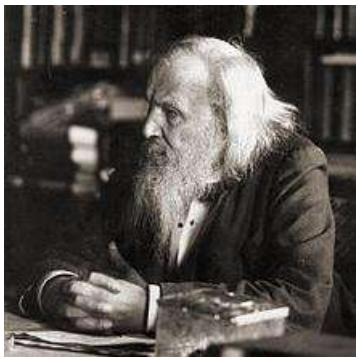
Mendeleev card games
Differentiated

Dmitri Mendeleev (1834-1907) is credited for being one of the founders of the modern periodic table of elements. On February 14th, 1869, Mendeleev wrote everything he knew about each element on to separate cards and tried to find patterns in their arrangement. Exhausted he fell asleep. When he awoke he devised a method of grouping cards that he called the Periodic table of elements. This activity enables students to construct a periodic table in a similar way.



Version 1: Ideal for low attaining students
Version 2: Ideal for medium-attaining students
Version 3: Ideal for high attaining students

Attainment is relative to the student's age and the educational context. In my experience most A-level / IB students will manage version 3. Version 2 will be challenging but achievable for GCSE students.

Tips for teacher:

- **The colours in version 1 help students identify groups**
- **The colours in version 2 separate metals (grey) and non-metals (yellow)**
- **Print cut out and shuffle cards (version 1 and 2 are best printed in colour)**
- **Students should ideally work in groups of 3**
- **Make sure students cannot see any periodic tables (version 1 and 2)**
- **Give each group at least one copy of the instruction/question sheets (included in this pack)**
- **Monitor groups for problems.**
- **Version 2 and 3 miss out the transition metals- students should not put "gap cards" in these positions as this is a missing block rather than an undiscovered element**
- **Students should also not use gap cards for the Nobel gases (if we only had the data on the cards it would be hard to predict the existence of the Nobel gases)**
- **If you suspect students know the periodic table well, use version 3.**

Periodic table card game (Version 1)

Activity

1. Arrange the cards in a line order of increasing atomic mass.
2. Can you see any repeating patterns in the combining power of the elements?
3. Try and arrange the elements into vertical columns with similar combining powers whilst also having them in rows of increasing mass.

Compare your arrangement of cards with the modern periodic table.

1. What are the similarities and differences between your arrangement and the modern periodic table? (list as many as you can)

2. Describe how you managed to solve the problem. What challenges did you face and how did you overcome them?

3. How did the colour of the cards help you work out the arrangement?

4. What group (vertical column) of elements is completely missing from your cards? Suggest a reason for this.

Cards for version 3 (Remember to cut and shuffle before giving to students. If possible print in colour to help students)

Hydrogen Mass = 1 Combines with 0.5 O	**Lithium** Mass = 7 Combines with 0.5 O	**Beryllium** Mass = 9 Combines with 1 O	**Boron** Mass = 11 Combines with 3 Cl	**Carbon** Mass = 12 Combines with 2O
Nitrogen Mass = 14 Combines with 3 H	**Oxygen** Mass = 16 Combines with 2 H	**Fluorine** Mass = 19 Combines with 1 H	**Sodium** Mass = 23 Combines with 0.5 O	**Magnesium** Mass = 24 Combines with 1 O
Aluminium Mass = 27 Combines with 3 Cl	**Silicon** Mass = 28 Combines with 2 O	**Phosphorus** Mass = 31 Combines with 3 H	**Sulphur** Mass = 32 Combines with 2 H	**Chlorine** Mass = 35 Combines with 1 H
Potassium Mass = 39 Combines with 0.5 O	**Calcium** Mass = 40 Combines with 1 O			

Periodic table card game (Version 2)

Activity

1. Arrange the cards in a line order of increasing atomic mass.
2. Can you see any repeating patterns in the combining power of the elements?
3. Try and arrange the elements into vertical columns with similar combining powers whilst also having them in rows of increasing mass.
4. Use the "GAP" cards any where you believe there may be a gap of **one** element. These are undiscovered elements! If you find any gaps where you suspect there may be a block of elements missing leave an empty space.
5. Predict the atomic mass and combining power of any undiscovered elements and make up a name for the element.

Compare your arrangement of cards with the modern periodic table.

5. What are the similarities and differences between your arrangement and the modern periodic table? (list as many as you can)

6. What does the colour of the cards (grey/yellow) show us?

7. Why is it difficult to work out which groups to put Tellurium and Iodine in? Why do you think Tellurium is in groupVI and Iodine in groupVII on the modern periodic table?

8. On the modern periodic table there is a block of elements in the middle that were not included in this game. What is this block called?

9. What group (vertical column) of elements is completely missing from your cards? Suggest a reason for this.

10. Find the modern names of the undiscovered element. How accurate was your prediction of the combing power and atomic mass?

11. What is the role of prediction in establishing the validity of a scientific theory? Use Mendeleev's discovery to support your answer.

Cards for version 3 (remember to cut and shuffle before giving to students)

Hydrogen Mass = 1 Combines with 0.5 O	**Lithium** Mass = 7 Combines with 0.5 O	**Beryllium** Mass = 9 Combines with 1 O	**Boron** Mass = 11 Combines with 3 Cl	**Carbon** Mass = 12 Combines with 2O or 4H
Nitrogen Mass = 14 Combines with 3 H	**Oxygen** Mass = 16 Combines with 2 H	**Fluorine** Mass = 19 Combines with 1 H	**Sodium** Mass = 23 Combines with 0.5 O	**Magnesium** Mass = 24 Combines with 1 O
Aluminium Mass = 27 Combines with 3 Cl or 1.5O	**Silicon** Mass = 28 Combines with 2 O	**Phosphorus** Mass = 31 Combines with 3 H	**Sulphur** Mass = 32 Combines with 2 H	**Chlorine** Mass = 35 Combines with 1 H
Potassium Mass = 39 Combines with 0.5 O	**Calcium** Mass = 40 Combines with 1 O	**Gallium** Mass = 70 Combines with 3 Cl or 1.5O	**Arsenic** Mass = 75 Combines with 3H	**Selenium** Mass = 79 Combines with 2H
Bromine Mass = 80 Combines with 1H	**Rubidium** Mass = 85.5 Combines with 0.5 O	**Strontium** Mass = 88 Combines with 1 O	**Indium** Mass = 115 Combines with 1.5 O	**Tin** Mass = 119 Combines with 2 O
Antimony Mass = 121.75 Combines with 3H	**Tellurium** Mass = 128 Combines with 2H	**Iodine** Mass = 127 Combines with 1 H	**GAP**	

Periodic table card game (Version 3)

Activity

1. Arrange the cards in a line order of increasing atomic mass.
2. Can you see any repeating patterns in the combining power of the elements?
3. Try and arrange the elements into vertical columns with similar combining powers whilst also having them in rows of increasing mass.
4. Use the "GAP" cards any where you believe there may be a gap of **one** element. These are undiscovered elements! If you find any gaps where you suspect there may be a block of elements missing leave an empty space.
5. Predict the atomic mass and combining power of any undiscovered elements and make up a name for the element.

Ask your teacher to show you the answer.
Compare your arrangement of cards with the modern periodic table.

1. What are the similarities and differences between your arrangement and the modern periodic table? (list as many as you can)

2. Why is it difficult to work out which groups to put Tellurium and Iodine in? Why do you think Tellurium is in groupVI and Iodine in groupVII on the modern periodic table?

3. On the modern periodic table there is a block of elements in the middle that were not included in this game. What is this block called?

4. What group (vertical column) of elements is completely missing from your cards? Suggest a reason for this.

5. Find the modern names of the undiscovered elements. How accurate were your predictions of combing powers and atomic masses?

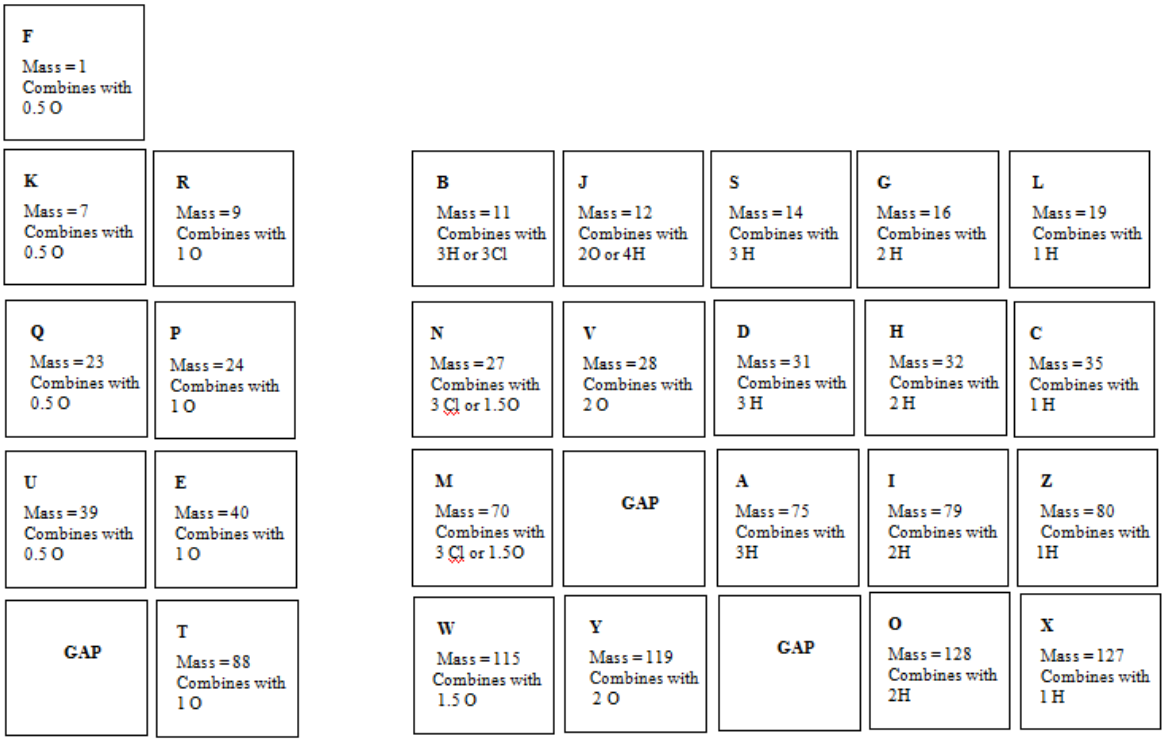
6. What is the role of prediction in establishing the validity of a scientific theory? Use Mendeleev's discovery to support your answer.

Cards for version 3 (remember to cut and shuffle before giving to students)

F Mass = 1 Combines with 0.5 O	**K** Mass = 7 Combines with 0.5 O	**R** Mass = 9 Combines with 1 O	**B** Mass = 11 Combines with 3H or 3Cl	**J** Mass = 12 Combines with 2O or 4H
S Mass = 14 Combines with 3 H	**G** Mass = 16 Combines with 2 H	**L** Mass = 19 Combines with 1 H	**Q** Mass = 23 Combines with 0.5 O	**P** Mass = 24 Combines with 1 O
N Mass = 27 Combines with 3 Cl or 1.5O	**V** Mass = 28 Combines with 2 O	**D** Mass = 31 Combines with 3 H	**H** Mass = 32 Combines with 2 H	**C** Mass = 35 Combines with 1 H
U Mass = 39 Combines with 0.5 O	**E** Mass = 40 Combines with 1 O	**M** Mass = 70 Combines with 3 Cl or 1.5O	**A** Mass = 75 Combines with 3H	**I** Mass = 79 Combines with 2H
Z Mass = 80 Combines with 1H	**T** Mass = 88 Combines with 1 O	**W** Mass = 115 Combines with 1.5 O	**Y** Mass = 119 Combines with 2 O	**O** Mass = 128 Combines with 2H
X Mass = 127 Combines with 1 H	**GAP**	**GAP**	**GAP**	

Use a periodic table to show students the correct arrangement to version 1 and 2

The correct arrangement for version 3 is as follows:



Resources

Visual elements
http://www.rsc.org/periodic-table

Photographic periodic table
www.periodictable.com