Chem1612 **Sample Quiz 1 (i)** **Last update: 21/08/17**

1. Reference: http://firstyear.chem.usyd.edu.au/LabManual/W5.pdf

   When computed on a calculator, the algebraic expression $\frac{40.00\text{ kg} \times 486\text{ J}}{(6.1\times10^{2}\text{ m} + 27.6\text{ m})}$ has a value of 30.48933501. Expressed to the appropriate number of significant figures, this is:

a) 30 kg J m^{-1}
b) 30. kg J m^{-1}
c) 30.4 kg J m^{-1}
d) 30.5 kg J m^{-1}
e) 30.49 kg J m^{-1}

2. A particular chemical reaction has $\Delta H° = +5$ kJ mol^{-1} and $\Delta S° = +25$ J K^{-1} mol^{-1}. Assuming that these values do not change with temperature, in what temperature range is this reaction spontaneous?

a) It is spontaneous at all temperatures
b) It is not spontaneous at any temperature
c) $T > 200$ K
d) $T < 200$ K
e) $T < -200$ K

3. An ideal gas receives 245 J of heat and expands by 1.30 L against an external pressure of 60.0 kPa. What is the change in internal energy of the system?

a) +167 J b) +323 J c) –323 J d) –167 J e) 0 J

4. Use the data below to calculate $\Delta_{universe}S^{o}$ for the deposition of iodine at 298 K.

a) –353 J K^{-1} mol^{-1}
b) –63 J K^{-1} mol^{-1}
c) +63 J K^{-1} mol^{-1}
d) +353 J K^{-1} mol^{-1}
e) +377 J K^{-1} mol^{-1}

	Δ_fH^{o} (kJ mol^{-1})	S^{o} (J K^{-1} mol^{-1})
$I_2(s)$	0.00	116
$I_2(g)$	62.0	261

5. In which one of the following processes does the entropy of the system decrease? Assume constant temperature and pressure unless specifically indicated otherwise.

a) $CO_2(s) \rightarrow CO_2(g)$
b) 1 mol $H_2(g)$ at 10 atm $\rightarrow$ 1 mol $H_2(g)$ at 1 atm
c) $O_2(g) + 2CO(g) \rightarrow 2CO_2(g)$
d) $C_2H_5OH(l)$ at 20°C $\rightarrow$ $C_2H_5OH(l)$ at 200°C
e) $C_8H_{14}(l) \rightarrow C_4H_6(g) + C_4H_8(g)$

Questions 5 and 6 refer to the following reaction: $2NO_2(g) \rightleftharpoons N_2O_4(g)$
K_p = 7.1 at 25 °C and K_p = 0.31 at 70 °C with reference to a standard state of 1×10^5 Pa pressure.

6. Which one of the following statements is true?

a) $\Delta_r H° > 0$ and $\Delta_r S° > 0$
b) $\Delta_r H° < 0$ and $\Delta_r S° > 0$
c) $\Delta_r H° < 0$ and $\Delta_r S° < 0$
d) $\Delta_r H° > 0$ and $\Delta_r S° < 0$
e) There is insufficient information to work out both signs.

7. Which is closest to the value of K_p for the following reaction at 25 °C?

$$\tfrac{1}{2}N_2O_4(g) \rightleftharpoons NO_2(g)$$

a) –7.1
b) –3.6
c) 0.14
d) 0.38
e) 0.020

8. Methanol, CH_3OH, (8.011 g) was burnt in excess oxygen to yield liquid water and $CO_2(g)$. 181.8 kJ of heat energy was liberated at 298 K and 101.3 kPa. The equation for the reaction is:

$$2CH_3OH(l) + 3O_2(g) \rightarrow 4H_2O(l) + 2CO_2(g)$$

What is the heat of combustion, $\Delta H°_{298}$ (in kJ mol^{-1}) for methanol?

a) –363.5 b) +363.5 c) +181.8 d) –727.2 e) +727.2

9. Given the following thermochemical data, what is the enthalpy of formation $\Delta_f H°_{298}$ for $C_6H_6(l)$ at 298 K and 101.3 kPa?

$$C_6H_6(l) + 3H_2(g) \rightarrow C_6H_{12}(l) \qquad \Delta H° = -206 \text{ kJ mol}^{-1}$$
$$6H_2(g) + 6C(s) \rightarrow C_6H_{12}(l) \qquad \Delta H° = -123 \text{ kJ mol}^{-1}$$

a) +329 kJ mol^{-1}
b) +206 kJ mol^{-1}
c) +83 kJ mol^{-1}
d) –83 kJ mol^{-1}
e) –329 kJ mol^{-1}

10. Samples of A (2.0 mol) and B (3.0 mol) are placed in a 10.0 L container and the following reaction takes place

$$2A(g) \rightleftharpoons 3B(g)$$

At equilibrium, the concentration of A is 0.14 M. What is the value of K_c?

a) 3.0 b) 0.33 c) 2.4 d) 0.42 e) 6.8

Correct answers: 1B, 2C, 3A, 4C, 5C, 6C, 7D, 8D, 9C, 10A

Chem1612	**Sample Quiz 1 (ii)**	**Last update: 21/08/17**

1. Reference: http://firstyear.chem.usyd.edu.au/LabManual/W5.pdf

   When computed on a calculator, the algebraic expression $\dfrac{3.69\text{ kg} \times 30.\text{ J}}{(87.1\text{ m} + 98.5\text{ m})}$ has a value of 0.596443966. Expressed to the appropriate number of significant figures, this is:

a) 0.5 kg J m^{-1}
b) 0.6 kg J m^{-1}
c) 0.59 kg J m^{-1}
d) 0.60 kg J m^{-1}
e) 0.596 kg J m^{-1}

2. A particular chemical reaction has $\Delta H° = –5$ kJ mol^{-1} and $\Delta S° = +25$ J K^{-1} mol^{-1}. Assuming that these values do not change with temperature, in what temperature range is $\Delta G°$ negative?

a) at all temperatures
b) at no temperature
c) $T > 200$ K
d) $T < 200$ K
e) $T < –200$ K

3. An ideal gas receives 245 J of heat and contracts by 1.30 L against an external pressure of 60.0 kPa. What is the change in internal energy of the system?

a) +167 b) +323 J c) –323 J d) –167 J e) 0 J

4. Use the data below to calculate $\Delta_{universe}S^o$ for the sublimation of iodine at 298 K.

	$\Delta_f H^o$ (kJ mol^{-1})	S^o (J K^{-1} mol^{-1})
I_2(s)	0.00	116
I_2(g)	62	261

a) –353. J K^{-1} mol^{-1}
b) –63.1 J K^{-1} mol^{-1}
c) +63.1 J K^{-1} mol^{-1}
d) +353 J K^{-1} mol^{-1}
e) +377 J K^{-1} mol^{-1}

5. In which one of the following processes does the entropy of the system increase? Assume constant temperature and pressure unless specifically indicated otherwise.

a) $CO_2(g) \rightarrow CO_2(s)$
b) 1 mol H_2(g) at 1 atm $\rightarrow$ 1 mol H_2(g) at 10 atm
c) $2CO_2(g) \rightarrow O_2(g) + 2CO(g)$
d) C_2H_5OH(l) at 40 °C $\rightarrow$ C_2H_5OH(l) at 20 °C
e) $C_4H_6(g) + C_4H_8(g) \rightarrow C_8H_{14}(l)$

Questions 5 and 6 refer to the following reaction: $N_2O_4(g) \rightleftharpoons 2NO_2(g)$
K_p = 0.14 at 25 °C and K_p = 0.18 at 70 °C with reference to a standard state of 1×10^5 Pa pressure.

6. Which one of the following statements is true?

a) $\Delta_r H° > 0$ and $\Delta_r S° > 0$

b) $\Delta_r H° < 0$ and $\Delta_r S° > 0$

c) $\Delta_r H° < 0$ and $\Delta_r S° < 0$

d) $\Delta_r H° > 0$ and $\Delta_r S° < 0$

e) There is insufficient information to work out both signs.

7. Which is closest to the value of K_p for the following reaction at 25 °C?

$$4NO_2(g) \rightleftharpoons 2N_2O_4(g)$$

a) 7.1

b) -3.6

c) 51

d) 0.14

e) 0.37

8. Acetone, CH_3COCH_3, (5.808 g) was burnt in excess oxygen to yield liquid water and $CO_2(g)$. 179.0 kJ of heat energy was liberated at 298 K and 101.3 kPa. The equation for the reaction is:

$$CH_3COCH_3(l) + 4O_2(g) \rightarrow 3H_2O(l) + 3CO_2(g)$$

What is the heat of combustion, ΔH^o_{298} (in kJ mol^{-1}) for acetone?

a) –1790. b) –179.0 c) –17.90 d) +179.0 e) +1790.

9. Given the following thermochemical data, what is the enthalpy of formation $\Delta_f H^o_{298}$ for $PF_5(g)$ at 298 K and 100 kPa?

$$2P(s) + 3F_2(g) \rightarrow 2PF_3(g) \qquad \Delta H^o = -1838 \text{ kJ mol}^{-1}$$

$$PF_3(g) + F_2(g) \rightarrow PF_5(g) \qquad \Delta H^o = -675 \text{ kJ mol}^{-1}$$

a) +582 kJ mol^{-1}

b) –1163 kJ mol^{-1}

c) –1257 kJ mol^{-1}

d) –1594kJ mol^{-1}

e) –2513 kJ mol^{-1}

10. Samples of A (4.0 mol) and B (2.0 mol) are placed in a 5.0 L container and the following reaction takes place $3A(g) \rightleftharpoons 2B(g)$

At equilibrium, the concentration of A is 0.82 M. What is the value of K_c?

a) 0.27 b) 0.31 c) 2.4 d) 4.0 e) 30.

Correct answers: 1D, 2A, 3B, 4B, 5C, 6A, 7C, 8A, 9D, 10B
Quiz (ii) needs checking.