Answer Key
Testname: TEST 1

Version A

1) C
2) D
3) C
4) C
5) A
6) C
7) A
8) E
9) C
10) B
11) C
12) A
13) A
14) E
15) D
16) A
17) A
18) B
19) E
20) D
21) E
22) E
23) C
24) B

Answer Key
Testname: TEST 1

Version B

1) E
2) B
3) A
4) E
5) B
6) B
7) B
8) D
9) D
10) E
11) C
12) C
13) B
14) E
15) E
16) A
17) C
18) A
19) C
20) A
21) E
22) C
23) D
24) D

Version A

1. **ATTEMPT ANY *ONE* OF THE FOLLOWING TWO PROBLEMS**

The reaction in a safety air bag is as follows:

$$2\ NaN_3\ (s) \rightarrow 2\ Na\ (s) + 3\ N_2(g)$$

If the airbag has a volume of 36 L and is to be filled with nitrogen gas at a pressure of 1.15 atm at a temperature of 26.0 °C., how many grams of NaN_3 needs to be decomposed?

Or

Hydrogen gas is produced when zinc reacts with sulfuric acid:

$$Zn\ (s) + H_2SO_4\ (aq) \rightarrow H_2\ (g) + Zn\ SO_4\ (aq)$$

If 159 mL of wet H_2 is collected over water 24.0°C and a barometric pressure of 738 torr, how many grams of Zn have been consumed.

Answer:

a.

formula 1 point

$PV=nRT$

$$n=\frac{PV}{RT}=\frac{(1.15atm)(36L)}{(0.0821L\text{-}atm/mol\text{-}K)(299K)}$$

$=1.69molN_2$ ← 4 points.

$$(1.68molN_2)\left(\frac{2molNaN_3}{3molN_2}\right)\left(\frac{65gNaN_3}{1molNaN_3}\right)=73.08gNaN_3$$

= 73 g with correct sig figs ← 4 points.
1 point for correct sig fig.

b.

$PV=nRT$ ← 1 point

P has to take into consideraton the

fact that it has water vapor in it.

P =738-22.38torr(partial pressure of water at 24°C)

$$=715.62\ torr\ x\ \frac{1atm}{760\ torr}=0.9416atm$$

$$n=\frac{PV}{RT}=\frac{(0.9416atm)(0.159L)}{(0.0821L\text{-}atm/mol\text{-}K)(297K)}$$

$=0.006140molH_2$ ← 4 point

$(0.006136molH_2)\left(\frac{molZn}{molH_2}\right)\left(\frac{65.39gZn}{1molZn}\right)=0.401\ g\ Zn$ ← 4 point
1 point for correct sig fig.

Version b

1. **ATTEMPT ANY *ONE* OF THE FOLLOWING TWO PROBLEMS**

The reaction in a safety air bag is as follows:

$$2\ NaN_3\ (s) \rightarrow 2\ Na\ (s) + 3\ N_2(g)$$

If the airbag has a volume of 40 L and is to be filled with nitrogen gas at a pressure of 1.15 atm at a temperature of 26.0 °C., how many grams of NaN_3 needs to be decomposed?

Or

Hydrogen gas is produced when zinc reacts with sulfuric acid:

$$Zn\ (s) + H_2SO_4\ (aq) \rightarrow H_2\ (g) + Zn\ SO_4\ (aq)$$

If 169 mL of wet H_2 is collected over water 24.0°C and a barometric pressure of 738 torr, how many grams of Zn have been consumed.

Answer:

a.

$PV=nRT$ ← formula 1 point

$$n=\frac{PV}{RT}=\frac{(1.15atm)(40L)}{(0.0821L\text{-}atm/mol\text{-}K)(299K)}$$

$=1.874molN_2$ ← 4 points

$$(1.873molN_2)\left(\frac{2molNaN_3}{3molN_2}\right)\left(\frac{65gNaN_3}{1molNaN_3}\right)=81.20gNaN_3$$

$=80g$ with correct significant figures. ← 4 points + 1 for correct sig fig

b.

$PV=nRT$ ← 1 point

P has to take into consideraton the

fact that it has water vapor in it.

P =738-22.35torr(partial pressure of water at 24°C)

$$=715.65\ torr\ x\ \frac{1atm}{760\ torr}=0.9416atm$$

$$n=\frac{PV}{RT}=\frac{(0.9416atm)(0.169L)}{(0.0821L\text{-}atm/mol\text{-}K)(297K)}$$

$=0.006526molH_2$ ← 4 points

$$(0.006526molH_2)\left(\frac{molZn}{molH_2}\right)\left(\frac{65.39gZn}{1molZn}\right)=0.426\ g\ Zn$$ ← 4 points + 1 for sig fig

YOU MUST ATTEMPT THIS PROBLEM

2. The fluorocarbon compound $C_2Cl_3F_3$ has a normal boiling point of 47.6 °C. The specific heat of $C_2Cl_3F_3$ (l) and $C_2Cl_3F_3$ (g) are 0.91 J /g K and 0.67 J /g K respectively. The heat of vaporization for the compound is 27.49 kJ / mol. Calculate the heat required to convert 25.0 g of $C_2Cl_3F_3$ from a liquid AT 5.00 °C to a gas at 82.00 °C.

Molecular mass = 187.4 ← one point

$$25\ g \times \frac{1\ mole}{187.4\ g} = 0.1334 mol$$

$$Q1 = mc\Delta T = 25\ g \times 0.91 \frac{J}{gK} \times 42.6\ K$$

$$= 969\ J = .969\ kJ$$

2 point

$$Q2 = \text{mass in moles} \times \text{heat of vaporization}$$

$$= 0.1334\ moles \times 27.49\ \frac{kJ}{mol}$$

$$= 3.667 kJ$$

2 point

$$Q3 = 25\ g \times 0.67\ \frac{J}{g} \times 34.4\ K$$

$$= 576\ J = 0.576\ kJ$$

2 point

$$Q = Q1 + Q2 + Q3 = 5.21\ kJ$$

← 2 points for answ
+ 1 point for c