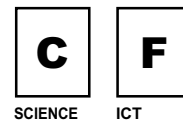


ICT ACTIVITY 21

Using temperature and pH probes for recording and spreadsheets for analysing data.

Year Group: Year 9



Resources

Computer, data-logging interface, pH and temperature probes, accurately known concentrations of an acid and alkali (1.00M HCl and 1.00M NaOH is suggested), safety goggles, Datadisk Pro software.

Context (Pupils' prior experience)

Acids and alkalis had been covered in previous units and the concept of neutralisation was familiar to students. Also, students were aware that values of pH could be obtained using universal indicator paper and that neutralisation should occur at pH 7. During Year 8 students had learnt that many chemical reactions produce heat, i.e. they are exothermic. This investigation was part of the UNIT 9e 'Reactions of metals and non-metal compounds'. It follows nicely from recaps in 'What is a salt?' I also combined this with Unit 9M 'Investigating Scientific Questions'.

Task Description

Introducing the careful use of pH and temperature probes and the use of burettes and pipettes is very important at this stage. A demonstration to show how each probe works in either acid or alkali solutions and how titration techniques can be used was followed by the purpose of their task. The following question was asked: 'Was using universal indicator a more accurate way of determining the end-point between an acid and an alkali than using a temperature or pH probe?'

Learning Intentions

SCIENCE: Knowledge and Understanding	ICT: Skills, Knowledge and Understanding	ICT Level		
		KS1	KS2	KS3
They select suitable equipment and make a series of observations and measurements that are adequate for the task. They record their observations, comparisons and measurements using tables and bar charts. They begin to plot points to form simple graphs, and use these graphs to point out and interpret patterns in their data.	They use ICT to present information in different forms and show they are aware of the intended audience and the need for quality in their presentations. They use ICT systems to sense physical data. They compare their use of ICT with other methods.	w/1	2/3	4/5
They make predictions based on their scientific knowledge and understanding. They select apparatus for a range of tasks and plan to use it effectively. They make a series of observations, comparisons or measurements with precision appropriate to the task. They begin to repeat observations and measurements and to offer simple explanations for any differences they encounter. They record observations and measurements systematically and, where appropriate, present data as line graphs.	They understand how ICT devices with sensors can be used to monitor and measure external events. They explore the effects of changing the variables in an ICT-based model. They assess the use of ICT in their work and are able to reflect critically in order to make improvements in subsequent work.	1/2	3/4	5/6
They measure a variety of quantities with precision, using instruments with fine-scale divisions. They choose scales for graphs and diagrams that enable them to show data and features effectively. They identify measurements and observations that do not fit the main pattern shown. They draw conclusions that are consistent with the evidence and use scientific knowledge and understanding to explain them.	They use complex lines of enquiry to test hypotheses. They present their ideas in a variety of ways and show a clear sense of audience. They develop, try out and refine ways of measuring and controlling events. They assess the validity of their results by comparing them with information from other sources.	2/3	4/5	6/7
Science POS related to task: Unit 9E and 9M	ICT POS related to task: "Finding things out"			

Teaching Approach

A brainstorm session initiated the investigation. The class was organized into three large groups, within groups they decided who was to complete which experiment: traditional methods of recording neutralization; using a temperature probe; using pH probe. Each group was rotated to enable them to use the sensors and the equipment. Following each experiment the pupils wrote up their findings. Those with computers at home word-processed their reports.

Subject Learning Gains (Science)

The use of data-logging equipment resulted in increased skills and precision in using scientific equipment. An incredible increase in scientific thinking and discussion, more able students understood that this chemical reaction resulted in a temperature change. The use of ICT led the class to an increase in the use of scientific vocabulary and communication. Results led the pupils to evaluate their work more thoroughly, and to discuss experimental techniques and the precision of the techniques being used. Interest in the topic was stimulated far more, which encouraged more in-depth questioning of the science concepts being explored.



This pupil has used several different methods to collect data, spreadsheets and charts to analyse results and word processing to write up a report. She has also critically reflected on her ICT.

She has achieved ICT Level 6.

Teachers' Assessment

Pupils' Work

Conclusion

From these experiments, we have learned that the most accurate experiment was using the pH probe. We conclude this from our results:

- The temperature probe appeared to be the least accurate of the three methods, the end-point being furthest from 25cm³ : 34cm³.
- The pH probe appeared to be the most accurate experiment, its end-point at 24cm³.
- The universal indicator experiment was fairly accurate, but the results weren't very consistent. The results ranged from 22cm³ to 24cm³. The average, however was 23.3cm³.

Attempt Number	Volume of HCl
1	23.4
2	23.2
3	23.2
4	23.2
5	22.0
6	23.0
7	24.0
8	23.4
9	24.2

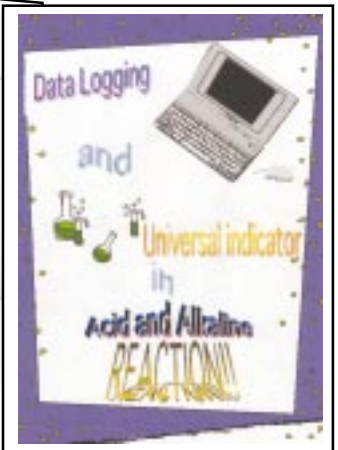
Universal indicator Titration

Volume	pH
2	13.7
4	13.8
6	13.7
8	13.7
10	13.6
12	13.6
14	13.6
16	13.4
18	13.2
20	13
22	12.7
24	9
26	2.2
28	1.9
30	1.7
32	1.6
34	1.6
36	1.5

pH probe titration

Temperature probe titration

Volume	Temperature (in degrees centigrade)
0	25.8
2	27.3
4	27.9
6	28.8
8	29.2
10	29.6
12	29.8
14	29.8
16	29.7
18	29.2
20	29.2
22	29.2
24	29.2
26	29.2
28	29.2
30	29.2
32	29.2
34	29.2
36	29.2
38	29.2
40	29.2
42	29.2
44	29.2
46	29.2
48	29.2
50	29.2



Evaluation by the Students

What difference did using ICT make?
 "It made the experiments more accurate."
 "It was easier to use a spreadsheet to set the work out ... and for presentation, and writing the report."
 "It enabled us to do the work quickly and concentrate on the science."
 "If we made a mistake we didn't have to write it all out again, and again."

What difference did using the probes make?
 "Using the probes was more fun."
 "The probes give a really accurate reading."
 "They were easier to use – no guess work needed."
 "Being visual, we could see the end-point more swiftly."

What difference did using the Excel spreadsheets make?
 "Plotting the graph was done automatically by the programme."
 "I found using Excel made it easy to enter the data."
 "Doing it by hand I could make mistakes, but by doing by hand it also helped me to understand what I was doing."
 "Using Excel I could have a variety of graphs – quickly."

Did you find it interesting?
 "We would like to do more data logging as a result. We need to spend more time on this."

ICT Teacher Evaluation

Teacher _____ Date of Activity _____ Class _____

Related to the Learning Objectives of the lesson

How did the ICT activity help to achieve the subject related objectives?

- Although delivered to a year 9 class, the lesson was set in the context of "A" level, this increased motivation and self-esteem.
- It enabled revision of key scientific concepts, which could then be extended using alternative methods to monitor neutralization.
- These pupils' ability to use data-logging equipment resulted in increased skills and precision in using scientific equipment.
- An incredible increase in scientific thinking and discussion, more able students understood that chemical reactions resulted in a temperature change. It led the class to use scientific vocabulary more accurately.
- Those pupils who were weaker in science but confident in ICT were able to shine in their groups.
- Results led the pupils to evaluate their results more thoroughly, and discuss experimental techniques and their precision.

How will you use the assessments of the pupils' progress and achievement in the subject to inform your planning?
 In the future I would increase data logging activities but in smaller group activities.

Teacher Confidence and Competence

What was your own level of ICT confidence before the activity? Do you feel you have gained in confidence and why? Reflecting on the classroom organisation, what factors do you think were important in doing the ICT activity?
 It was useful to remind myself of the procedures for using the probes and sensing equipment. Practising using the equipment with colleagues in the department meant we could all use this lesson with our students.
 Having several sets of probes is essential for this activity to be carried out. Setting up the equipment was time-consuming.

Hardware and Software Issues

Did the software used give any feedback to the pupil? If so, how was this feedback recorded and used by you and the pupil?
 Only in the sense of the data producing charts.

What hardware or software problems did you experience?
 The Phillip Harris probes were sensitive and some broke. The students quickly grasped how to use the equipment and the software. They knew how to use Excel, which was very helpful, as we didn't need to give a lengthy explanation of how to use it.