correct Options:

(D) $N_2(g)+3H_2(g)\rightarrow 2NH_3(g)$

Solution:

.

145 **In the reaction CS_2 (*l*) + $3O_2$ (g) → CO_2 (g) + $2SO_2$(g) ΔH = - 265 kcal**
The enthalpies of formation of CO_2 and SO_2 are both negative and are in the ratio 4 : 3. The enthalpy of formation of CS_2 is + 26kcal/mol. Calculate the enthalpy of formation of SO_2.

Correct Options:

(D) – 71.7 kcal/mol

Solution:

$Cs_2\ (\ell) + 3O_2\ (g) \rightarrow Co_2\ (g) + 2So_2 + 2so_2\ \Delta H =$
Let $\Delta H_f\ (CO_2, g) = 4x$
and $\Delta H_f\ (SO_2, g) = 3x$
$\Delta H_{reaction} = \Delta H_f\ (CO_2,g) = 2\ \Delta H_f\ (SO_2.g) - \Delta H_f\ (CS_2\ \ell)$ enthalpy of formation = - 71.7 kcal / mol
$-265 = 4x + 6x - 26$
$x = -23.9$
$\therefore\ \Delta H_f\ (SO_2,g) = 3x = 71.7$ kcal / mol.

146 **Radiation of $\lambda = 155$ nm was irradiated on Li (work function = 5eV) plate. The stopping potential (in eV) is.**

Correct Options:

(A) 3eV

Solution:

3 eV
Co_{rite} Actual
Correct option

$$K.E.\ max = \frac{hc}{\lambda} - \phi$$

$= 8 - 5$
$= 3eV$
$\therefore\ V_0 = 3\ eV$

147 A mole of N_2H_4 loses ten moles of electrons to form a new compound Y. Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in Y? (there is no change in the oxidation number of hydrogen)

Correct Options:

(C) +3

Solution:

oxidation number of N =-2 in N2H4

there are two N in N2H4

two N loses 10 mol electrons

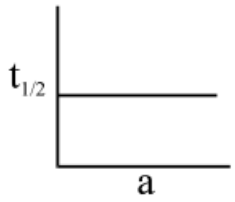
one N loses 5 mol electrons hence -2+5=+3

new oxidation state of N =+3

148 Which of the following curves represents a Ist order reaction :

Correct Options:

(B)



Solution:

$T_{1/2}$= ln2/k

149 A sample of radioactive element undergoes 90% decomposition in 366 minutes. Its $t_{0..5}$ in minutes is

Correct Options:

(A) (ln2/ln10)x366

Solution:

$$t_{05} = \frac{1}{K}\ \ln_2; t_{O.9} = \frac{1}{K}\ \ln 10; \frac{t_{0.5}}{t_{0.9}} = \frac{1}{K}$$

$$\text{In } 2x\frac{k}{\ln 10}$$

150 Given that standard heat enthalpy of CH_4, C_2H_4 and C_3H_8 are – 17.9, 12.5, –24.8 Kcal/mol. The ΔH for $CH_4 + C_2H_4 \rightarrow C_3H_8$ is -

Correct Options:

(D) –19.4 Kcal

Solution:

.

151 How many electrons fit in the orbital for which n = 3 and l - 1?

Correct Options:

(B) 6

Solution:

the answer is 2

152 The number of electrons emitted is

Correct Options:

(A)
proportional to the intensity of the
incident radiation

Solution:

CONCEPTUAL

153

For the reaction $A(g) + 2B(g) \longrightarrow C(g) + D(g)$ $\quad \frac{dx}{dt} = k\,[A]\,[B]^2$

Initial pressure of A and B are respectively 0.60 atm and 0.80 atm. At a time when pressure of C is 0.20 atm, rate of the reaction, relative to the initial value is :

Correct Options:

(A) $\frac{1}{6}$

Solution:

Initial Rate = $k\,[A]\,[B]^2$

Rate 1 = $k\,[0.60]\,[0.80]^2$ .....(i)

Rate 2 = $k\,[A_t]\,[B_t]^2$ .....(ii)

Given Rxn

$A(g)$	+	$2\,B\,(g)$	$\longrightarrow$	$C\,(g)$	+	$D\,(g)$	
0.60 atm		0.80 atm		0		0	t = 0
(0.60 – 0.2)		(0.80–0.40)		0.20		0.20 atm	
0.40 atm		0.40 atm		0.20 atm		0.20 atm	t = t

Put value of pressure of t = t in rate equation (II)

Rate 2 = $k\,[.40]\,[.40]^2$

$$\frac{\text{Rate}\,2}{\text{Rate}\,1} = \frac{k[.40][.40]^2}{k[.60][.80]^2} \quad \Rightarrow \quad \frac{\text{Rate}\,2}{\text{Rate}\,1} = \frac{2}{3} \times \frac{1}{4} = \frac{1}{6}$$

154 Two radioactive elements X and Y have half lives of 50 and 100 minute respectively. Initial sample of both the elements have same no. of atoms. The ratio of the remaining number of atoms of X and Y after 200 minute is:

Correct Options:

(D) 1/4

Solution:

let initial atoms is a

after 200 min X=a/2^4 = a/16

after 200 min Y=a/2^2 = a/4

155 $3A \rightarrow 2B$, rate of reaction $\frac{+d[B]}{dt}$ is equal to

Correct Options:

(B) $-\frac{2}{3}\frac{d[A]}{dt}$

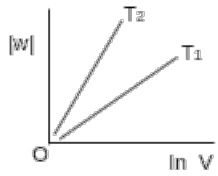
Solution:

-

156 **Consider the reversible isothermal expansion of an ideal gas in a closed system at two different temperatures T_1 and T_2 ($T_1 < T_2$). The correct graphical depiction of the dependence of work done (w) on the final volume (V) is :**

Correct Options:

(D)



Solution:

|w| = nRT $\ell n \frac{v_f}{v_i}$ |w| = nRT $\ell n\, v_f - nRT\, v_i$ Intercept will be – ve

157 **The correct relationship between free energy change in a reaction and the corresponding equilibrium constant K_c is –**

Correct Options:

(B) – Δ G° = RT ln K_c

Solution:

.

158 If uncertainty in position and momentum are equal, then uncertainty in velocity is

Correct Options:

(C) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

Solution:

(c) : From Heisenberg uncertainty principle,

$$\Delta p \cdot \Delta x \geq \frac{h}{4\pi} \quad \text{or} \quad m\Delta v \times \Delta x \geq \frac{h}{4\pi}$$

$$\text{or} \quad (m\Delta v)^2 \geq \frac{h}{4\pi} \qquad (\because \Delta x = \Delta p)$$

$$\text{or} \quad \Delta v \geq \frac{1}{2m}\sqrt{\frac{h}{\pi}}$$

159 **The rate of reaction was found to be equal to its rate constant at any concentration of the reactant. The order of the reaction is**

Correct Options:

(A) zero order

Solution:

-

160 **For the first order opposed by first order reaction ; $k_f = 9 \times 10^{-3}$ min^{-1} and $k_b = 2 \times 10^{-3}$ min^{-1}**
If we start with the concentration of A equal to 1 (M) what will be concentration of B in $10^3/11$ mins ?

Correct Options:

(C) 0.517(M)

Solution:

The integrated rate equation is

$$\ln \frac{x_{eq}}{(x_{eq} - x)} = (k_f + k_b) \times t$$

$$\ln \frac{x_{eq}}{(x_{eq} - x)} = 11 \times 10^{-3} \times \frac{10^3}{11} = 1 = \ln e$$

$$\text{or} \quad x = x_{eq} \frac{(2.718 - 1)}{2.718} = x_{eq} \times 0.632$$

$$A \underset{k_b}{\overset{k_f}{\rightleftharpoons}} B$$

$$1 \qquad 0$$

$$(1 - x_{eq}) \qquad x_{eq}$$

$$\therefore \quad \frac{x_{eq}}{(x_{eq} - x)} = e$$

$$\text{or} \quad x_{eq} = e\, x_{eq} - x\, e$$

$$\text{or} \quad x\, e = e\, x_{eq} - x_{eq}$$

$$\text{or} \quad x = \frac{x_{eq}(e - 1)}{e}$$

$$\therefore \quad \frac{x_{eq}}{1 - x_{eq}} = \frac{k_f}{k_b} = \frac{9}{2}$$

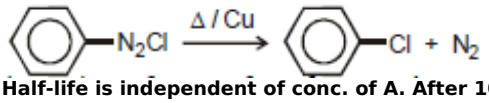
$$\text{or} \quad 2\, x_{eq} = 9 - 9\, x_{eq}$$

$$\text{or} \quad x_{eq} = \frac{9}{11} = 0.818$$

$$\therefore \quad x = 0.818 \times 0.632$$

$$\text{or} \quad x = 0.517 \text{ (M)}$$

161



Half-life is independent of conc. of A. After 10 minutes volume of N_2 gas is 10 L and after complete reaction volume is 50 L. Hence rate constant in min–1 :

Correct Options:

(B) (2.303/10) log 1.25

Solution:

$$Ph - N_2Cl \xrightarrow{\Delta / Cu} Ph - Cl + N_2$$

Half life is independent of concentration $\Rightarrow$ reaction is of first order $Ph - N_2Cl \rightarrow PhCl + N_2$

t = 0	A_0	0	0
t = 30	A_0–x	x	x
t = ∞	0	A_0	A_0

$x \propto 10$

$A_0 \propto 50$

$\Rightarrow A_0 - x \propto 40$

$$K = \frac{2.303}{t}\log\frac{A_0}{A_0 - x}$$

$$= \frac{2.303}{10}\log\frac{50}{40}$$

$$= \frac{2.303}{10}\log(1.25)\,min^{-1}$$

162 **The rate of a reaction is expressed in different ways as follows ;**
+ 1/2(d[C]/dt) = – 1/3 (d[D]/dt) = + 1/4 (d[A]/dt) = – (d[B]/dt) The reaction is :

Correct Options:

(B) B + 3D → 4A + 2C

Solution:

$$-\frac{1}{3}\frac{d[D]}{dt} = -\frac{d[B]}{dt} = \frac{1}{2}\frac{d[C]}{dt} = \frac{1}{4}\frac{d[A]}{dt}$$

$$B + 3D \longrightarrow 2C + 4A$$

$$B + 3D \longrightarrow 4A + 2C$$

163

The variation of equilibrium constant with temperature is given below :

Temperature Equilibrium Constant

T_1 = 25oC K_1 = 10

T_2 = 100oC K_2 = 100

The value of ΔH0 , Δ G0 at T_1 and Δ G0 at T_2 (in Kj mol^{-1}) respectively, are close to[use R = 8.314JK^{-1} mol^{-1}]

Correct Options:

(C) 28.4, - 5.71 and -14.29

Solution:

.

164 **A hydrogen like species with atomic numeb Z is in higher energy level "n" and emits photons of energy 25.7 and 8.7 ev when makes a transitions to I^{st} and 2nd excited state respectively. Determine "n"?**

Correct Options:

(B) 5

Solution:

CONCEPTUAL

165 The maximum number of 3d-electrons having spin quantum number, s = + ½ is :

Correct Options:

(B) 5

Solution:

-

166 Read the following statements :
(i) Peroxisomes are involved in photorespiration of the non-green cell of plants and also perform β-oxidation of fatty acids in animal cells
(ii) Mitochondria possess enzymes for the β-oxidation of fatty acids
(iii) The fluid-dynamic mosaic model of plasma membrane explains both structural and functional aspects
(iv) The movement of cilla and flagella is due to the presence of dynein proteins (V) Lysosomes orignate from Golgi
How many of the above statements are correct ?

Correct Options:

(C) Four

Solution:

-

167 The significance of quantisation is going to be lost as

Correct Options:

(C) Both (a) and (b)

Solution:

CONCEPTUAL

168 In an atom two electrons move around the nucleus in circular orbits of radii R & 4R. The ratio of the time taken by them to complete one revolution is :

Correct Options:

(C) 1 : 8

Solution:

time= distance/velcity

velocity = K. z/n

169

यदि 100 मोल H_2O_2 , 1 bar तथा 300 K पर अपघटित होती है तो 1 bar दाब के विरूद्ध प्रसारित होने पर एक मोल $O_2(g)$ द्वारा किया गया कार्य (kJ) होगा :

$2H_2O_2(l) \rightleftharpoons 2H_2O(l) + O_2(g)$

$(R = 8.3\ J\ K^{-1}\ mol^{-1})$

Correct Options:

(C) 124.50

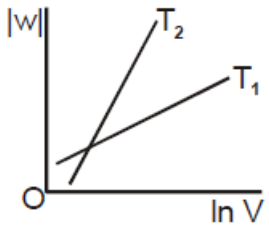
Solution:

-

170 Consider the reversible isothermal expansion of an ideal gas in a closed system at two different temperatures T_1 and T_2 ($T_1 < T_2$). The correct graphical depiction of the dependence of work done (w) on the final volume (V) is

Correct Options:

(C)



Solution:

$$\omega = -nRT \ln \frac{v_2}{v_1}$$

$$|\omega| = nRT \ln \frac{v_2}{v_1}$$

$$|\omega| = nRT \ln v_2 - nRT \ln v_1$$

$y = mx - C$

Slope of curve 2 is more than curve 1 and inter cept of curve 2 is more negative then curve 1.

171 The electrons identified by quantum numbers n and l :i) n = 4, l = 1 ii) n = 4, l = 0 iii) n = 3, l = 2 iv) n = 3, l = 1 can be placed in order of increasing energy as

Correct Options:

(B) iv < ii < iii < i

Solution:

-

172

The correct option for free expansion of an ideal gas under adiabatic condition is

Correct Options:

(A) $q = 0, \Delta T = 0$ and $w = 0$

Solution:

(a) : For free expansion of an ideal gas, $P_{ex} = 0$,

$w = -P_{ex}\Delta V = 0$

For adiabatic process, $q = 0$

According to first law of thermodynamics,

$\Delta U = q + w = 0$

As internal energy of an ideal gas is a function of temperature, $\Delta U = 0, \ \therefore \ \Delta T = 0$

173 **Oxidising power of chlorine in aqueous solution can be determined by the parameters indicated below :**

$$\frac{1}{2}Cl_2(g) \xrightarrow{\frac{1}{2}\Delta_{diss}H^{\Theta}} Cl(g) \xrightarrow{\Delta_{eg}H^{\Theta}} Cl^-(g) \xrightarrow{\Delta_{hyd}H^{\Theta}} Cl^-(aq)$$

The energy involved in the conversion of $\frac{1}{2}Cl_2(g)$ to $Cl^-(aq)$

(Using the data, $\Delta_{diss}\ H^{\Theta}_{Cl_2} = 240\ kJ\ mol^{-1}$, $\Delta_{eg}\ H^{\Theta}_{Cl} = -349\ kJ\ mol^{-1}$, $\Delta_{hyd}\ H^{\Theta}_{Cl^-} = -381\ kJ\ mol^{-1}$) will be

Correct Options:

(A) – 610 kJ mol^{-1}

Solution:

(A). For the process $\frac{1}{2}Cl_2(g) \longrightarrow Cl^-(aq)$

$$\Delta H = \frac{1}{2}\Delta H_{diss.}\ of\ Cl_2 + \Delta_{eg}Cl + \Delta_{hyd}Cl^-$$

$$= +\frac{240}{2} - 349 - 381 = -610\ kJ\ mol^{-1}$$

174 **The electronic configuration of chlorine is**

Correct Options:

(C) 2,8,7

Solution:

2,8,7

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

Correct Options:

(A) 8.4 × 10^6 J

Solution:

$q_2 = 3 \times 10^6$ cal.
$T_2 = 900$ K.
$T_1 = 300$ K

$$\frac{q_2 + q_1}{q_2} = \frac{T_2 - T_1}{T_2}$$

$$\frac{w}{q_2} = \frac{T_2 - T_1}{T_2}$$

$$\frac{w}{3 \times 10^6} = \frac{600}{900} = \frac{2}{3}$$

$w = 2 \times 10^6$ cal

$\therefore w = 2 \times 4.2 \times 10^6$ J

$= 8.4 \times 10^6$ J

176 **Bond order normally gives idea of stability of a molecular species. All the molecules viz. H_2, Li_2 and B_2 have the same bond order yet they are not equally stable. Their stability order is**

Correct Options:

(D) $H_2 > Li_2 > B_2$

Solution:

$H_2 > Li_2 > B_2$

177 **The standard heat of combustion of Al is −837.8 kJ mol^{-1} at 25°C. If Al reacts with O_2 at 25°C , which of the following releases 250 kcal of heat ?**

Correct Options:

(B)
the formation of 0.624 mol of
Al_2O_3

Solution:

$2Al + \frac{3}{2} O2 \longrightarrow Al_2O_3$

2 mol 1.5 mol O2 1 mol Al_2O_3

1 mol 0.75 mol O2 0.5 mol Al_2O_3

$\Delta H° = -837.8$ kJ mol^{-1}

837.8 kJ mol^{-1} ≡ combustion of 1 mol Al or formation of

0.5 mol Al_2O_3

$\therefore 250$ kcal $= \frac{250 \times 8.314}{2}$ kJ = 1.24 mol Al

or 0.62 mol of Al_2O_3

178 The value of $\log_{10} K$ for a reaction $A \rightarrow B$ is
(Given $\Delta H^\circ_{r\,298\,K} = -54.07$ kJ mol^{-1},
$\Delta S^\circ_{r\,298\,K} = 10$ JK^{-1}mol^{-1} and
$R = 8.314$ JK^{-1}mol^{-1}, $2.303 \times 8.314 \times 298 = 5705$)

Correct Options:

(B) 10

Solution:

For the equilibrium, $A \rightarrow B$

$\Delta G^{o} = \Delta H^{o} - T\Delta S^{o}$

$\Delta G^{o} = -2.303\ RT\ \log_{10} K$ (K is equilibrium constant)

$-2.303\ RT\ \log_{10} K = \Delta H^{o} - T\Delta S^{o}$

$2.303\ RT\ \log_{10} K = T\Delta S^{o} - \Delta H^{o}$

$\log_{10} K = \frac{T\Delta S^{o} - \Delta H^{o}}{2.303\ RT} = \frac{298 \times 10 + 54.07 \times 1000}{2.303 \times 8.314 \times 298} = 10$

Hence (B) is correct option.

179 **Plutonium decays with a half-life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is**

Correct Options:

(D) $\frac{1}{8}$

Solution:

Number of half-life periods = $\frac{72000}{24000} = 3$

$\therefore$ The fraction that remains = $\frac{1}{2^3} = \frac{1}{8}$

180 **Find the work done when 2 mole of hydrogen expand isothermally from 15 to 50 litres against a constant pressure of 1 atm at 25ºC.**

Correct Options:

(A) 847.0 cals

Solution:

.

181 **In which of the following process work is done by surrounding**

Correct Options:

(A) $H_2O(s) \rightarrow H_2O(\ell)$

Solution:

$W = -\Delta n_g RT$; $W = -P\Delta V$ } Work done by surrounding is (+)ive

182 Which of the following series of transitions in the spectrum of hydrogen atom falls in visible region?

Correct Options:

(C) Balmer series

Solution:

(c) : Lyman series : UV region
Balmer series : Visible region
Paschen series : IR region
Brackett series : IR region

183 **If the series limit of wavelength of the Lyman series for the H-atom is 912Å, then the series limit of wavelength for the Balmer series of the H-atom is**

Correct Options:

(C) 912 x 4Å

Solution:

CONCEPTUAL

184 **Which of the following set of quantum numbers belong to highest energy ?**

Correct Options:

(D)

$$n = 3,\ l = 2,\ m = 1,\ s = +\frac{1}{2}$$

Solution:

-

185 One mole of an ideal gas at 300 K in thermal contact with surroundings expands isothermally from 1.0 L to 2.0 L against a constant pressure of 3.0 atm. In this process, the change in entropy of surroundings (ΔS_{surr}) in JK^{-1} is
(1 L atm = 101.3 J)

Correct Options:

(C) –1.013

Solution:

$$\Delta E = q + w$$

$$0 = q - P_{ext}\Delta V$$

$$q = P_{ext}\Delta V = 3 \text{ atm } (2 - 1) \text{ L} = 3 \text{ atm L}$$

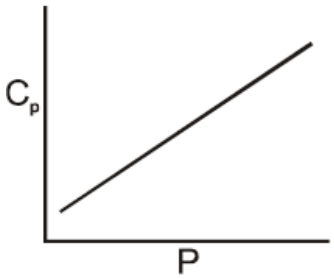
$$= (3 \times 101.3) \text{ Joule}$$

$$\Delta S_{surr} = -\frac{q}{T} = \frac{3 \times 101.3}{300} = -1.013 \text{ Joule/K}$$

186 **For a diatomic ideal gas in a closed system, which of the following plots does not correctly describe the relation between various thermodynamic quantities?**

Correct Options:

(A)



Solution:

For diatomic ideal gas

$$C_V = \frac{5}{2}R$$

$$C_P = \frac{7}{2}R$$

C_V depends on T and independent on V

C_P depends on T and independent on P

187 **Which of the following sets of the four quantum numbers, n, l, m and m_s describes one of the outermost electrons in a ground state magnesium atom?**

Correct Options:

(B) $3, 0, 0, -\frac{1}{2}$

Solution:

conceptual

188 **Calculate the value of ΔH_c^o for diborane (B_2H_6) from the following data:**

(i) $2B(s) + \frac{3}{2} O_2(g) \longrightarrow B_2O_3(s)$ $\Delta H = -1273$ kJ

(ii) $H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(\ell)$ $\Delta H = -286$ kJ

(iii) $H_2O(\ell) \longrightarrow H_2O(g)$ $\Delta H = 44$ kJ

(iv) $2B(s) + 3H_2(g) \longrightarrow B_2H_6(g)$ $\Delta H = 36$ kJ

Correct Options:

(A) –2035 kJ/mol

Solution:

(a)

189 **For the reaction, A+B ⇌ C + D, Kc = 9. If A and B are taken in equal amounts, then amount of C at equilibrium is :-**

Correct Options:

(C) 0.75

Solution:

.

190 **Given the data below, what approximately is ΔH for the reaction:$H_2(g) + C_2H_4(g)$ □□→ $C_2H_6(g)$. Average Bond energies H—H—436 kJ/moleCl—Cl—242 kJ/moleH—Cl—432 kJ/mole**

Correct Options:

(B) –186 kJ /mole

Solution:

ΔH = 436 + 242 – 2 × 432 = – 186 kJ

191

The value of Planck's constant is 6.63×10^{-34} J s. The velocity of light is 3.0×10^{8} m s^{-1}. Which value is closest to the wavelength in nanometers of a quantum of light with frequency of 8×10^{15} s^{-1} ?

Correct Options:

(C) 4×10^{1}

Solution:

(c) : Applying $\upsilon = c/\lambda$,

$$\lambda = \frac{c}{\upsilon} = \frac{3\times10^{8}}{8\times10^{15}} = 37.5\times10^{-9}\ \text{m}$$
$$= 37.5\ \text{nm} \approx 4 \times 10^{1}\ \text{nm}$$

192 **The energy required to break one mole of Cl–Cl bonds in Cl2 is 242 kJ mol^{-1}. The longest wavelength of light capable of breaking a single Cl – Cl bond is (c = 3 x 108 ms^{-1} and NA = 6.02 x 10^{23} mol^{-1})**

Correct Options:

(D) 494 nm

Solution:

1 mole 242×10^{3} J

1 molecule $\frac{242\times10^{3}}{6.022\times10^{-23}\times1.6\times10^{-19}}$ eV

$= 25.11 \times 10^{-1}$ eV

$= 2.511$ eV

$\therefore \lambda = \frac{12400}{E_{eV}}$ Å

$= \frac{12400}{2.511}$ Å

$= 4938$ Å

193 **Two moles of an ideal gas ($C_v = \frac{5}{2}R$) was compressed adiabatically against constant pressure of 2 atm. Which was initially at 350 K and 1 atm pressure. The work involve in the process is equal to**

Correct Options:

(D) 500 R

Solution:

$$\omega = nC_v(T_2 - T_1) = -p_{ext} \times nR\left[\frac{T_2}{P_2} - \frac{T_1}{P_1}\right]$$

$$\Rightarrow \frac{5}{2}R(T_2 - 350) = -2R\left[\frac{T_2}{2} - \frac{350}{T}\right]$$

$$\therefore T_2 = 450\ \text{k}$$

$$\therefore \omega = nC_v(T_2 - T_1) = 2 \times \frac{5}{2}R \times 100 = 500$$

194 **1 mole of an ideal monoatomic gas initially at 300 K, pressure P and volume V in a closed adiabatic vessel fitted with a movable piston is suddenly compressed by placing a weight on the piston. The gas pressure is increased to 2P. What is the raise in temperature (ΔT) for adiabatic process?**

Correct Options:

(B) 120

Solution:

$$\frac{T_2 - T_1}{\gamma - 1} = -P_{ext}\left(\frac{T_2}{P_2} - \frac{T_1}{P_1}\right); \qquad \frac{T_2 - 300}{1.66 - 1} = -2P\left(\frac{T_2}{2P} - \frac{300}{P}\right) \Rightarrow 420\ K; \quad T_2 - T_1 = 420 - 300 = 120$$

195 **Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon?**

Correct Options:

(D) 1s

Solution:

CONCEPTUAL

196 The relation between pressure P and volume V is given by $PV^{\frac{1}{4}} = \text{constant}$. If the percentage decrease in volume is $\frac{1}{4}$, then the approximate percentage increase in pressure is

Correct Options:

(A) $\frac{1}{16}$

Solution:

$P\,V^{\frac{1}{4}} = \text{Constant}$

$\%$ decreases in volume $= \frac{1}{4}$

$\frac{dv}{v} \times 100 = \frac{1}{4}$

Now, $PV^{\frac{1}{4}} = a$

$\log P + \frac{1}{4}\log v = \log a$

$\frac{dp}{p} + \frac{1}{4}\frac{dv}{v} = 0$

$100 \times \frac{dP}{P} + \frac{1}{4}\frac{dV}{V} \times 100 = 0$

$\frac{dP}{P} \times 100 = -\frac{1}{4}\frac{dV}{V} \times 100$

$= \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

197 **Two elements X (at-mass 16) and Y (at-mass 14) combine to form compounds A, B and C. The ratio of different masses of Y which combines with a fixed mass of X in A, B and C is 1 : 3 : 5. If 32 parts by mass of X combines with 84 parts by mass of Y in B, then in C 16 parts by mass of X will combine with :**

Correct Options:

(C) 70 parts by mass of Y

Solution:

70 parts by mass of Y

198 **The quantum numbers of most energetic electron in Ne atom when it is in first excited state is**

Correct Options:

(C) $3, 0, 0, \pm 1/2$

Solution:

The electronic configuration of Ne atom is $1s^2\ 2s^2\ 2p^6$. In its first excitation state the electron from 2p will unpair and shift to 3s where its quantum numbers will be 3, 0, 0, ± ½.

199

The empirical formula of an acid is CH_2O_2, the probable molecular formula of acid may be:-

Correct Options:

(B) CH_2O_2

Solution:

CH_2O_2

200

Under isothermal conditions, a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is [Given that 1 L bar = 100 J]

Correct Options:

(B) -30 J

Solution:

Expansion of a gas against a constant external is an irreversible process. The work done in an irreversible process

$= -P_{ext}\,\Delta V = -P_{ext}\,(V_2 - V_1) = -2\,(0.25 - 0.1)$

$= -2 \times 0.15$ L bar $= -0.30 \times 100$ J $= -30$ J