E-learning with Google form

punkc2008@gmail.com

Use of google form

- As a means of flipped learning
- Having prior knowledge of the class and tailor made the lessons that follow
- **Sequence**:
  - Request students to complete the google form before hand
  - Look at the results and modify the teaching plan for the class

Flipped learning

- Assessment of learning
- Assessment for learning / teaching
- Assessment as learning
- Google form or other means for **knowing the prior knowledge of students**
- Make sure that at the end of every lesson, there is a **recap period** to consolidate what the students have learnt.

PISA全球測試 港生科學第2跌第9

港生PISA表現*

排名	國家或經濟體系		
	科學	閱讀	數學
1	新加坡	新加坡	新加坡
2	日本	香港	香港
3	愛沙尼亞	加拿大	澳門
4	台北	芬蘭	台北
5	芬蘭	愛爾蘭	日本
6	澳門	愛沙尼亞	中國**
7	加拿大	韓國	韓國
8	越南	日本	瑞士
9	香港	挪威	愛沙尼亞
10	中國**	新西蘭	加拿大

*在2006至2012年間，港生的科學排名介乎2至3，閱讀介乎2至10，數學介乎1至3

**中國只有北京、上海、江蘇及廣東省參加

資料來源： PISA

20161207明報

PISA全球測試 港生科學第2跌第9

- PISA香港中心總監何瑞珠指出，受推行新高中學制影響，同時修讀3科理科（物理、生物及化學）的學生，由2009年舊制下的四成下降至2015年新制下的4%，或導致科學科尖子比率跌至歷屆最低，亦反映同時選修3科理科已不再是高能力學生的首選。

- 何瑞珠質疑教師能否有效利用電子教學促進科學教育，她亦看不到「翻轉課室」有助提升學生探究能力。

20161207明報

Problem types (Wood 2006:99)

Type	Data	Methods	Outcomes/ goals	Skills
1	Given	Familiar	Given	Recall of algorithm
2	Given	Unfamiliar	Given	Looking for parallels to known methods
3	Incomplete	Familiar	Given	Analysis of problems to decide what further data are required
4	Incomplete	Unfamiliar	Given	Weighing up possible methods and deciding on data required
5	Given	Familiar	Open	Decision about appropriate goals; exploration of knowledge networks
6	Given	Unfamiliar	Open	Decision about goals and choice of appropriate methods; exploration of knowledge and technique networks
7	Incomplete	Familiar	Open	Once goals have been specified by the student, they are seen to be incomplete
8	Incomplete	Unfamiliar	Open	Suggestions of goals and methods to get there

Problem types (Wood 2006: 99)

- Type 3: Data incomplete, methods familiar, given outcomes
- *If you want me to do this, I shall need the following…*
- E.g. chemical tests to distinguish compounds

Wood, C. (2006) "The development of creative problem solving in chemistry" in *Chemistry Education Research and Practice* Volume 7(2), 96 – 113. [Online: Available URL: http://www.rsc.org/images/Wood%20paper%20final_tcm18-52110.pdf accessed on 15/12/2016]

Problem types (Wood 2006: 99)

- Type 4: Incomplete data, unfamiliar methods, given outcomes
- *How many atoms are there in a $5 coin?*
- *If I knew the mass of the coin and if I knew the type of metal constituents present in the coin, I could get an answer, but it would only be an estimate…*

Wood, C. (2006) "The development of creative problem solving in chemistry" in *Chemistry Education Research and Practice* Volume 7(2), 96 – 113. [Online: Available URL: http://www.rsc.org/images/Wood%20paper%20final_tcm18-52110.pdf accessed on 15/12/2016]

Problem types (Wood 2006: 100)

- Type 5: Given data, familiar methods, open outcomes
  - *Given the formula $[Cu(NH_3)_4]^{2+}$ deduce from it as much as you can?*
  - *A range of responses:*
    - *Oxidation number of copper*
    - *Type of interaction between copper(II) and ammonia*
    - *Colour*
    - *Its formation*

Wood, C. (2006) "The development of creative problem solving in chemistry" in *Chemistry Education Research and Practice* Volume 7(2), 96 – 113. [Online: Available URL: http://www.rsc.org/images/Wood%20paper%20final_tcm18-52110.pdf accessed on 15/12/2016]

Questions may be set on misconceptions of students

- Taber, K. (2002) *Chemical Misconceptions: Prevention, Diagnosis and Cure*, London: Royal Society of Chemistry

Some important features of google form

- **Question types**:
  - Multiple choice
  - Multiple options (More than 1 choice)
  - Short answers
- Can insert **pictures / video**
- Can generate **data report**

Exemplar 1

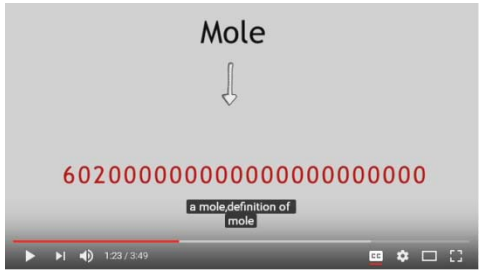
- Students are having difficulties in studying chemistry calculations
- Rearrangement of topics in Topic III
  - Metallic bond
  - Mole concept
    - Mole to number and vice versa
    - Mole to mass and vice versa
    - Stoichiometry
      - Expt – Decomposition of baking powder
  - Reactions of metals …….

Exemplar 1

- Level of students: High
- Flow of lessons
  - 3 lessons (35 minutes) on mole concept
  - Google form at home
  - 4^{th} lesson (discussion on their performance in google form)
  - 5^{th} – 6^{th} lessons (Experiment on decomposition of baking powder)
  - 7^{th} lesson (Post-experiment discussion and round up for chemical calculations before examination)

Exemplar 1: Google form

- 30 responses out of 32 students
- Q.1 Watch a video and then answer the question which follows.
- **Objective**:
  - To consolidate what they have learnt about mole
- Video link:
  - What is a mole?
  - https://www.youtube.com/watch?v=wqZSxErQ7Ck



Exemplar 1: Google form

1. What do you understand by the term mole?

   Play the video and which of the following statements is/are correct?

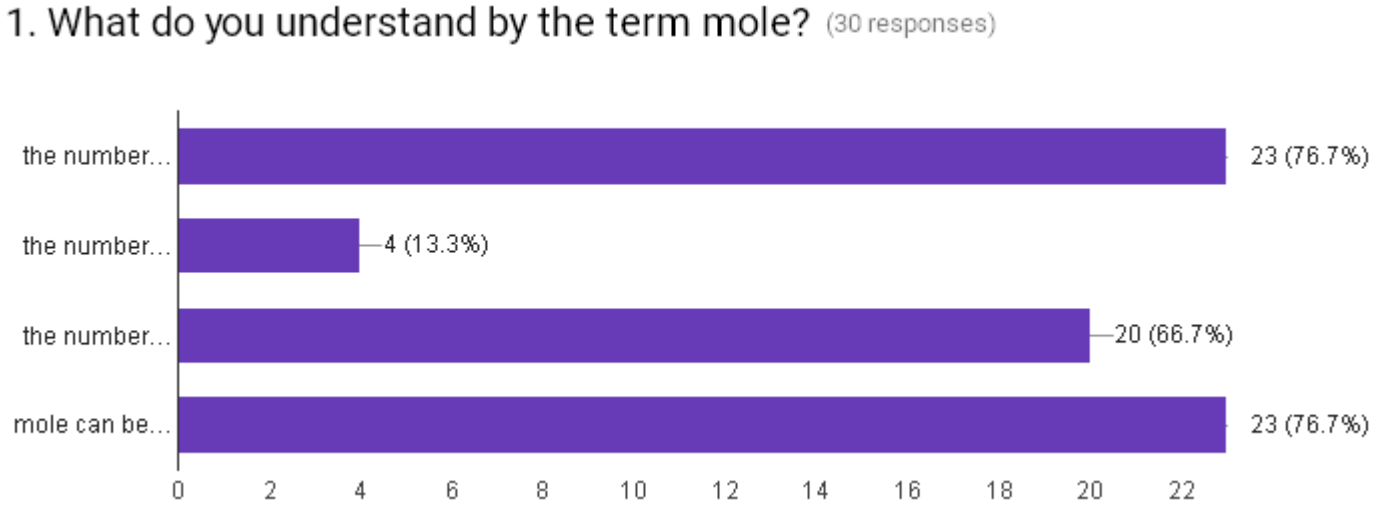
   A. the number of atoms in 1 mole of Au is the same as the number of atoms in 1 mole of H.

   B. the number of atoms present in 1 mole of hydrogen molecules is 1.204 x 10^23.

   C. the number of chemical entities present in 1 mole is called the Avogadro's constant.

   D. mole can be considered as a counting unit.

Exemplar 1: Q1 Results



- Comments:
  - Not all students can fully attempt the question.
  - Follow-up action: should further illustrate what is meant by mole / Avogadro's constant in class

Exemplar 1

2. Work out the molar mass of calcium carbonate and carbon dioxide.

   [Given: Relative atomic masses: Ca = 40.0, C = 12.0, O = 16.0]

Objective:

To check the understanding of mole $\leftrightarrow$ mass calculations.

Exemplar 1: Q2 Results

calcium carbonate : 100 g carbon dioxide : 44 g
100g and 44g
CaCO3:100g CO2:44g
Calcium carbonate (CaCO3): 40.0+12.0+16.0*3= 100g Carbon dioxide (CO2): 12.0+16.0*2= 44g
144 g
CaCO3:100g CO2:44g
100g/mol(calcium carbonate); 44g/mol(carbon dioxide)
Calcium carbonate: 40+12+16x3=100 Carbon dioxide: 12+16x2=44
CaCO3=40.0+12+16*3=100g CO2=12+16*2=60g

Comments:

Most students know how to perform the calculations.

Mistakes made are careless or the students misunderstand the question.

Exemplar 1

3. The equation below shows the thermal decomposition of calcium carbonate. What information can be obtained from the following chemical equation?

   $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

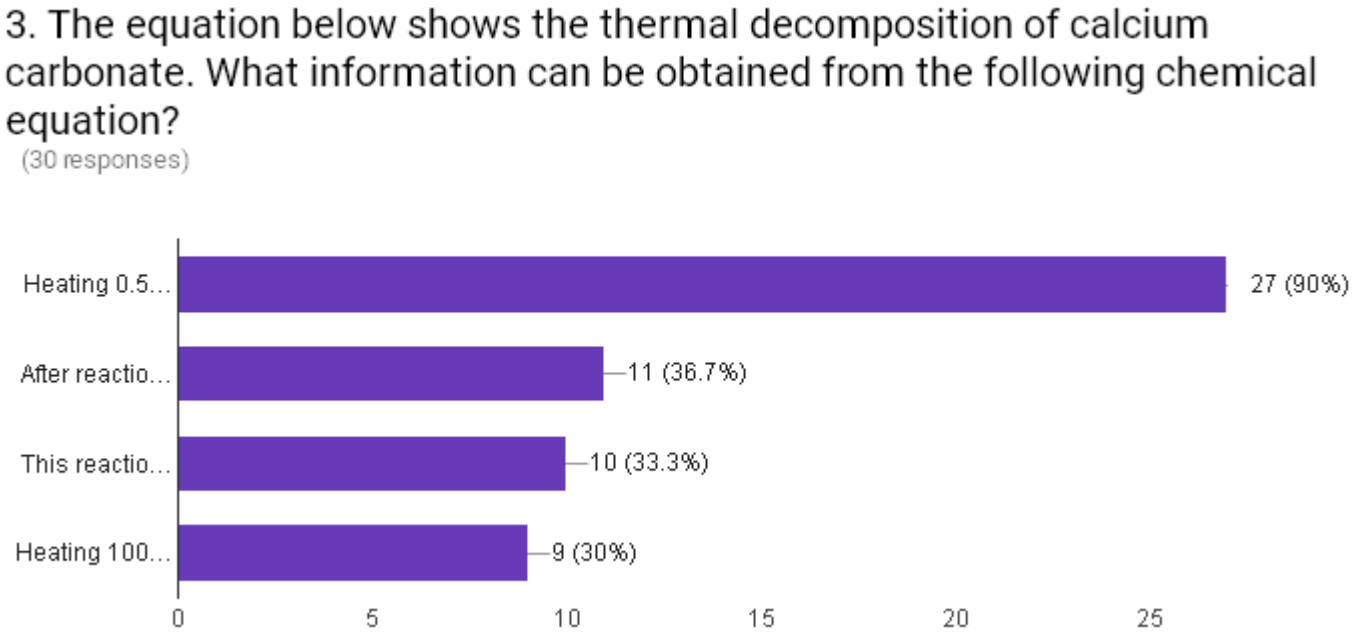
   A. Heating 0.5 mol of calcium carbonate will obtain 0.5 mol of calcium oxide and 0.5 mol of carbon dioxide.

   B. After reaction, there is a loss of mass.

   C. This reaction is an exothermic reaction. [Note: An exothermic reaction is a reaction that gives out heat.]

   D. Heating 100 g of calcium carbonate, the maximum loss of mass of 44 g.

Exemplar 1: Q3 Results



- Comments:
  - Not many students select B and D – lack of thorough understanding of the chemical equation given
  - 1/3 of students forgot what they have learnt in Planet Earth.
  - Follow-up action: further explanation in class

Exemplar 1

Objective for Q.4 – Q.6:

To prepare the students ready for the practical

4. Give the chemical formula and work out the molar mass of each of the following chemical species: sodium hydrogen carbonate, sodium hydroxide, sodium carbonate and sodium oxide.

Exemplar 1: Q.4 Results

4. Give the chemical formula and work out the molar mass of each of the following chemical species: sodium hydrogen carbonate, sodium hydroxide, sodium carbonate and sodium oxide.

(30 responses)

NaHCO3, NaOH, Na2CO3, Na2O : 84, 40, 106, 62 respectively

NaHCO3:84g NaOH:40g Na(CO3)2:143g Na2O:62g

1)Sodium hydrogen carbonate
a. Na(HCO3)
b. 23.0+(1.0+12.0+16.0*3) = 84g
2)Sodium hydroxide
a. NaOH
b. 23.0+16.0+1.0 = 40g
3)Sodium carbonate
a. Na2CO3
b. 23.0*2+12.0+16.0*3 = 106g
4)Sodium oxide
a. Na2O
b. 23.0*2+16.0 = 62g

NaHCO3 84g per mol
NaOH 40g per mol
Na2CO3 106 per mol
NaO 39g per mol

Comments:

- Most are correct.
- For those with wong answers, they do not know the formulae of the various chemical species.

Exemplar 1

- 5a.

  In the coming practical, you are going to determine the chemical equation for the thermal decomposition of sodium hydrogen carbonate. Accurately about 2.00 g of sodium hydrogen carbonate is used. Work out the amount of sodium hydrogen carbonate used in mol.

Exemplar 1: Q5a Results

5a. In the coming practical, you are going to determine the chemical equation for the thermal decomposition of sodium hydrogen carbonate. Accurately about 2.00 g of sodium hydrogen carbonate is used. Work out the amount of sodium hydrogen carbonate used in mol.

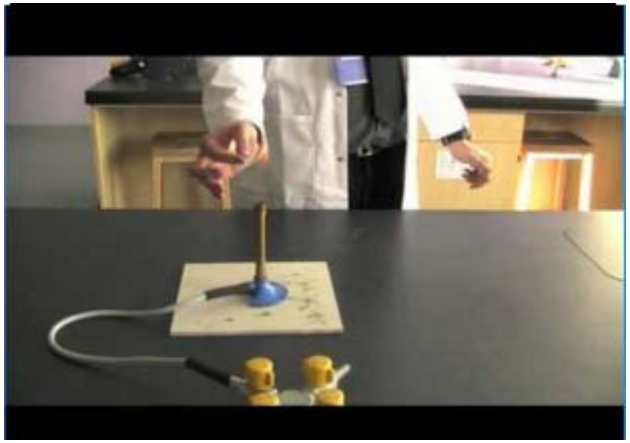
(30 responses)

2/84=0.0238mol
2/84=0.0238mol
2/84=0.0238mol
0.02mol
0.02mol
1/42mol
1/42mol
0.0187 mol
Let x be the amout of Na(HCO3) used in mol [23.0+(1.0+12.0+16.0*3)]*x = 2g 84x = 2 x = 2/84 x = 0.0238 mol (corr. to 3 s.f.) 0.0238 mol of sodium hydrogencarbonate is used.

Exemplar 1

7. In the coming practical, you are going to use Bunsen burner and it will be the first time in F.4 in using this apparatus. Review the video below and select the best choice.

   Video link: https://www.youtube.com/watch?v=N7ssCM3qM3U



Follow-up work in the subsequent session

- Revision on the **number ↔ mole ↔ mass** conversions.
- Revision on **chemical formulae** of some chemical species.
- **Calculations** based on chemical equations
  - Concept of **limiting reagent** introduced

Lab session

- Revision on the number ↔ mole ↔ mass conversions.
- For the 1st 20 minutes: Further elaborations on the chemical calculations
- 30 minutes to complete the practical
- 20 minutes to discuss
- Not enough time to discuss, set some questions for the students to do.

Final session before exam

- Discussion on the worksheet

- Further elaboration on basic chemical calculations involving the mole concept

Related Questions in Examination

- Which of the following chemical species can undergo thermal decomposition?

  (1) $NaHCO_3$

  (2) Na_2CO_3

  (3) $CaCO_3$

  A. (1) only
  B. (2) only
  C. (1) and (3) only
  D. (2) and (3) only

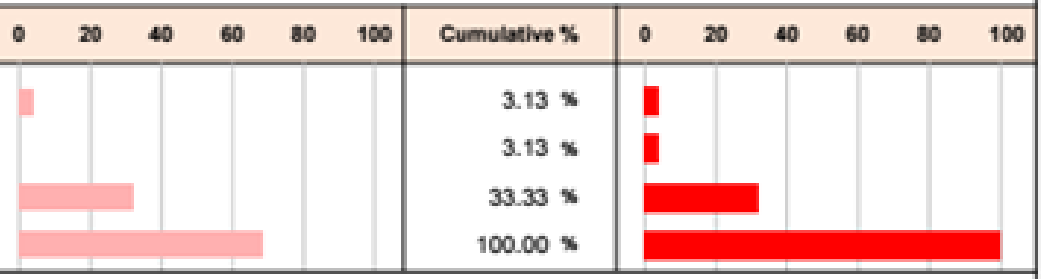
F4 Chemistry T1 1617 (ALL)

Table Analysis - For Each Question

16 Q_16

Mean	Median	Mode	Range	Std. Dev.	Variance	Minimum	Maximum	Skewness	Kurtosis	95% Conf. Int.
3.60	4.00	4.00	3.00	0.66	0.43	1.00	4.00	0.00	0.00	3.47 to 3.74

Choices Desc	ID	Value	Frequency	Percent %	Cumulative %
A	1	0	3	3.13 %	3.13 %
B	2	0	0	0.00 %	3.13 %
C	3	1	29	30.21 %	33.33 %
D	4	0	64	66.67 %	100.00 %



No. of Respondents = 96 No Respond = 0

Related Questions in Examination

- Which of the following chemical species can undergo thermal decomposition?

  (1) $NaHCO_3$

  (2) Na_2CO_3

  (3) $CaCO_3$

A. (1) only (3) B. (2) only (0)

C. (1) and (3) only (29) D. (2) and (3) only (64)

Related Questions in Examination

- Copper reacts with silver nitrate solution as follows:

  $Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$

  1.699 g of silver nitrate dissolves in excess water. 6.350 g of copper is then added to the solution.

  (a) Explain, which chemical species, copper or silver nitrate, is the **limiting reagent**.

  (b) Calculate the **maximum mass of silver** obtained.

  (c) The **mass** obtained **practically is NOT the same** as that calculated in (b). Suggest a reason.

5. Copper reacts with silver nitrate solution as follows:

$$Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$$

1.699 g of silver nitrate dissolves in excess water. 6.35 g of copper is then added to the solution.

[Relative atomic masses: Cu = 63.5, Ag = 107.9, N = 14.0, O = 16.0]

(a) Explain which chemical species, copper or silver nitrate, is the limiting reagent.

AgNO3.

mole of copper = 6.35 ÷ 63.5 = 0.1

mole of silver nitrate = 1.699 ÷ (107.9 + 14.0 + 16 × 3) = 0.01

2

Copper is in excess and the limiting reagent is silver nitrate.

(2 marks)

(b) Calculate the maximum mass of silver obtained.

Maximum mass of silver obtained:

0.01 (2 × 107.9)

= 2.158 g.

Cannot make use of the mole ratio in the equation

(2 marks)

5. Copper reacts with silver nitrate solution as follows:

$$Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$$

1.699 g of silver nitrate dissolves in excess water. 6.35 g of copper is then added to the solution.

[Relative atomic masses: Cu = 63.5, Ag = 107.9, N = 14.0, O = 16.0]

(a) Explain which chemical species, copper or silver nitrate, is the limiting reagent.

Silver nitrate.

This student might not understand the meaning of limiting reagent.

X

(2 marks)

(b) Calculate the maximum mass of silver obtained.

The amount of silver nitrate

$= \frac{1.699}{107.9 + 14 + (16 \times 3)}$

$= 0.01$ mol

2

The maximum mass of 0.01 mol of silver

$= 0.01 \times 107.9$

$= 1.079$ g

(2 marks)

5. Copper reacts with silver nitrate solution as follows:

$$Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$$

1.699 g of silver nitrate dissolves in excess water. 6.35 g of copper is then added to the solution.

[Relative atomic masses: Cu = 63.5, Ag = 107.9, N = 14.0, O = 16.0]

(a) Explain which chemical species, copper or silver nitrate, is the limiting reagent.

Silver nitrate is the limiting reagent. Copper is in excess. From the equation, 1 mol of copper reacts with 2 mol of silver nitrate. In this case, only 0.8495 g of copper reacts with 1.699 g of silver nitrate.

This student cannot explain clearly how the choice of limiting reagent is made.

(2 marks)

(b) Calculate the maximum mass of silver obtained.

	Copper	Silver nitrate
Mass :	6.35 g	1.699 g
Mole :	$\frac{6.35}{63.5} = 0.1$	$\frac{1.699}{107.9 + 14 + 16\times3} = 0.01$

2

∴ Maximum mass of silver = $0.01 \times 107.9 = 1.079$ g

(2 marks)

5. Copper reacts with silver nitrate solution as follows:

$$Cu(s) + 2AgNO_3(aq) \rightarrow 2Ag(s) + Cu(NO_3)_2(aq)$$

1.699 g of silver nitrate dissolves in excess water. 6.35 g of copper is then added to the solution.

[Relative atomic masses: Cu = 63.5, Ag = 107.9, N = 14.0, O = 16.0]

(a) Explain which chemical species, copper or silver nitrate, is the limiting reagent.

Mol of copper = $6.35 \div 63.5 = 0.1$ mol

Mol of $AgNO_3$ = $1.699 \div (107.9 + 14 + 48) = 0.01$ mol

$AgNO_3$ is the limiting reagent.

2

(2 marks)

(b) Calculate the maximum mass of silver obtained.

The mol of silver obtained = the mol of $AgNO_3$ = 0.01 mol

2

Maximum mass of silver = $0.01 \times 107.9 = 1.079$ g

About 60% (58/96) of students got full mark.

(2 marks)

Some comments

- Has to focus on what the students misunderstand for improvement of teaching / learning

- May consider to videotape the details during explanation [May use “Explain everything”]
  - As recaps for current students
  - As archives for students of later year to revise past year questions

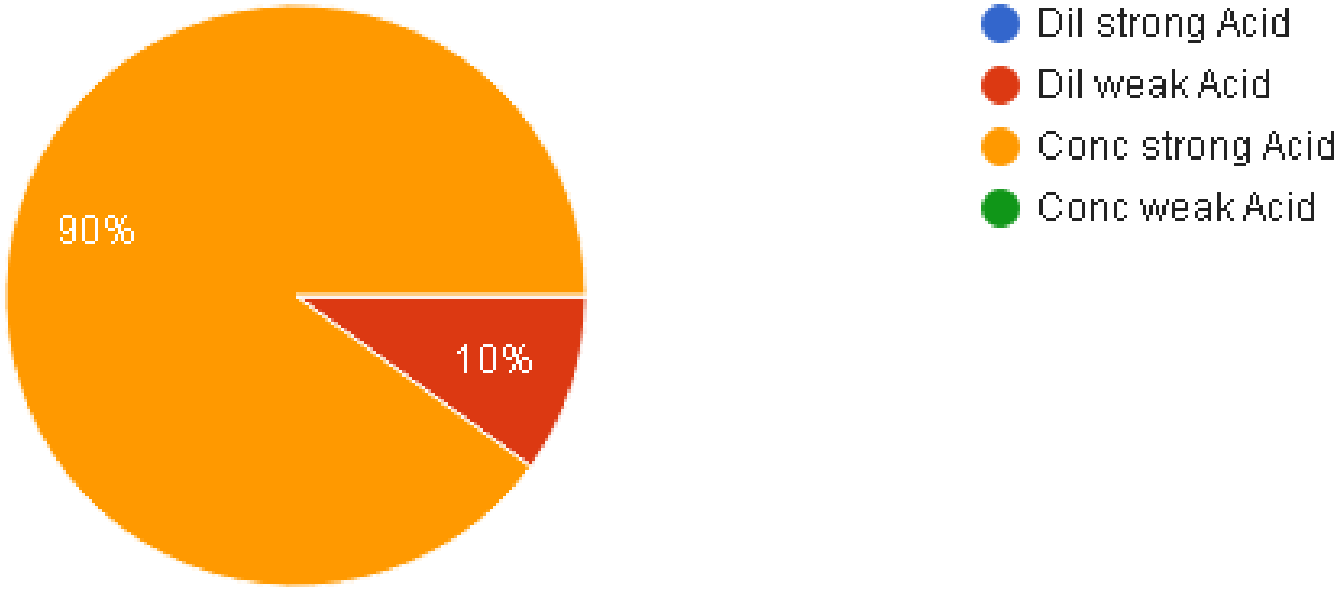
Exemplar 2

- Acids and Alkalis: Concentration and strength
- Curriculum link: Topic IV

1. A 20 dm^3 18 M sulphuric acid is a
    A. Dil strong Acid
    B. Dil weak Acid
    C. Conc strong Acid
    D. Conc weak Acid

Exemplar 2: Q1 Results

1. A 20 dm^3 18 M sulphuric acid is a (10 responses)



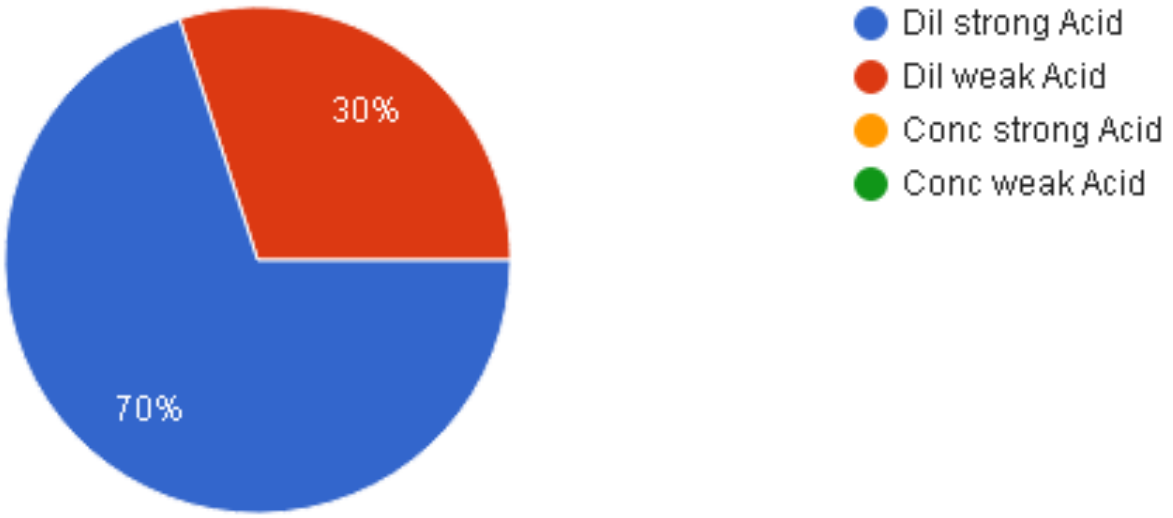
Exemplar 2

- Q.2. A 0.1M monoprotic acid (HA) solution has a pH value of 1.8. What is the type of acid?
    A. Dil strong Acid
    B. Dil weak Acid
    C. Conc strong Acid
    D. Conc weak Acid

Exemplar 2 Results

2. A 0.1M monoprotic acid (HA) solution has a pH value of 1.8. What is the type of acid?

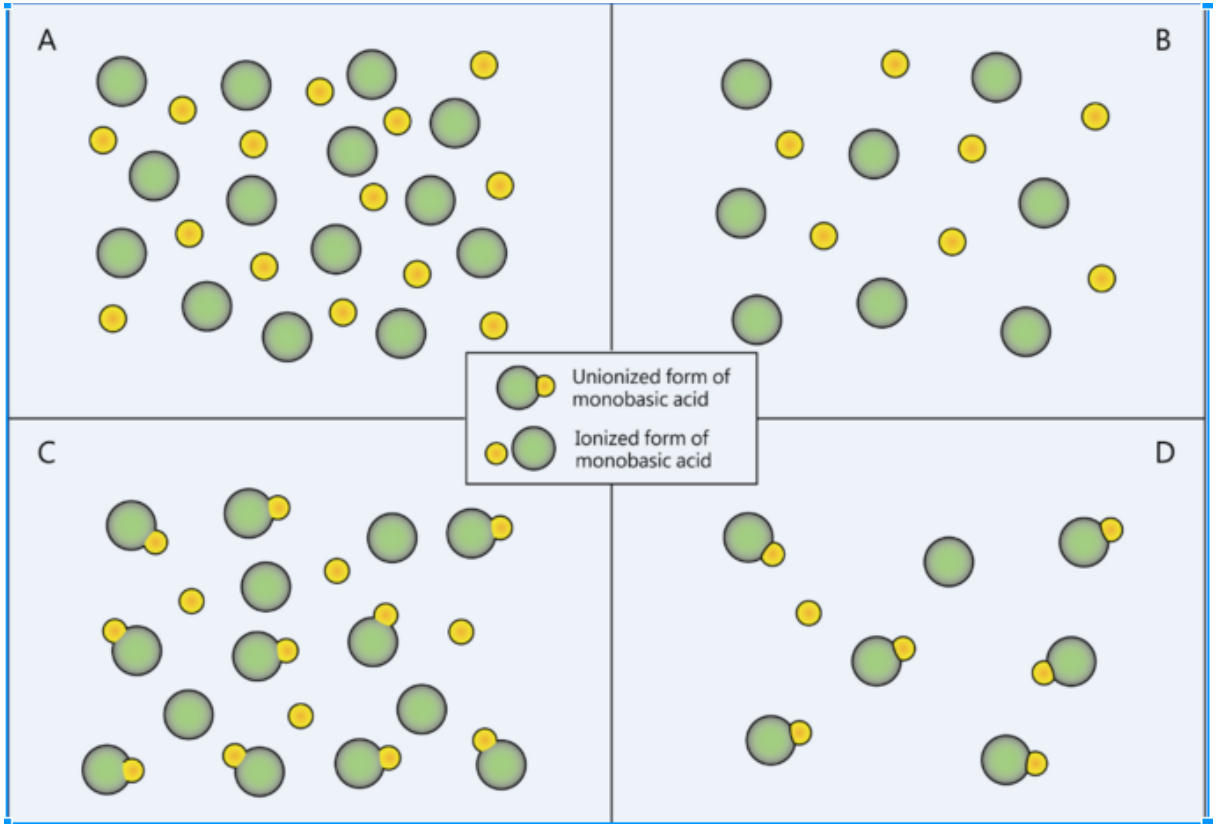
(10 responses)



Exemplar 2

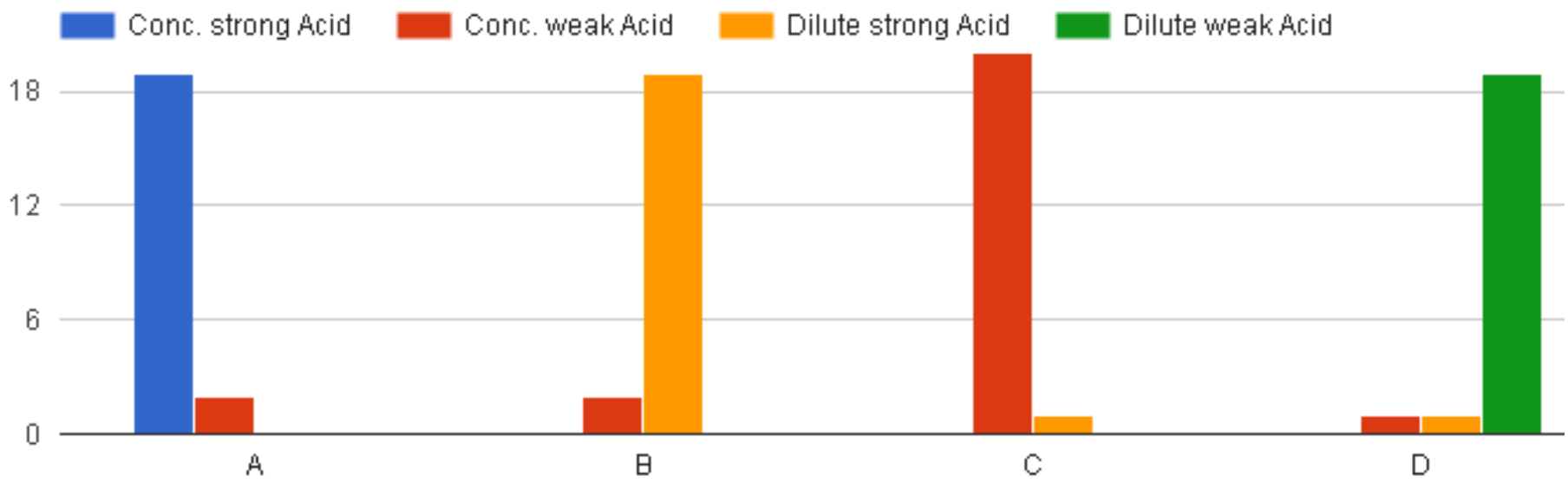
5. Which of the following is the best description of the following acid?

Matching
Conc strong acid
Conc. Weak acid
Dilute strong acid
Dilute weak acid



Exemplar 2: Results

5. Which of the following is the best description of the following acid?



Some challenging questions and remarks

- Not every student may do it
  - (What is the incentive of the students for doing so?)
- May make the diversity gap greater
  - More challenging to teach
- Is it worth to use google form for every lesson?
  - Students have limited time but resources are more than adequate
- E-learning for chemistry