 ATAR Year 11 Chemistry

Chemical reactions

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mark\_\_\_\_\_\_\_ /45

**Part 1: Multiple Choice – Answer all questions on the grid provided.**

1. Which of the following is not an indication of chemical change?
   1. A smell
   2. A colour change
   3. A change of state (or phase)
   4. Light being emitted
2. Consider the chemical reaction below:



*Which of the following statements are true?*

1. Energy breaks the covalent bonds between the Na atoms
2. Energy breaks the covalent bonds with the oxygen molecules
3. Energy is released as ionic bonds are formed.
4. i, ii & iii
5. ii & iii only
6. i & iii only
7. ii only
8. Activation energy is ….
   1. The energy released when chemical bonds are formed
   2. The energy required to break the chemical bonds of reactants
   3. The energy absorbed by breaking the bonds of reactants
   4. The energy absorbed by forming the chemical bonds of products

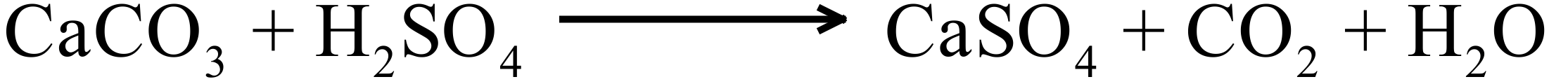
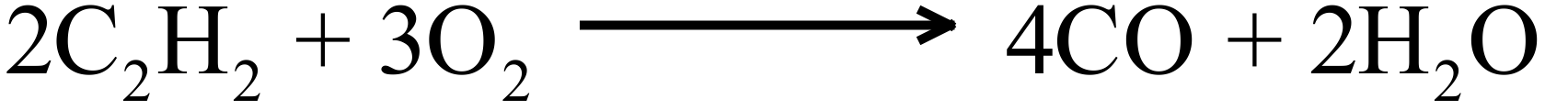
4. The mass of 1 mol of sodium is 23 g. What is the mass of one sodium atom?

a) 6 x 1023 g

b) 6 x 10-23 g

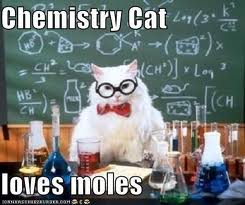
c) 3.8 x 10-23 g

d) 3.8 x 10-24 g

1. Which of the following is not a balanced chemical equation?
   1. 
   2. 
   3. 
   4. 
2. Butane is commonly used as a fuel source. It combusts with oxygen to produce carbon dioxide and water. The reaction is commonly represented as:



Which of the following shows a correct molar ratio from this reaction?

1. n(C4H10) = 4 × n(CO2)
2. n(H2O) = × n(CO2)
3. n(O2) = 4×n(CO2)
4. n(H2O) = 4 ×n(C4H10)
5. The enthalpy of combustion of methane (CH4) is -882 kJ mol-1.The mass of methane which has to be burned to produce 44⋅1 kJ is:
   1. 0⋅8g
   2. 80g
   3. 44⋅1g
   4. 441g
6. How many oxygen atoms are present in one formula unit of calcium hydroxyapatite – [Ca3(PO4)2]3.Ca(OH)2 ?
   1. 26
   2. 14
   3. 10
   4. 2
7. Which statement about change in enthalpy is true?
   1. Heat is given off to the surroundings in endothermic reactions.
   2. Enthalpy is a chemical substance of heat.
   3. Enthalpy is associated with kinetic energy of the reactants.
   4. The sign of ∆H is always positive in endothermic reactions.

10. One mole of argon atoms resembles one mole of magnesium atoms in that they both have the same:

1. mass
2. volume
3. number of atoms
4. number of neutrons

**11.** The complete combustion of the hydrocarbon C*x*H*y* produced CO2 and H2O in the ratio 1:1. The hydrocarbon could be

A propane.

B propene.

C methylpropane

D methane.

12. Which of the following compounds exists and is named correctly?

A methene

B C3H5

C 2,2-dimethyl propene

D 2,2,3-trimethyl pentane

**13**. The hydrocarbon with the formula C3 H8 is

**A** propane.

**B** 1-propane.

**C** 1-propene.

**D** propene.



Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Part 1: Multiple Choice answer grid.

For each question shade the box to indicate the answer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | 🞏 a | ◼ b | 🞏 c | 🞏 d |

Use **only** a blue or black pen to **shade** the boxes.

For example, if b is your answer shade the box to the left of b.

If you make a mistake, place a cross through that square,

**do not erase or use correction fluid**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | 🞏 a | ◼ b | 🞏 c | ◼ d |

Shade your new answer.

For example, if b is a mistake and d is your correct answer:

In the event that you then change your mind back to your original answer,

you then cross out the second selection and then circle the first choice.

For example, if b was the first choice and d your second, but b is your correct answer:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | 🞏 a | ◼ b | 🞏 c | ◼ d |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  | 8 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |
| 2 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  | 9 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |
| 3 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  | 10 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |
| 4 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  | 11 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |
| 5 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  | 12 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |
| 6 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  | 13 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |
| 7 | 🞏 a | 🞏 b | 🞏 c | 🞏 d |  |  |  |  |  |  |

/13

Question 14 (4 marks)

Potassium nitrate, KNO3, and ammonium sulfate, (NH4)2SO4, can both be used in fertilisers as a source of nitrogen for plants. What mass of ammonium sulfate contains the same amount of nitrogen as 65.0 g of potassium nitrate?

*% N in KNO3 = 14.01/(39.1 + 14.01 + 48) ×100 = 13.9% (1)*

*% N in (NH4)2SO4 = 28.02/(28.02 + 8.064 + 32.07 + 64) × 100 = 21.2% (1)*

m*(N) in 65.0 g of KNO3 = 0.139 × 65 = 9.035 g (1)*

m*((NH4)2SO4) = 9.035 × 100/21.2 = 42.61 g (1)*

*Alternatively*

*M(KNO3)=39.10+14.01+3x16=101.11*

*n(KNO3)=65.10/101.1= 0.6429mol (1)*

*n(N) =0.6429* in KNO3 and *(NH4)2SO4 (1)*

*n((NH4)2SO4)=1/2 n(N)= 0.32145 mol (1)*

*m((NH4)2SO4)= n((NH4)2SO4)xM((NH4)2SO4)*

*= 0.32145x[2x(14+4x1.008)+32.07+4x16]*

*= 0.32145x132.134*

*=42.47g (ignore rounding errors) (1)*

Question 15 (11 marks)

Consider the following reaction:

2SO2(g) + O2 (g) ⇌ 2SO3(g)

For the forward reaction ΔH is –200 kJ.

1. State whether the reaction endothermic or exothermic ( 1 mark)

*exothermic*

b If 4 moles of SO2(g) reacted completely, calculate the number of molecules of oxygen gas that were consumed in the reaction. (2 marks)

n(O2) = 0.5 × n(SO2) = 2 moles\*

N(O2) = n(O2) × 6.022 × 1023 = 1.20 × 1024\*

1. Calculate the mass of SO3 produced from 150g of SO2 (5 marks)

*M(SO2)= 32.07+2x16.00=64.07*

*n(SO2)=m/M = 150/64.07=2.341 moles*

*n(SO3) = n(SO2)=2.341 moles*

*M(SO3)= 32.07+ 3x16 =80.07*

*m (SO3) = nxM= 2.341 x 80.07 = 187g*

d. State whether energy is absorbed or released (1 mark)

*released*

e. Calculate the amount of this energy produced from the combustion of 5.6 moles of SO2

( 2 marks)

*2 moles S02 produces 200kJ*

*1 mole S02 produces 100kJ*

*Therefore 5.6 moles produces 5.6 x 100= 560 kJ*

*Alternatively : Energy = Energy per 2 moles x 5.6/2 =200 x5.6/2 = 280kJ*

Question 16 (3 marks)

State whether the given reactions are exothermic or endothermic.

|  |  |
| --- | --- |
| Reaction | Exothermic or endothermic |
| CH4(g) + 2O2(g) → CO2(g) + 2H2O(l) | *exothermic* |
| NH4Cl dissolved in water and temperature of water went from 20°C to 11°C. | *endothermic* |
| CO2(g) → CO2(s) | *endothermic* |

**Question 17 ( 6 marks)**

Write balanced reactions, showing the reactants and the products, for the following:

1. Adding dilute sulfuric acid to potassium (2 marks)

*2K(s) + H2SO4→ K2SO4 + H2 (g)*

1. Reaction of silver nitrate with a freshly cleaned strip of copper (include state symbols) ( 2 marks)

*AgNO3+Cu(s)→ Ag(s)+ CuNO3 (aq)*

1. The reaction of calcium carbonate with nitric acid ( 2 marks)

*CaCO3+ HNO3→ Ca(NO3)2 + CO2 + H20*

**Question 18 (10 marks)**

Iron(III) oxide reacts with carbon solid to form pure iron and carbon dioxide

1. Write a balanced equation for this reaction ( 2 marks)

*2Fe2O3+3C →4Fe +3CO2*

*1 mark correct molecules + 1 mark correctly balanced*

1. Calculate the mass of carbon are needed to react with 5kg of iron(III) oxide (4 marks)

M (*Fe2O3*)=2x55.85+3x16.00=159.7

n(*Fe2O3)=m/M =5000/159.7=31.308mol*

*n(C)=(3/2) x 31.308 =46.96 mol*

*m(C)= n XM= 46.96x12 = 563g*

1. Calculate the no. molecules of  *Fe2O3* that would be needed to produce 630g of CO2 ( 4 marks)

*M (CO2) = 12+ 2x16 =44g*

*n(CO2)=m/M= 630/44=14.32mol*

*n(Fe2O3)=(2/3) x14.32 = 9.55mol*

*N (Fe2O3) =9.55x6.02x1023= 5.75x1024molecules*

**Question 19 ( 3 marks)**

In the reaction of solid ammonium chloride and solid barium chloride the products felt cold to touch.

State whether this is exothermic or endothermic and explain why this occurs.

*The reaction is endothermic*

*The potential energy of the bonds of the products is greater than that of the reactants.*

*Therefore energy is absorbed from the surroundings making it feel colder*

Question 20 (8 marks)

|  |  |
| --- | --- |
| Name | Structural formula |
| *3,3-dimethyl hexane*  *( 2 marks, hexane is for the longest chain)* |  |
| 2,3-dimethyl but-1-ene | (*2 marks)* |
| trans pent-2-ene  *( 1 mark for name, 1 if trans included)* | **Work:___PROJECTS:_WACE:_CHEMISTRY:CHEMISTRY 11:TR:01-MS_TO_RPE:HANDOVER:FROM ROB:jpg:PC11_WA_TR_1e_01_03_06bQ.jpg** |

|  |  |
| --- | --- |
| Draw an aromatic compound with 8 carbon atoms | Work:___PROJECTS:_WACE:_CHEMISTRY:CHEMISTRY 11:TR:01-MS_TO_RPE:HANDOVER:FROM ROB:jpg:PC11_WA_TR_1e_01_03_07cA.jpg  *(2 marks – other solns possible, must have benzene* |

Question 15 (6 marks)

1,2-dibromoethane (CH2BrCH2Br) can be produced using different reaction pathways. Both ethane and ethene can be used as starting materials.

a Write equations using structural formulas to show how CH2BrCH2Br can be formed from both ethene and ethane. (4 marks)

a Ethane as a starting material (2 marks)

|  |
| --- |
|  |

Ethene as a starting material ( 2 marks)

|  |
| --- |
|  |

b Starting with ethane: *substitution*

Starting with ethene: *addition* (2 marks)