



Assessing pollution levels: teacher notes

Education in Chemistry

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In this worksheet students calculate the levels of NO₂ in the air by considering factors such as road types, proximity to roads and yearly trends

Teacher notes

The article makes useful background reading on the topic of air pollution. Students could read this for homework before the lesson or it could be shared at the start of the lesson.

This exercise uses a [data set](#) from 2010 collected by schools in Dudley, West Midlands.

For high achievers, the use of a goal-free problem may be useful. Give the data set to the students and ask them what conclusions they can draw from it.

Answers

1. Calculating means and ranges

- Calculate the mean level of nitrogen dioxide (NO₂) for the months of January, February and March.
- Calculate the ranges for the levels of NO₂ for the months of January, February and March.

	Jan	Feb	Mar
Mean	47.0	42.5	35.1
Range	26.72–69.2	24.82–64.3	11.37–61.9

2. The European Union has asked the UK to measure levels of NO₂ in the air. Where levels are greater than 40 µg/m³ action is required to reduce pollution.

- On your data set, highlight measurements above 40 µg/m³.

Address	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amblecote Primary	n/a	32.59	24.27	21.43	15.10	11.72	12.49	n/a	26.43	18.23	24.62	n/a
Christ Church Primary	37.78	35.94	23.07	21.24	18.80	18.60	12.90	n/a	18.90	22.71	40.55	n/a
Clent View	26.72	29.49	21.44	15.54	10.74	11.61	7.63	10.75	11.65	15.06	26.77	28.56
Halesowen Road	69.2	63.2	61.9	52.4	48.8	44.9	34.0	41.6	52.2	48.5	54.3	64.5
Town Centre	59.7	51.6	53.0	47.5	49.5	45.2	33.4	35.7	44.8	43.4	53.7	53.1
Hall Street, Dudley	66.3	64.3	60.9	49.1	43.8	42.7	29.4	37.6	44.3	42.7	47.7	59.4
Northfield Rd Primary	38.33	37.70	11.37	n/a	n/a	16.30	14.42	16.72	30.10	n/a	33.89	n/a
Quarry Bank Primary	45.66	40.70	33.92	27.93	25.31	22.70	19.70	23.23	29.86	24.74	30.02	39.30
Redhall Primary, Zoar St	30.38	24.82	21.64	19.00	13.07	12.54	11.38	14.90	17.71	20.94	30.57	n/a
Zoar Street	48.70	44.67	39.48	34.23	32.34	29.37	22.36	27.40	33.87	28.50	40.09	44.25

- Discuss any trends.

- Three of the sites have measurements of NO₂ above the level of action in most months of the year.
- Two primary schools have measurements of NO₂ above the level of action at some point in the year.

3. Comparing how the type of road affects the minimum and maximum levels of NO₂ measured

- What type of street registered the lowest level of NO₂?

Residential

- What type of street registered the highest level of NO₂?

A road

- Suggest why these types of streets had a big difference in levels of NO₂.

A roads are major roads. NO₂ is produced by vehicle exhaust. Residential streets have much lower levels of traffic than A-roads.

4. Comparing trends across the year

- Which month registered the lowest level of NO₂?

July (Clent View)

- Which month registered the highest level of NO₂?

January (Halesowen Road)

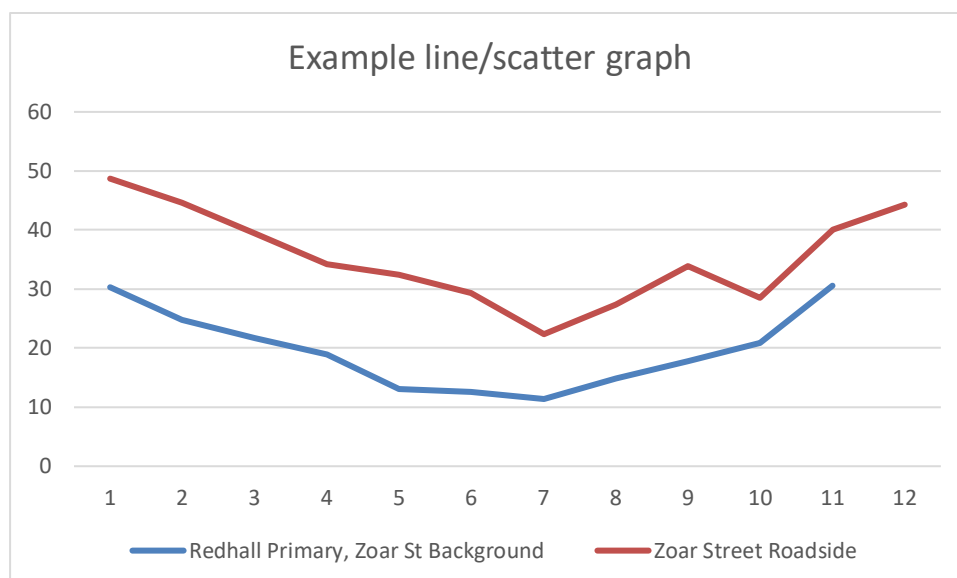
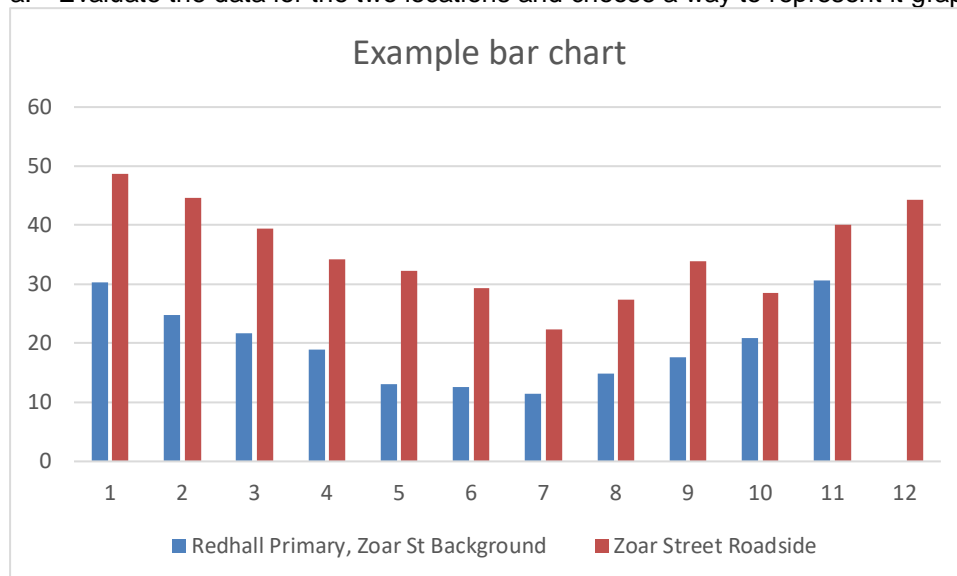
- Describe and explain the seasonal trends in the data.

NO₂ measurements are highest in the winter, when people may be more likely to use their cars to get to work and school. As the season turns to spring and then summer, the NO₂ measurements drop – more people may choose to walk or take public transport. During the summer holidays there is no school traffic, which lowers the measurements around the primary schools and could also contribute to lower measurements on other roads.

5. Considering the effect of proximity to the roadside

Two diffusion tubes were placed in different locations on Zoar Street.

a. Evaluate the data for the two locations and choose a way to represent it graphically.



b. Describe and explain the trends seen.

Throughout the year the NO₂ levels in the background site are lower than those at the roadside. This is because more NO₂ is present at the roadside due to vehicular traffic. The gap between the measurements is roughly the same, except in October when the value for the roadside site was lower than the trend suggests. This could be an anomalous result from the diffusion tube or there could have been a one-off event such as a road closure.