

Carbon Chemistry – Teacher Notes

Carbon is the 12th most common element on Earth. To know how it will behave within global systems we need to first understand how its' chemistry is controlled by its atomic structure.

What is an element? **An element is a substance made of only one kind of atom, in this case carbon.**

What is the symbol for the element carbon? **C**

Find carbon on the periodic table below and draw an arrow to it.

Group→	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
↓Period																		
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo
Lanthanides	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu			
Actinides	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr			

Using the information from the periodic table provided:

How many protons does carbon have? The atomic number or number of protons lies above the symbol in the periodic table. **6**

How many electrons **must** a neutral atom of carbon have? **6**

If its Atomic Weight is usually 12, how many neutrons **must** it have? **6**

(This package also includes activities with the isotope carbon-14)

Teacher demonstration

Carbon is found in many materials used by humans.

Materials

A tray of samples of materials containing carbon can be demonstrated to the students.

Samples could be of: graphite, coal, "lead" pencil, oil, bone, limestone, plastic bags, tissues, paper, petroleum jelly (Vaseline),

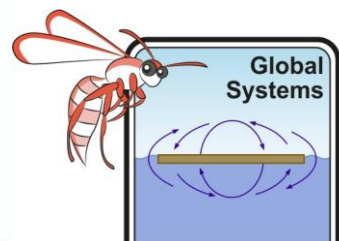


Interesting facts

Carbon black or lampblack is pure carbon that is finer than soot having a larger surface area to volume ratio. Medieval monks used it to colour ink. The inscriptions are still clearly legible. Up to Early Victorian times lampblack was used to make the best and longest lasting dark pigment for writing and painting. Anything organic was burned in an oxygen poor environment and the fine black soot-like residue remaining was mixed with water and gum. After Mid-Victorian times coal and crude oil were burned. Children of the poor were employed because fumes from oil combustion and fine carbon particles ruined their lungs within about four years. Like coal miners at that time, they died of "black lung". Carbon black is still being produced though under much healthier

conditions. It is commonly used as a filler and colouring agent in car tyres and other artificial rubber products.

Carbon Chemistry – Teacher Notes



The following experiment is usually performed as a teacher demonstration as it involves the production of flames and smelly gas. . If you combust (burn) organic materials either fresh or fossilised into fossil fuel, one of the products will be a black sooty residue which is mostly carbon. The best time to carry out this activity is the last session in the day. When the laboratory can be aired overnight. Most students find destructive testing fascinating.

AIM To test for the presence of carbon by combustion

Materials

- Bunsen burner
- Tongs
- Safety Glasses
- Bench protector
- Bowl of water to extinguish flames
- Strips of material to burn (organic and inorganic)
- Fume cupboard or hood if possible



You may choose to use: Thin strips of wood (pop stick) and newspaper, a metal washer, woollen cloth or wool, a rock, a piece of coal, a piece of fruit, aluminium foil (cooking foil),

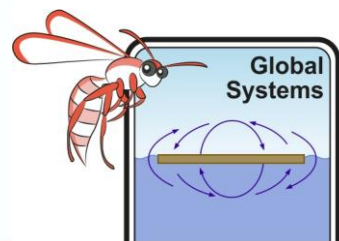
Method

1. Students should check on safety procedure when using a lit Bunsen burner.
2. Pick up each specimen and place in Bunsen flame for 5 seconds.
3. Remove from Bunsen and extinguish any flames.
4. Write your observations in the table provided.

Observations

Substance	Origin	Before burning	Burned	Is carbon present?
Wood	Tree	Solid, Brown/grey colour - depends.	Solid, black Gas grey	Yes
Paper	Tree	Solid	Solid black Gas grey	Yes
Washer	Iron ore	Solid silvery metallic	Solid. Only slight change of colour	No
Wool	Sheep	Solid white	Black fine dust (solid)	Yes
Rock	Rock	Solid, Depends on rock	Much the same	No
Plastic strip	Fossil fuel	Solid clear/white?	Melted black liquid that became solid. Gas dark and smelly	Yes
Aluminium foil	Aluminium ore/bauxite	Solid, shiny, metallic	Solid melted to liquid then cooled to a solid again. Melted portion less shiny	No

Carbon Chemistry – Teacher Notes



Conclusion

Combustion can be used to test for the presence of carbon

How did you know if carbon was present as a product of combustion (burning)? A fine black sooty residue formed. Soot is mostly carbon

What was common to all the materials that burned to leave black soot? They were all created by living things (organic)

Extension "Flames are the release of past sunlight".

Explain what this statement means



Plants used sunlight to photosynthesise and make materials for their own bodies. This energy is released as light (flames) when wood or peat is burned. If animals eat plants, energy is transferred to them. Fossil fuels are the remains of plants and animals. When they are burned the energy released originally came from photosynthesis within plants.