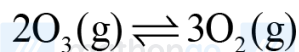


Questions

MathonGo

Q1 - 24 June - Shift 1



At 300 K, ozone is fifty percent dissociated. The standard free energy change at this temperature and 1 atm pressure is $(-)$ $\underline{\hspace{1cm}}$ J mol⁻¹ (Nearest integer)

[Given: $\ln 1.35 = 0.3$ and $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$]

Space for your notes:

Q2 - 24 June - Shift 2

The correct order of bond orders of C_2^{2-} , N_2^{2-} and O_2^{2-} is, respectively.



Space for your notes:

Q3 - 25 June - Shift 1

The standard entropy change for the reaction $4\text{Fe}(\text{s}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{Fe}_2\text{O}_3(\text{s})$ is -550 JK^{-1} at 298 K.

[Given : The standard enthalpy change for the reaction is -165 kJ mol^{-1}]. The temperature in K at which the reaction attains equilibrium is $\underline{\hspace{1cm}}$. (Nearest Integer)

Space for your notes:

Q4 - 25 June - Shift 2

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Questions

MathonGo

At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are $-3268 \text{ kJ mol}^{-1}$ and $-1300 \text{ kJ mol}^{-1}$, respectively.

The change in enthalpy for the reaction



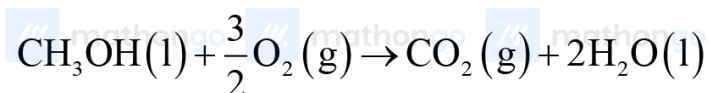
(A) $+324 \text{ kJ mol}^{-1}$ (B) $+632 \text{ kJ mol}^{-1}$

(C) -632 kJ mol^{-1} (D) -732 kJ mol^{-1}

Space for your notes:

Q5 - 26 June - Shift 1

For complete combustion of methanol



the amount of heat produced as measured by bomb calorimeter is 726 kJ mol^{-1} at 27°C . The enthalpy of combustion for the reaction is $-x \text{ kJ mol}^{-1}$, where x is _____. (Nearest integer)

(Given : $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$)

Space for your notes:

Q6 - 26 June - Shift 2

CNG is an important transportation fuel. When 100 g CNG is mixed with 208 oxygen in vehicles, it leads to the formation of CO_2 and H_2O and produces large quantity of heat during this combustion, then the amount of carbon dioxide, produced in grams is _____. [nearest integer]

[Assume CNG to be methane]

Space for your notes:

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Questions

MathonGo

Q7 - 26 June - Shift 2

A fish swimming in water body when taken out from the water body is covered with a film of water of weight 36 g. When it is subjected to cooking at 100°C , then the internal energy for vaporization in kJ mol^{-1} is _____. [nearest integer]

[Assume steam to be an ideal gas. Given $A_{\text{vap}}H^{\ominus}$ for water at 373 K and 1 bar is 41.1 kJ mol^{-1} ; $R = 8.31 \text{ JK}^{-1}\text{mol}^{-1}$]

Space for your notes:

Q8 - 26 June - Shift 2

40° of HI undergoes decomposition to H_2 and I_2 at 300 K. ΔG^{\ominus} for this decomposition reaction at one atmosphere pressure is _____ J mol^{-1} . [nearest integer]

(Use $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$; $\log 2 = 0.3010$. $\ln 10 = 2.3$, $\log 3 = 0.477$)

Space for your notes:

Q9 - 27 June - Shift 1

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Questions

MathonGo

Match List-I with List-II

	List-I	List-II
(A)	Spontaneous process	(I) $\Delta H < 0$
(B)	Process with $\Delta P = 0$, $\Delta T = 0$	(II) $\Delta G_{T,P} < 0$
(C)	$\Delta H_{\text{reaction}}$	(III) Isothermal and isobaric process
(D)	Exothermic process	(IV) [Bond energies of molecules in reactants] - [Bond energies of product molecules]

Space for your notes:

Choose the correct answer from the options given below:

(A) (A) – (III), (B) – (II), (C) – (IV), (D) – (I)

(B) (A) – (II), (B) – (III), (C) – (IV), (D) – (I)

(C) (A) – (II), (B) – (III), (C) – (I), (D) – (IV)

(D) (A) – (II), (B) – (I), (C) – (III), (D) – (IV)

Q10 - 27 June - Shift 2

When 5 moles of He gas expand isothermally and reversibly at 300 K from 10 litre to 20 litre, the magnitude of the maximum work obtained is _____

J. [nearest integer] (Given: $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ and

$\log 2 = 0.3010$)

Space for your notes:

Q11 - 28 June - Shift 1

4.0 L of an ideal gas is allowed to expand isothermally into vacuum until the total volume is 20 L. The amount of heat absorbed in this expansion is _____ L atm.

Space for your notes:

#MathBoleTohMathonGo

Questions

MathonGo

Q12 - 28 June - Shift 2

For combustion of one mole of magnesium in an open container at 300 K and 1 bar pressure, $\Delta_c H^\ominus = -601.70 \text{ kJ mol}^{-1}$, the magnitude of change in internal energy for the reaction is _____ kJ. (Nearest integer)
(Given : $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$)

Space for your notes:

Q13 - 29 June - Shift 1

17.0 g of NH_3 completely vapourises at -33.42°C and 1 bar pressure and the enthalpy change in the process is 23.4 kJ mol^{-1} . The enthalpy change for the vapourisation of 85 g of NH_3 under the same conditions is _____ kJ.

Space for your notes:

Q14 - 29 June - Shift 2

2.2 g of nitrous oxide (N_2O) gas is cooled at a constant pressure of 1 atm from 310 K to 270 K causing the compression of the gas from 217.1 mL to 167.75 mL. The change in internal energy of the process, ΔU is '-x' J. The value of 'x' is _____.

Space for your notes:

[nearest integer]

(Given: atomic mass of N = 14 g mol^{-1} and of O = 16 g mol^{-1} .)

Molar heat capacity of N_2O is $100 \text{ JK}^{-1} \text{ mol}^{-1}$)

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Questions

MathonGo

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Answer Key

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Q1 (747)

Q2 (C)

Q3 (300)

Q4 (C)

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Q5 (727)

Q6 (143)

Q7 (38)

Q8 (2735)

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Q9 (B)

Q10 (8360)

Q11 (0)

Q12 (600)

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Q13 (117)

Q14 (195)

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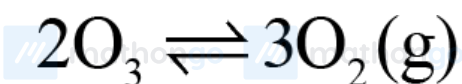
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Q1 (747)



$$\frac{2}{5} \quad \frac{3}{5}$$

$$k_p = \frac{P_{\text{O}_2}^3}{P_{\text{O}_3}^2}$$

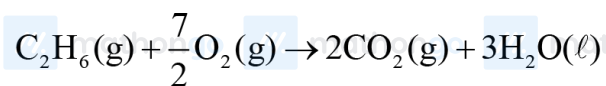
$$k_p = 1.35$$

$$\Delta G^\circ = -RT \ln k_p$$

$$= -8.3 \times 300 \times \ln 1.35$$

$$= -747 \text{ J/mol}$$

Q2 (C)



$$\Delta_c H(\text{C}_2\text{H}_6) = 2\Delta_f H(\text{CO}_2(\text{g})) + 3\Delta_f H(\text{H}_2\text{O}(\ell))$$

$$- \Delta_f H(\text{C}_2\text{H}_6, \text{g})$$

$$-1560 = 2(-394) + 3(-286) - \Delta_f H(\text{C}_2\text{H}_6, \text{g})$$

$$\Delta_f H(\text{C}_2\text{H}_6, \text{g}) = -86 \text{ kJ/mole}$$

Q3 (300)

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$$\Delta G = \Delta H - T\Delta S = 0 \text{ at equilibrium}$$

$$\Rightarrow -165 \times 10^3 - T \times (-505) = 0$$

$$\Rightarrow T = 300\text{K}$$

The answer is 300

Q4 (C)

$$\Delta H = \sum \Delta H_{\text{Combustion}} (\text{Reactant}) - \sum \Delta H_{\text{Combustion}}$$

(Product)

$$= 3 \times (-1300) - [-3268]$$

$$= -632 \text{ kJ mol}^{-1}$$

Q5 (727)

$$\Delta U = -726 \text{ KJ/mol}$$

$$\Delta n_g = 1 - 3/2 = \frac{-1}{2}$$

$$\Delta H = \Delta U + \Delta n_g RT$$

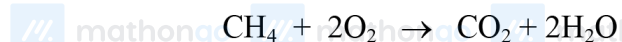
$$= -726 - \frac{1}{2} \times \frac{8.3 \times 300}{1000}$$

$$= -727.245$$

Q6 (143)

Hints and Solutions

MathonGo



$$\text{Mole} \quad \frac{100}{16} \quad \frac{208}{32}$$

$$= 6.25 \quad = 6.5$$

$$\frac{\text{Mole}}{\text{Stoi. Coeff.}} = \frac{6.25}{1} \quad \frac{6.5}{2} = 3.25$$

So, O₂ is limiting reagentMole – Mole analysis

$$\frac{n_{\text{O}_2}}{2} = \frac{n_{\text{CO}_2}}{1}$$

$$\frac{6.5}{2} = n_{\text{CO}_2}$$

$$\text{Mass of CO}_2 = \frac{6.5}{2} \times 44 = 143 \text{ gm}$$

Q7 (38)

$$n = \frac{36}{18} = 2 \text{ mol}$$

$$\Delta U = \Delta H - \Delta n_g RT$$

$$= 41.1 - \frac{1 \times 8.31 \times 373}{1000} \text{ kJ/mol}$$

$$= 38 \text{ kJ/mol}$$

Q8 (2735)

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Hints and Solutions

MathonGo



$$t_i = 1$$

$$t_{eq} = 1 - 0.4 = \frac{0.4}{2} = \frac{0.4}{2}$$

$$K_p = \frac{(0.2)^2 (0.2)^2}{1 - 0.4} = \frac{0.2}{0.6} = \frac{1}{3}$$

$$\Delta G = \Delta G^\circ + RT \ln K = 0$$

$$\Delta G^\circ = -RT \ln K \Rightarrow -8.31 \times 300 \times 2.3 \times \log\left(\frac{1}{3}\right)$$

$$= 2735 \text{ J/mol}$$

Q9 (B)(A) For a spontaneous process $\Delta G_{T,P} < 0$ (B) $\Delta P = 0 \rightarrow$ Isobaric process $\Delta T = 0 \rightarrow$ Isothermal process(C) $\Delta H_{\text{reaction}} = (\Sigma \text{Bond energies of reactants}) -$ $(\Sigma \text{bond energies of products})$ (D) $\Delta H < 0$ is for exothermic reaction**Q10 (8360)**

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$$n = 5 \text{ mol}$$

$$T = 300 \text{ K}$$

$$V_1 = 10 \text{ L}$$

$$V_2 = 20 \text{ L}$$

$$w = -nRT \ln \frac{V_2}{V_1}$$

$$= -5 \times 8.3 \times 300 \times \ln \frac{20}{10}$$

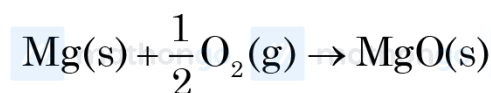
$$= -8630.38 \text{ J}$$

Q11 (0)

Free expansion, $P_{\text{ext}} = 0$, $w = 0$
 $q = 0$, $\Delta U = 0$, $\Delta U = 0$

Ans. 0

Q12 (600)



$$\Delta H = \Delta U + \Delta n_g RT$$

$$-601.70 \times 10^3 = \Delta U - \frac{1}{2} \times 8.3 \times 300$$

$$-601.70 \text{ kJ} = \Delta U - 1.245 \text{ kJ}$$

$$\Delta U = -600.455 \text{ kJ}$$

Ans. 600

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Hints and Solutions

MathonGo

Q13 (117)

Given data is for 1 moles and asked for 5 moles so
value is $23.4 \times 5 = 117 \text{ kJ}$

Q14 (195)

$$\text{N}_2\text{O moles} = \frac{2.2}{44} = \frac{1}{20}$$

$$\Delta H = nC_p \Delta T = \frac{1}{20} \times 100(-40) = -200\text{J}$$

$$\Delta U = q_p + w$$

$$w = -P_{\text{ext.}} \Delta V$$

$$W = -1 \frac{(167.75 - 217.1)}{1000} \times 101.3\text{J}$$

$$w = +5\text{J}$$

$$\Delta U = -200 + 5 = -195\text{J}$$

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