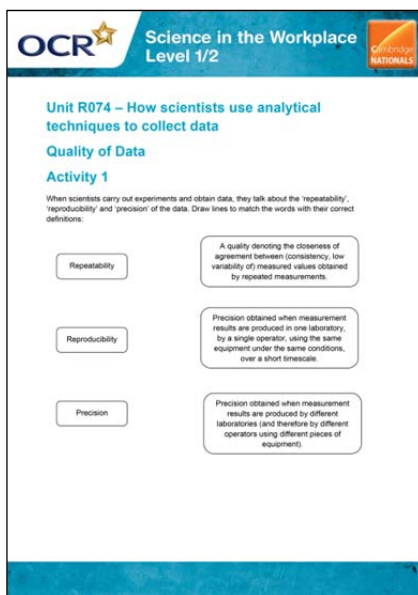


Unit R074 – How scientists use analytical techniques to collect data

Quality of Data

Instructions and answers for teachers

The activity below covers LO1: Be able to apply the principles of good laboratory practice.



Associated files:

Identifying and controlling variables (activity)

Activity 1 – approx. 5 minutes

Activity 2 – approx. 25 minutes

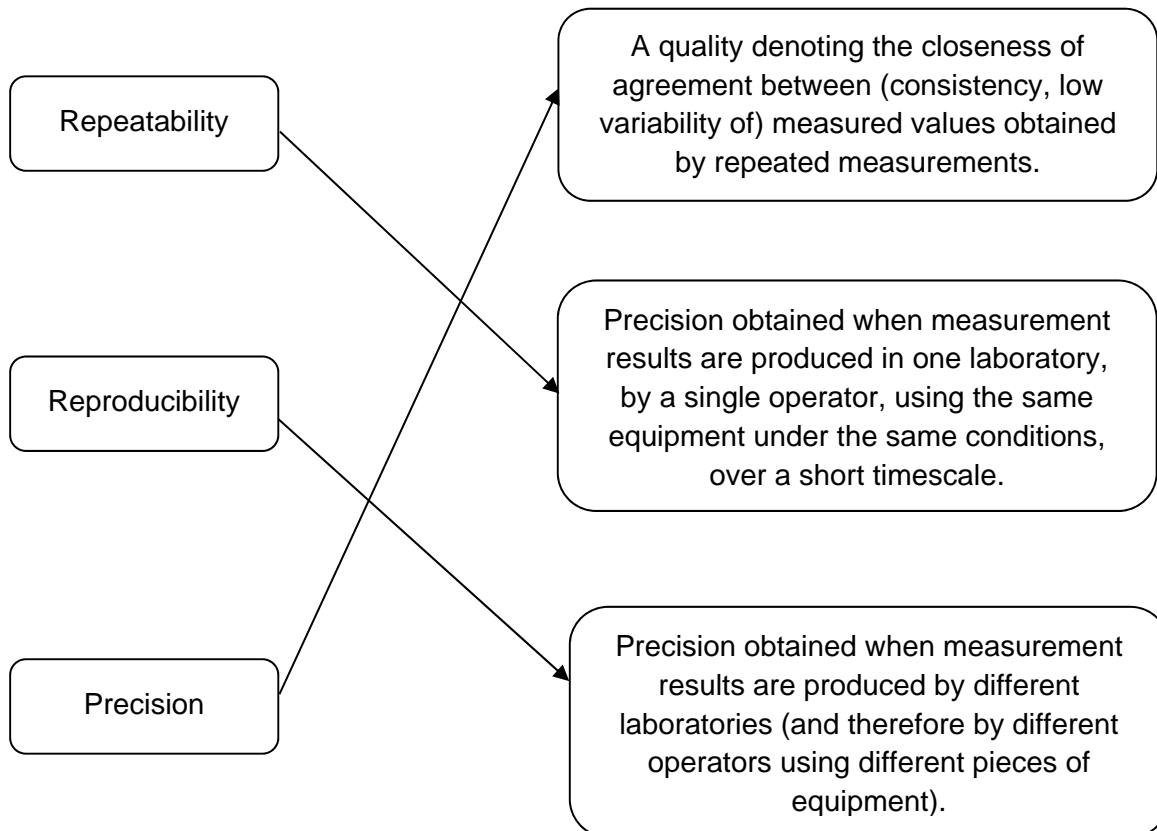


This activity offers an opportunity for English skills development.

In this lesson element learners are provided with a set of data from a number of different experiments. Learners are asked to identify which sets of results represent reproducible data and repeatable data and explain why.

Activity 1

When scientists carry out experiments and obtain data, they talk about the 'repeatability', 'reproducibility' and 'precision' of the data. Draw lines to match the words with their correct definitions:



Activity 2

Four groups of students wanted to carry out an investigation to see if changing the temperature of water would affect how quickly a tablespoon of sugar would dissolve in it.

These are the results the students obtained:

Group 1				
Temperature (°C)	Time 1 (s)	Time 2 (s)	Time 3 (s)	Time average (s)
20	30	32	31	31.0
40	21	22	21	21.3
60	8	8	8	8.0
80	5	4	5	4.7
100	3	3	3	3.0

Group 2				
Temperature (°C)	Time 1 (s)	Time 2 (s)	Time 3 (s)	Time average (s)
20	20	32	33	28.3
60	4	10	9	7.7
100	1	4	3	2.6

Group 3	
Temperature (°C)	Time 1 (s)
20	33
40	24
60	10
80	6
100	4

Group 4				
Temperature (°C)	Time 1 (s)	Time 2 (s)	Time 3 (s)	Time average (s)
20	30	32	34	32.0
30	26	27	28	27.0
40	25	22	23	23.3
50	18	17	18	17.7
60	12	12	13	12.3
70	8	9	10	9.0
80	6	5	7	6.0
90	5	4	5	4.7
100	3	4	3	3.3

- 1) Look at the data the groups produced, which group do you think produced the best results? Explain your answer.

Group 4 because:

- they took reading every 10⁰C, and
- they covered the range of 20 – 100, and
- they repeated each temperature 3 times, and
- they took the average,
- and their reading for each temperature were all close to each other.

- 2) Which group do you think produced the most precise results? Explain your answer.

Group 1 because:

- all their results for each temperature were close to each other
- for some temperatures they got the same reading 3 times.

- 3) Which group do you think produced the most repeatable results? Explain your answer.

Group 1 because:

- they repeated the test 3 times and all the readings for each temperature were the same or very similar
- Group 2's results were very different to each other for each temperature
- Group 4's results were not too bad but had a wider range than group 1
- you cannot tell if group 3's results were repeatable because they did not do any repeats.

- 4) What do you think group 3 should do to make their results more valid? Explain your answer.

Group 3 should repeat the results 3 times and take the average.
They should also consider doing more temperatures.

- 5) What do you notice about the first set of results in groups 2's data compared to other groups?

What does this suggest about their experimental method?

The first set of results for group 2 was much lower than the other set of results for this group.

This indicates that they did something wrong in their experiment that caused that whole set of results to be less than it should.

- 6) You have not been given much information about the details of the experiment the students carried out.

What things do you think they should have changed?

What things do think they should have kept the same?

What things do you think they should have measured to make sure that their experiment produced good scientific data?

They should have changed the temperature of the water a good range would be between 20 – 100 doing at least 5 different temperatures so they could plot their data on a graph.

They should have kept the amount of water, the amount of sugar, the environment, the equipment the same.

They should have measured the time taken in seconds using a stop clock.

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