

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

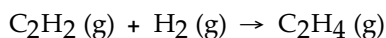
Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Carbon			
C (s, diamond)	1.88	2.84	2.43
C (s, graphite)	0	0	5.69
C ₂ H ₂ (g)	226.7	209.2	200.8
C ₂ H ₄ (g)	52.30	68.11	219.4
C ₂ H ₄ (g)	-84.68	-32.89	229.5
CO (g)	-110.5	-137.2	197.9
CO ₂ (g)	-393.5	-394.4	213.6
Hydrogen			
H ₂ (g)	0	0	130.58
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91

1) The value of ΔS° for the catalytic hydrogenation of acetylene to ethene,

1) _____



is _____ J/K.

A) -18.6

B) -112.0

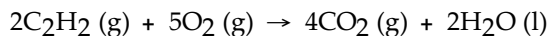
C) +550.8

D) +112.0

E) +18.6

2) The combustion of acetylene in the presence of excess oxygen yields carbon dioxide and water:

2) _____



The value of ΔS° for this reaction is _____ J/K.

A) -122.3

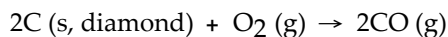
B) +689.3

C) +122.3

D) +432.4

E) -432.4

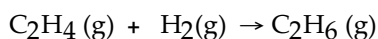
3) The value of ΔS° for the reaction 3) _____



is _____ J/K.

- A) -195.7 B) +185.9 C) -185.9 D) +9.5 E) -9.5

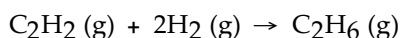
4) The value of ΔS° for the catalytic hydrogenation of ethene to ethane, 4) _____



is _____ J/K.

- A) -120.5 B) +101.9 C) -232.5 D) +112.0 E) -101.9

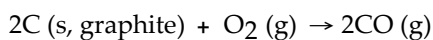
5) The value of ΔS° for the catalytic hydrogenation of acetylene to ethane, 5) _____



is _____ J/K.

- A) -76.0 B) +440.9 C) +28.7 D) -232.5 E) +232.5

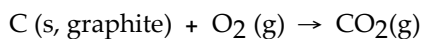
6) The value of ΔS° for the oxidation of carbon to carbon monoxide, 6) _____



is _____ J/K. Carbon monoxide is produced in the combustion of carbon with limited oxygen.

- A) -408.6 B) -12.8 C) +395.8 D) +179.4 E) +408.6

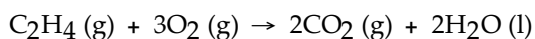
7) The value of ΔS° for the oxidation of carbon to carbon dioxide, 7) _____



is _____ J/K. The combustion of carbon, as in charcoal briquettes, in the presence of abundant oxygen produces carbon dioxide.

- A) +424.3 B) +2.9 C) -205.0 D) -2.9 E) +205.0

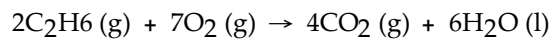
8) The combustion of ethene in the presence of excess oxygen yields carbon dioxide and water: 8) _____



The value of ΔS° for this reaction is _____ J/K.

- A) -267.4 B) +140.9 C) -140.9 D) -347.6 E) +347.6

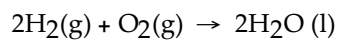
9) The combustion of ethane in the presence of excess oxygen yields carbon dioxide and water: 9) _____



The value of ΔS° for this reaction is _____ J/K.

- A) -718.0 B) +151.0 C) -151.0 D) -620.9 E) +718.0

10) The combustion of hydrogen in the presence of excess oxygen yields water: 10) _____



The value of ΔS° for this reaction is _____ J/K.

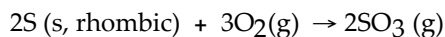
- A) -265.7 B) -405.5 C) +405.5 D) +265.7 E) -326.3

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

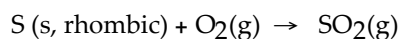
11) The value of ΔS° for the oxidation of solid elemental sulfur to gaseous sulfur trioxide, 11) _____



is _____ J/K.

- A) -19.3 B) -166.4 C) +493.1 D) +19.3 E) -493.1

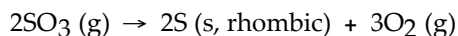
12) The value of ΔS° for the oxidation of solid elemental sulfur to gaseous sulfur dioxide, 12) _____



is _____ J/K.

- A) -11.6 B) -248.5 C) +248.5 D) +11.6 E) +485.4

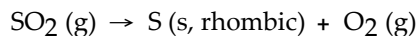
- 13) The value of ΔS° for the decomposition of gaseous sulfur trioxide to solid elemental sulfur and gaseous oxygen, 13) _____



is _____ J/K.

- A) +166.4 B) +19.3 C) +493.1 D) -493.1 E) -19.3

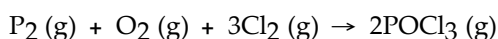
- 14) The value of ΔS° for the decomposition of gaseous sulfur dioxide to solid elemental sulfur and gaseous oxygen, 14) _____



is _____ J/K.

- A) -248.5 B) -11.6 C) +248.5 D) +485.4 E) +11.6

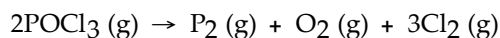
- 15) The value of ΔS° for the formation of POCl_3 from its constituent elements, 15) _____



is _____ J/K.

- A) +771 B) +321 C) -771 D) -442 E) -321

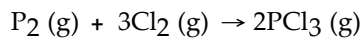
- 16) The value of ΔS° for the decomposition of POCl_3 into its constituent elements, 16) _____



is _____ J/K.

- A) +321 B) +771 C) +442 D) -771 E) -321

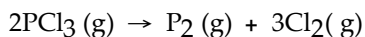
- 17) The value of ΔS° for the formation of phosphorous trichloride from its constituent elements, 17) _____



is _____ J/K.

- A) +129.4 B) +311.7 C) -129.4 D) -311.7 E) -263.7

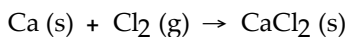
- 18) The value of ΔS° for the decomposition of phosphorous trichloride into its constituent elements, 18) _____



is _____ J/K.

- A) +311.7 B) -129.4 C) +263.7 D) +129.4 E) -311.7

19) The value of ΔS° for the formation of calcium chloride from its constituent elements, 19) _____



is _____ J/K.

- A) +104.6 B) +369.0 C) -104.6 D) +159.8 E) -159.8

20) The value of ΔS° for the decomposition of calcium chloride into its constituent elements, 20) _____



is _____ J/K.

- A) +104.6 B) +159.8 C) +369.0 D) -104.6 E) -159.8

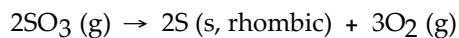
21) The value of ΔH° for the oxidation of solid elemental sulfur to gaseous sulfur trioxide, 21) _____



is _____ kJ/mol.

- A) +790.4 B) -790.4 C) +105.1 D) -395.2 E) +395.2

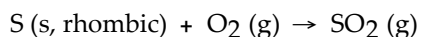
22) The value of ΔH° for the decomposition of gaseous sulfur trioxide to its component elements, 22) _____



is _____ kJ/mol.

- A) +395.2 B) -395.2 C) -790.4 D) +105.1 E) +790.4

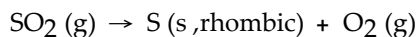
23) The value of ΔH° for the oxidation of solid elemental sulfur to gaseous sulfur dioxide, 23) _____



is _____ kJ/mol.

- A) +11.6 B) -269.9 C) +269.9 D) +0.00 E) -11.6

24) The value of ΔH° for the decomposition of gaseous sulfur dioxide to solid elemental sulfur and gaseous oxygen, 24) _____



is _____ kJ/mol.

- A) +135.0 B) +0.0 C) -135.90 D) +269.9 E) -269.9

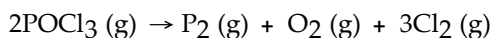
25) The value of ΔH° for the formation of POCl_3 from its constituent elements, 25) _____



is _____ kJ/mol.

- A) -397.7 B) -1228.7 C) -686.5 D) +686.5 E) +1228.7

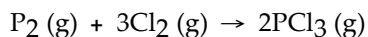
26) The value of ΔH° for the decomposition of POCl_3 into its constituent elements, 26) _____



is _____ kJ/mol.

- A) -940.1 B) -1,228.7 C) +0.00 D) +1,228.7 E) +940.1

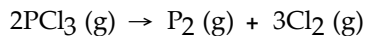
27) The value of ΔH° for the formation of phosphorous trichloride from its constituent elements, 27) _____



is _____ kJ/mol

- A) +432.4 B) -720.5 C) -432.4 D) -288.1 E) +720.5

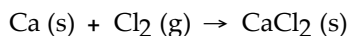
28) The value of ΔH° for the decomposition of phosphorous trichloride into its constituent elements, 28) _____



is _____ kJ/mol.

- A) -288.1 B) +720.5 C) +288.1 D) +576.2 E) -720.5

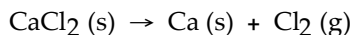
29) The value of ΔH° for the formation of calcium chloride from its constituent elements, 29) _____



is _____ kJ/mol.

- A) +397.9 B) +795.8 C) -795.8 D) -397.9 E) +0.00

30) The value of ΔH° for the decomposition of calcium chloride into its constituent elements, 30) _____

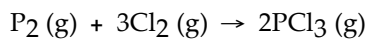


is _____ kJ/mol.

- A) -397.9 B) +397.9 C) +795.8 D) -795.8 E) -0.00

- 31) The value of ΔG° at 25 °C for the oxidation of solid elemental sulfur to gaseous sulfur trioxide, 31) _____
- $$2\text{S (s, rhombic)} + 3\text{O}_2 (\text{g}) \rightarrow 2\text{SO}_3 (\text{g})$$
- is _____ kJ/mol.
- A) +185.2 B) +740.8 C) +370.4 D) -740.8 E) -370.4
- 32) The value of ΔG° at 25 °C for the oxidation of solid elemental sulfur to gaseous sulfur dioxide, 32) _____
- $$\text{S (s, rhombic)} + \text{O}_2(\text{g}) \rightarrow \text{SO}_2 (\text{g})$$
- is _____ kJ/mol.
- A) -300.4 B) -269.9 C) +300.4 D) +269.9 E) +395.2
- 33) The value of ΔG° at 25 °C for the decomposition of gaseous sulfur trioxide to solid elemental sulfur and gaseous oxygen, 33) _____
- $$2\text{SO}_3 (\text{g}) \rightarrow 2\text{S (s, rhombic)} + 3\text{O}_2 (\text{g})$$
- is _____ kJ/mol.
- A) +740.8 B) -740.8 C) -370.4 D) +185.2 E) +370.4
- 34) The value of ΔG° at 25 °C for the decomposition of gaseous sulfur dioxide to solid elemental sulfur and gaseous oxygen, 34) _____
- $$\text{SO}_2 (\text{g}) \rightarrow \text{S (s, rhombic)} + \text{O}_2 (\text{g})$$
- is _____ kJ/mol.
- A) -300.4 B) +395.2 C) +269.9 D) -269.9 E) +300.4
- 35) The value of ΔG° at 25 °C for the formation of POCl_3 from its constituent elements, 35) _____
- $$\text{P}_2 (\text{g}) + \text{O}_2 (\text{g}) + 3\text{Cl}_2 (\text{g}) \rightarrow 2\text{POCl}_3 (\text{g})$$
- is _____ kJ/mol.
- A) +606.2 B) -606.2 C) +1,109 D) -1,005 E) -1,109
- 36) The value of ΔG° at 25 °C for the decomposition of POCl_3 into its constituent elements, 36) _____
- $$2\text{POCl}_3 (\text{g}) \rightarrow \text{P}_2 (\text{g}) + \text{O}_2 (\text{g}) + 3\text{Cl}_2 (\text{g})$$
- is _____ kJ/mol.
- A) -606.2 B) +1,109 C) -1,005 D) +606.2 E) -1,109

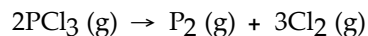
- 37) The value of ΔG° at 25 °C for the formation of phosphorous trichloride from its constituent elements, 37) _____



is _____ kJ/mol.

- A) -373.3 B) +539.2 C) +642.9 D) -539.2 E) -642.9

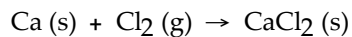
- 38) The value of ΔG° at 25 °C for the decomposition of phosphorous trichloride into its constituent elements, 38) _____



is _____ kJ/mol.

- A) +539.2 B) -642.9 C) +642.9 D) -539.2 E) -373.3

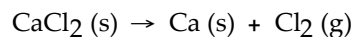
- 39) The value of ΔG° at 25 °C for the formation of calcium chloride from its constituent elements, 39) _____



is _____ kJ/mol.

- A) -795.8 B) +763.7 C) +795.8 D) -748.1 E) +748.1

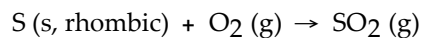
- 40) The value of ΔG° at 25 °C for the decomposition of calcium chloride into its constituent elements, 40) _____



is _____ kJ/mol.

- A) -748.1 B) -795.8 C) +763.7 D) +748.1 E) +795.8

- 41) The value of ΔG° at 373 °K for the oxidation of solid elemental sulfur to gaseous sulfur dioxide, 41) _____



is _____ kJ/mol. At 298K, ΔH° for this reaction is -269.9 kJ/mol, and ΔS° is +11.6 J/K.

- A) -300.4 B) +300.4 C) -4,597 D) -274.2 E) +4,597

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

42) The value of ΔG° at 373 K for the oxidation of solid elemental sulfur to gaseous sulfur trioxide, 42) _____



is _____ kJ/mol.

A) -61.3

B) -740.8

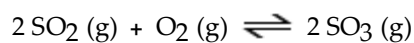
C) -728.3

D) +61.3

E) +740.8

43) Given the thermodynamic data in the table below, calculate the equilibrium constant for the reaction:

43) _____



Substance	ΔH_f° (kJ/mol)	Δ° (J/mol · K)
SO ₂ (g)	-297	249
O ₂ (g)	0	205
SO ₃ (g)	-395	256

- A) 3.82×10^{23}
- B) 1.06
- C) 1.95
- D) 2.32×10^{24}
- E) More data are needed.

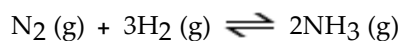
44) The equilibrium constant for a reaction is 0.48 at 25 °C. What is the value of ΔG° (kJ/mol) at this temperature?

44) _____

- A) -4.2
- B) 4.2
- C) 1.5×10^2
- D) 1.8
- E) More information is needed.

45) The equilibrium constant for the following reaction is 5.0×10^8 at 25 °C.

45) _____

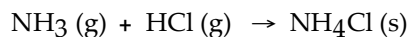


The value of ΔG° for this reaction is _____ kJ/mol.

- A) -4.2
- B) -22
- C) 22
- D) -50
- E) -25

46) Consider the reaction:

46) _____



Given the following table of thermodynamic data at 298 °K:

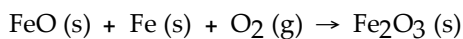
Substance	ΔH_f° (kJ/mol)	S° (J/K • mol)
NH ₃ (g)	-46.19	192.5
HCl (g)	-92.30	186.69
NH ₄ Cl (s)	-314.4	94.6

The value of K for the reaction at 25 °C is _____.

- A) 1.4×10^8
- B) 150
- C) 9.3×10^{15}
- D) 8.4×10^4
- E) 1.1×10^{-16}

47) Consider the reaction:

47) _____



Given the following table of thermodynamic data at 298 °K:

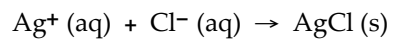
Substance	ΔH_f° (kJ/mol)	S° (J/K • mol)
FeO (s)	-271.9	60.75
Fe (s)	0	27.15
O ₂ (g)	0	205.0
Fe ₂ O ₃ (s)	-822.16	89.96

The value K for the reaction at 25 °C is _____.

- A) 5.9×10^4
- B) 3.8×10^{-14}
- C) 370
- D) 8.1×10^{19}
- E) 7.1×10^{85}

48) Consider the reaction:

48) _____



Given the following table of thermodynamic data at 298 °K:

Substance	ΔH_f° (kJ/mol)	S° (J/K·mol)
Ag ⁺ (aq)	105.90	73.93
Cl ⁻ (aq)	-167.2	56.5
AgCl(s)	-127.0	96.11

The value of K for the reaction at 25 °C is _____.

- A) 3.7×10^{10}
- B) 810
- C) 1.9×10^{-10}
- D) 5.4×10^9
- E) 1.8×10^4

Answer Key

Testname: CHAPTER 19 PRACTICE QUESTIONS

- 1) B
- 2) E
- 3) B
- 4) A
- 5) D
- 6) D
- 7) B
- 8) A
- 9) D
- 10) E
- 11) B
- 12) D
- 13) A
- 14) B
- 15) D
- 16) C
- 17) E
- 18) C
- 19) E
- 20) B
- 21) B
- 22) E
- 23) B
- 24) D
- 25) B
- 26) D
- 27) B
- 28) B
- 29) C
- 30) C
- 31) D
- 32) A
- 33) A
- 34) E
- 35) E
- 36) B
- 37) E
- 38) C
- 39) D
- 40) D
- 41) D
- 42) C
- 43) D
- 44) D
- 45) D
- 46) C
- 47) E
- 48) D