

DART Activities for Atomic Structure

Sample 1 Cloze test (Atomic Structure)

Sample 2 Cloze test (Atomic Structure)

Sample 3 Matching Columns 1

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Sample 5 Wordsearch 1

Sample 6 Wordsearch 2

Sample 7 Crossword 1

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Answer Sheet

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Sample 10 Sequencing

Sample 11 Comprehension

Instructions for DART activities

- Cloze Tests
- Matching Columns
- Wordsearch
- Crossword
- Multiple Choice
- Sequencing
- Comprehension

ATOMIC STRUCTURE

Please fill in the missing numbered spaces from the following list of words.

Spherical , energies , probability , space , uncertainty, first, nucleus , dumb-bell , orbital , electron

Four different types of solution to Schrödinger's wave equations emerged. Each of these is a three-dimensional space within which there is a greater than 99% probability of finding an (1) of certain energy. Such a (2) was termed an (3) (the word being distinct from Bohr's word orbit but incorporating it just as this new wave-mechanical model of the atom incorporates Bohr's model). One type of orbital is a (4) space, termed s, with the nucleus at its centre. Its size is determined by the energy level to which it belongs and is labelled accordingly. The next type of orbital, termed p, is (5) shaped and is arranged about the central nucleus. For each energy level except the (6) , three such dumb-bell-shaped orbitals exist at mutual right angles. The existence of three orbitals accounts for spectral observations in the presence of an applied magnetic field (the Zeeman effect). In the presence of an applied magnetic field all three orbitals have slightly different (7) depending on their orientation with respect to the magnetic field; in the absence of a magnetic field they all have equal energies; the overall size is again determined by the energy level. These p orbitals have a nodal point at the centre of the nucleus, i.e. there is zero (8) of finding an electron at the centre of the nucleus. But then the question arises: how does an electron get from one side of the (9) to the other? This can be explained in two ways. Since the electron has wave properties, nodal points are points of zero amplitude but through which a wave can pass. Alternatively, the (10) principle makes it clear that an electron is not confined to an orbital; an orbital is only a region in which there is a high probability of finding an electron of certain energy.

- 1 _____ 2 _____ 3 _____
- 4 _____ 5 _____ 6 _____
- 7 _____ 8 _____ 9 _____
- 10 _____

In the spaces below draw the shapes of the following orbitals

S Orbital	P Orbital	3 P Orbitals

ATOMIC STRUCTURE

Please fill in the missing numbered spaces from the following list of words.

Orbitals, positive, dumb-bell, nucleus, eight, neutrons, alkali, spherical, three, transition.

The three subatomic particles of an atom are protons (1) , and electrons. The first two are found in the (2) while the electron orbits the nucleus in energy levels. Each energy level holds a different number of electrons. The first holds two electrons, the second holds (3) and the third holds eighteen. In each energy level there are regions which electrons can occupy called (4) . The first level has one type of orbital called the *s* orbital, the second level has two types of orbital an *s* orbital and a *p* orbital and the third has three types of orbital an *s*, a *p* and a *d*. The *s* orbital is (5) in shape and it holds two electrons. There are (6) different *p* orbitals called *p_x*, *p_y*, and *p_z*. These have a (7) shape and are arranged in space at right angles to each other. Each *p* orbital holds two electrons. There are five different *d* orbitals, each of which hold two electrons. Most of the (8) metals have an incomplete *d* sublevel. The (9) metals all have one electron in their outer shell. They all have similar properties and when they form ions they lose this outer electron to get a (10) charge.

1 _____ 2 _____ 3 _____

4 _____ 5 _____ 6 _____

7 _____ 8 _____ 9 _____

10 _____

In the spaces below draw the shapes of the following orbitals

S Orbital	P Orbital	3 P Orbitals

THE ATOM 1

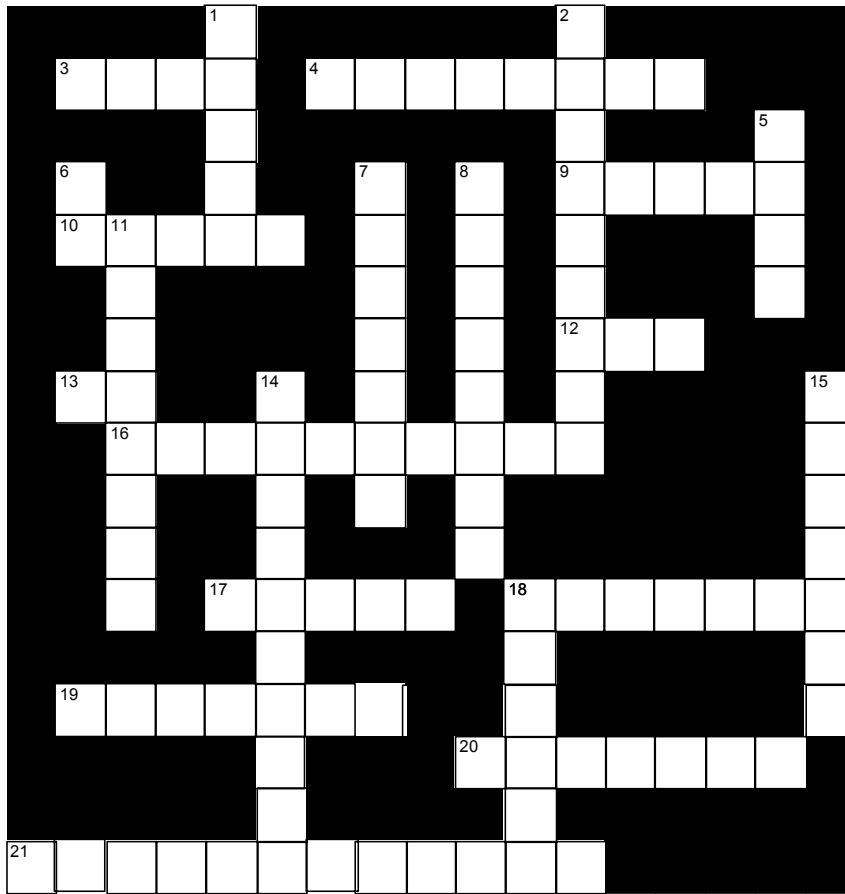
- | | |
|--|--|
| <ol style="list-style-type: none"> 1. SPECTRUM OBTAINED AS LIGHT PASSES THROUGH A GASEOUS SAMPLE (10) 2. THIS ELECTRODE ATTRACTS ELECTRONS (5) 3. ONE OF TWO LIQUID ELEMENTS (7) 4. A NEGATIVE ELECTRODE (7) 5. MOVEMENT OF GASES (9) 6. HE GROUPED ELEMENTS IN THREES.(10) 7. ELEMENTS PRODUCE THIS TYPE OF SPECTRUM (8) 8. ATOM OF AN ELEMENT WITH DIFFERENT MASS NUMBER (7) 9. A FORM OF MATTER (6) 10. HE DISCOVERED THE ATOMIC NUMBER (7) 11. HE PROPOSED THE "LAW OF OCTAVES" (7) 12. MUSICAL TERM OR GROUP OF SEVEN (6) 13. WHERE YOU WILL FIND A PAIR OF ELECTRONS (7) 14. USED TO FORM A SPECTRUM (5) | <ol style="list-style-type: none"> 15. FIXED AT A DEFINITE VALUE (9) 16. MASS _____ INSTRUMENT USED TO SEPARATE ISOTOPES (12) 17. A GROUP OF THREE SIMILAR ELEMENTS (5) |
|--|--|

M	O	D	R	D	A	I	R	T	N	S
E	L	I	E	D	N	E	E	E	E	Y
D	I	F	T	O	O	D	D	N	W	E
E	D	F	E	B	D	O	E	I	L	A
V	T	U	M	E	E	H	S	M	A	M
A	B	S	O	R	P	T	I	O	N	O
T	G	I	R	E	O	A	T	R	D	S
C	P	O	T	I	T	C	N	B	I	E
O	R	N	C	N	O	A	A	I	U	L
L	I	L	E	E	S	O	U	T	Q	E
P	S	O	P	R	I	P	Q	A	I	Y
E	M	I	S	S	I	O	N	L	L	I

**WHEN THE WORDSEARCH IS COMPLETE THE REMAINING LETTERS
HIDDEN MESSAGE**

_ _ _ _ _ / _ _ _ _ / _ _ / _ _ _ _ _

THE ATOM 1



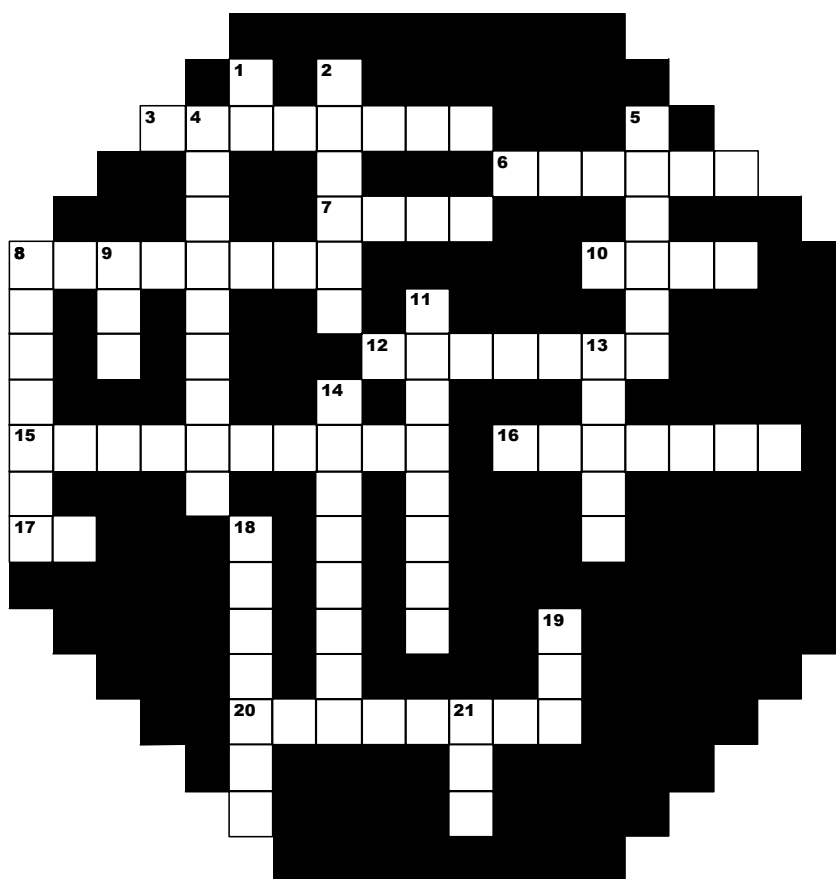
ACROSS

3. HE GAVE US A MODEL OF THE ATOM (4)
4. ELEMENTS PRODUCE THIS TYPE SPECTRUM (8)
9. THESE TESTS HELP TO IDENTIFY METALS (5)
10. THIS ELECTRODE ATTRACTS ELECTRONS (5)
12. CHARGED ATOM (3)
13. SYMBOL FOR AN ATOM WHOSE MASS IS 35.453 (2)
16. SPECTRUM OBTAINED AS LIGHT THROUGH A GASEOUS SAMPLE (10)
17. USED TO FORM A SPECTRUM (5)
18. WHERE YOU WILL FIND A PAIR ELECTRONS (7)
19. ONE OF TWO LIQUID ELEMENTS (7)
20. A NEGATIVE ELECTRODE (7)
21. MASS _____ INSTRUMENT TO SEPARATE ISOTOPES (12)

DOWN

1. A GROUP OF THREE ELEMENTS (5)
2. MOVEMENT OF GASES (9)
5. A RAY OF LIGHT (4)
6. SYMBOL FOR SODIUM (2)
7. ATOM OF AN ELEMENT WITH DIFFERENT NUMBER OF NEUTRONS (7)
8. TO FIX THE ENERGY OF AN ELECTRON AT A DEFINITE VALUE (9)
11. HE PROPOSED THE "LAW OF OCTAVES" (8)
14. HE GROUPED ELEMENTS IN THREES.(10)
15. HE PUT FORWARD THE IDEA ATOMIC NUMBER (7)
18. MUSICAL TERM OR GROUP OF SEVEN (6)

ATOM 2



Across

3. A SERIES OF COLOURED LINES (8)
6. IT CAN BE NEGATIVE OR POSITIVE (6)
7. A NOBLE GAS (4)
8. THE CHARGE ON A CHLORIDE ION (8)
10. THE SMALLEST PART OF AN ELEMENT (4)
12. HE DISCOVERED THE ELECTRON (7)
15. HIS EXPERIMENT DESTROYED THE "PLUM PUDDING" THEORY (10)
16. THIS CAN HOLD TWO ELECTRONS (7)
17. SYMBOL FOR SODIUM (2)
20. IT ORBITS THE NUCLEUS (8)

Down

1. SYMBOL FOR IRON (2)
2. IRISH SCIENTIST (6)
4. ALPHA AND BETA ----- (9)
5. IT HAS A POSITIVE CHARGE
8. IT HAS NO CHARGE (7)
9. A FORM OF MATTER (3)
11. HE DISCOVERED THE NEUTRON (8)
13. CIRCULAR PATH AROUND AN OBJECT (5)
14. THE CHARGE ON A SODIUM ION (8)
18. WHERE MOST OF THE WEIGHT OF AN ATOM IS FOUND (7)
19. CHARGED ATOM (3)
21. A BEAM OF LIGHT (3)

CHEMISTRY REVISION Atomic Structure

MULTIPLE CHOICE EXAM

- The first subatomic particle discovered was the ____
(a) *proton* (b) *neutron* (c) *electron* (d) *nucleus*
- The only subatomic particle that does not carry an electric charge is the ____
(a) *proton* (b) *neutron* (c) *electron* (d) *nucleus*
- The atomic number of an element whose atom has 9 protons and 10 neutrons is ____
(a) *9* (b) *19* (c) *10* (d) *18*
- The mass number of an element whose atom has 12 protons and 13 neutrons is ____
(a) *12* (b) *13* (c) *25* (d) *12.5*
- J.J Thomson used the cathode ray tube to discover the ____
(a) *atom* (b) *proton* (c) *neutron* (d) *electron*
- Atomic mass units are based on the mass of an atom of ____ -
(a) *carbon-12* (b) *carbon-14* (c) *oxygen-16* (d) *nitrogen-14*
- An atom of iron contains 26 electrons. How many energy levels are used in containing these electrons?
(a) *1* (b) *4* (c) *2* (d) *3*
- _____ is an unreactive element.
(a) *Hydrogen* (b) *Chlorine* (c) *Helium* (d) *Sodium*.
- Which of the following is a Transition element?
(a) *Gallium* (b) *Vanadium* (c) *Aluminium* (d) *Sodium*
- At room temperature, most elements are ____
(a) *solid* (b) *liquid* (c) *gas* (d) *invisible*
- Most elements are ____
(a) *Metaloids* (b) *gases* (c) *non-metals* (d) *metals*
- What is the maximum number of electrons that can occupy energy level 4
(a) *4* (b) *16* (c) *8* (d) *32*
- Only one of the following orbitals is spherical. Which?
(a) *3d* (b) *4s* (c) *2p* (d) *4f*
- Two isotopes of an element have different ____
(a) *mass number* (b) *atomic number* (c) *number of protons* (d) *number of electrons*
- Who demonstrated using X-ray that the nucleus of each element has an integral positive charge?
(a) *Mendeleev* (b) *Dobereiner* (c) *Thomson* (d) *Moseley*
- The modern periodic table lists elements in order of increasing ____--
(a) *Atomic radius* (b) *Atomic number* (c) *Atomic mass* (d) *Mass number*
- In the periodic table, elements in a horizontal row are referred to as a ____
(a) *group* (b) *octave* (c) *period* (d) *family*
- Which element achieves greater stability by having half filled sublevel
(a) *Chromium* (b) *Copper* (c) *Zinc* (d) *Iron*
- The electronic configuration of Nitrogen (atomic number=7) is ?
(a) $1s^2 2s^2 3p^2 3s^1$ (b) $1s^2 2s^2 2p^3$ (c) $1s^2 2s^4 3p^1$ (d) $1s^2 2s^2 3s^2$
- How many types of orbitals are present in the fourth energy level
(a) *1* (b) *4* (c) *2* (d) *3*

Chemistry revision

Multiple choice answer sheet

- Place an X in the appropriate box
- Do not write on the question paper

NAME: _____

CLASS: _____

CORRECT ANSWERS: _____

% MARK: _____

	(a)	(b)	(c)	(d)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

Template for Multiple Choice Exam

	(a)	(b)	(c)	(d)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

Flame Tests

Choose from the list below the apparatus needed for the experiment.

Bunsen Burner

Conical Flask

Wooden Splints

Tripod

Gauze

Pipette

Mortar & Pestle

Beakers

Tongs

Burette

Test-tube

Retort Stand

Apparatus

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Arrange the following instructions into the correct sequence

a	Hold the wooden splint in the flame and note the colour
b	Repeat using various metal salts
c	Place the crushed salt in a beaker and label the beaker
d	Use a different wooden splint for each metal salt

e	Dip the wooden splint in concentrated acid and then in the salt
f	Crush the salt in a Mortar and Pestle
g	Light the Bunsen Burner and adjust to get a blue flame
h	List the metals used and record their colours

Correct order.

1st	2nd	3rd	4th	5th	6th	7th	8th

PROCEEDINGS OF SOCIETIES
CHEMICAL SOCIETY

Thursday March 1

Professor A. W. WILLIAMSON. *Ph.D.*, F.R.S..

Vice-President, in the Chair

Mr. JOHN A. R. NEWLANDS read a paper entitled *The Law of Octaves, and the Causes of Numerical Relations among the Atomic Weights.* The author claims the discovery of a law according to which the elements analogous in their properties exhibit peculiar relationships, similar to those subsisting in music between a note and its octave. Starting from the atomic weights on Cannizzaro's system, the author arranges the known elements in order of succession, beginning with the lowest atomic weight (hydrogen) and ending with thorium (=231.5); placing, however, nickel and cobalt, platinum and iridium, cerium and lanthanum, &c., in positions of absolute equality or in the same line. The fifty-six elements so arranged are said to form the compass of eight octaves, and the author finds that chlorine, bromine, iodine, and fluorine are thus brought into the same line, or occupy corresponding places in his scale. Nitrogen and phosphorus, oxygen and sulphur, &c., are also considered as forming true octaves. The author's supposition will be exemplified in Table II., shown to the meeting. And here subjoined:—

Dr. GLADSTONE made objection on the score of its having been assumed that no elements remain to be discovered. The last few years had brought forth thallium, indium, caesium, and rubidium, and now the finding of one more would throw out the whole system. The speaker believed there was as close an analogy subsisting between the metals named in the last vertical column as in any of the elements standing on the same horizontal line.

Professor G F. FOSTER humorously inquired of Mr. Newlands whether he had ever examined the elements according to the order of their initial letters? For he believed that any arrangement would present occasional coincidences, but he condemned one which placed so far apart manganese and chromium, or iron from nickel and cobalt.

Mr. NEWLANDS said that he had tried several other schemes before arriving at that now proposed. One founded upon the specific gravity of the elements had altogether failed, and no relation could be worked out of the atomic weights under any other system than that of Cannizzaro.

Table II—Elements arranged in Octaves

H	1	F	8	Cl	15	Co&Ni	22	Br	29	Pd	36	I	42	Pt & Ir	50
Li	2	Na	9	K	16	Cu	23	Rb	30	Ag	37	Ca	44	Os	51
G	3	Mg	10	Ca	17	Zn	24	Sr	31	Cd	38	Ba&V	45	Hg	52
Bo	4	Al	11	Cr	19	Y	25	Ce&La	33	U	40	Ta	46	Tl	53
C	5	Si	12	Ti	18	In	26	Zr	32	Sn	39	W	47	Pb	54
N	6	P	13	Mn	20	As	27	Di&Mo	34	Sb	41	Nb	48	Bi	55
O	7	S	14	Fe	21	Se	28	Ro&Ru	35	Te	43	Au	49	Th	56

Questions:

1. What is the modern term for "Atomic Weight"?
2. Whose system of Atomic Weights did Newlands use?
3. It was suggested that Newlands was assuming that no new elements would be discovered. Would Newlands have been correct if he had made this assumption? Explain your answer.
4. Three chemical symbols used by Newlands are not valid. List the three incorrect symbols, and suggest a possible name for one of them.
5. What is meant by the word octave as used by Newlands?
6. Name two elements listed correctly by Newlands as being in the same horizontal group.
7. Name two elements listed incorrectly by Newlands as being in the same horizontal group.
8. Newlands arranged elements in order of -----
9. Identify a group of elements (in the modern Periodic Table) none of whose members are listed in Newlands' table. Explain why.
10. How many elements are listed in Newlands' table?

INSTRUCTIONS

Cloze tests

These tests were prepared using Microsoft Word, but any word processor may be used.

1. Type in a piece of text taking care to choose language that is appropriate to the level you are aiming for.
2. Allow some blank lines at the top of the page to accommodate the words that are to be removed.
3. Place the cursor in front of a chosen word and insert using the shift key "_____(1)_____".
4. Use the mouse to highlight the word. Drag using the mouse the highlighted word to the top of the text and release.
5. Repeat steps 3 and 4 for each of the chosen words.
6. Remember to change the order of the words at the top.
7. To avoid confusion that the number in brackets is separating two words you can underline it also.
8. Write the numbers in a table at the bottom and ask the student to fill in the missing words.
9. The Teachers Resource CD Rom could also be used to extract text for a cloze test.

Matching columns

This was created using the insert table function

1. Always allow a few blank lines at the top of the page by hitting the return button. This gives room for the heading and instructions.
2. Create a table of 4 x 10. Widen the second and fourth columns to take the text.
3. Number the first column and use letters in the third column.
4. Mix the phrases and their definitions.
5. At the bottom of the page under the table insert a second table 10 x 2. Number the top row.

Wordsearch

This package was available on the internet as shareware at www.wordsearchkit.com. The manual is also available on the same site.

1. Read the appropriate chapter in the textbook and make a list of words.
2. Devise clues for each word and indicate the number of letters in brackets.
3. When installed the program is found by using "START" followed by "PROGRAMS" followed by "WORDSEARCH CONSTRUCTION KIT 98".
4. In the program click on FILE/NEW PUZZLE and you can then fill in Title and Category
5. Make sure to check the box which says Use Clues
6. Proceed to enter the word and clues. At the end Use the Spell Check
7. You now choose the Puzzle Shape (or design your own) and choose the Layout of the page (or design your own).
8. You can control the Word Direction and the Word Integration.
9. Type in the number of attempts (1 to 999) and click on Create
10. The four best Fits are displayed and the words not used (if any) are shown. To ensure all words are used you can increase the size of the Puzzle, allow all Directions or increase Word Integration.
11. The number of empty spaces in the puzzle is also shown. You can insert a hidden message using all of the empty spaces. The hidden message cannot contain spaces. A text box at the bottom of the page can be used to explain the layout of the hidden message.
12. Save the Puzzle. Go to FILE/PRINT and the PUZZLE OVERRIDES menu is displayed. Here you can choose what to print and the fonts used in the puzzle. Click on VIEW/PRINT for a preview. If O K then use FILE/PRINT PAGE to print.

Crosswords

This package was available on the internet as shareware at

www.wordsearchkit.com at the bottom of the page. The manual is also available on the same site.

- 1) Read the appropriate chapter in the textbook and make a list of words.
- 2) Devise clues for each word and indicate the number of letters in brackets.
- 3) When installed the program is found by using "START" followed by "PROGRAMS" followed by "CROSSWORD CONSTRUCTION KIT 98".
- 4) In the program click on FILE/NEW PUZZLE and you can then fill in Title and Category
- 5) Proceed to enter the word and clues. At the end use the Spell Check
- 6) You now choose the Puzzle Shape (or design your own) and choose the Layout of the page (or design your own).
- 7) Type in the number of attempts (1 to 999) and click on Create
- 8) The four best Fits are displayed and the words not used (if any) are shown. To ensure all words are used you can increase the size of the Puzzle.
- 9) Save the Puzzle. Go to FILE/PRINT and the PUZZLE OVERRIDES menu is displayed. Here you can choose what to print and the fonts used in the puzzle. Click on VIEW/PRINT for a preview. If O K then use FILE/PRINT PAGE to print.

Multiple choice tests

1. Choose a topic and create a multiple choice test using any word processor.
2. On a separate page design an answer sheet, with spaces for Pupil Name, Class, etc.
3. Insert a 5 X 21 table (if there are 20 questions) and use Table Properties (right click on the table) to Right Align the table and allow Text Wrapping.
4. Put the headings (a), (b)..... in the top row, and the numbers 1,2.....20 down the first column.
5. Save the answer sheet
6. Highlight the entire table and use Edit/Copy
7. Create a new document and use Edit/Paste to copy the exact grid into the new page.
8. Select all the cells and right click to bring up the Table menu. Select shading, choose a grey and choose cell and click OK. Choose the correct answer on each line and choose Shading and None
9. Repeat this for all the correct answers. Only the correct cells will be visible as empty boxes. Print this overlay onto a transparency page. When placed over the answer sheet grid the correct answers are visible and can be counted quickly.

Sequencing

The student is presented with a mixed up order of an experimental procedure and asked to place the instructions in their correct order. An alternative method is to give the student a set of cards with instructions and ask them to physically arrange them in order.

Comprehension

The student is provided with a photocopy of a scientific article from a newspaper, book or magazine and asked to answer questions found in the text.