**Science Skills**

**Reading Line Graphs**

**Level 4

**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Class: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Line Graphs**

**Line graphs** are used to **track** things when changes have been made.

At Level 4, you are expected to be able to do all the calculations you learned at Level 3.

These are repeated on this page. The more complicated calculations you are expected to do are described on the next page.

1. **Recognising what is being compared**
a) the temperatures in two cities at different times of day are being compared
b) the temperature in the individual cities at different times of day are being compared

2. **Finding data**
The temperature in Edinburgh at noon is 15ºC
The temperature in Rome at 6am is 17ºC
The temperature in Rome is lowest at 6am
The temperature in Edinburgh is highest at 2pm
If the temperature is 9º, it must be 6am in Edinburgh

3. **Calculating differences from the data**
At 10am, the temperature in Rome is 8º higher than the temperature in Edinburgh
At 4pm, the temperature in Edinburgh is 12.5º less than the temperature in Rome.

4. **Recognising and describing trends** (A *trend* is the way things are going)
In both cities, the temperature rises between 6am and 2pm, then the temperature falls.

5. **Drawing conclusions (Writing what you have learned from the graph)**
At all times of day, the temperature in Rome is higher than the temperature in Edinburgh
Between 6am and 2 pm, the later in the day, the higher the temperature in both cities.
Between 2pm and 6pm, the later in the day, the lower the temperature in both cities.

6. **Predicting**At 8 pm in Rome the temperature is likely to be less than 24ºC.
In Edinburgh at 4am, the temperature is likely to be less than 9ºC

**Reading Line Graphs at Level 4**

1. **Describing relationships between the two sets of data.**
 Remember: the relationship is the trend in the way the results vary, depending on
 changes in the data shown on the axes.
 For example, things can increase, decrease or stay the same

Examples of how to describe relationships:

a) The larger/greater the increase/decrease in ….., the larger/greater the increase/decrease
 in …..

b) The more the …, the more the … The more the …, the less the …

c) The longer the…, the more/less the…



The **greater** the number of hours that pass, the **lower** the blood alcohol level

increasing

Or

The **longer** the period of time, the **lower** the blood alcohol level

Or

As **time passes**, the level of alcohol in the blood **decreases**.

increasing

**2 Calculating differences from the data**
**Questions which start “*How many times greater*…” or “*How many times more*…” usually require you to divide.**

 **Example:**How many times greater was the blood alcohol level after 2 hours than after 6 hours?

*Working*

The blood alcohol level after 2 hours was 120 mg/100ml
After 6 hours, the blood alcohol level was 60 mg/100ml

 **120 ÷ 60 = 2**

*Answer:* The blood alcohol level after 2 hours was **2 times greater** than the blood alcohol level after 6 hours.

**3** **Calculating Percentage Increase / Decrease**



Example: From the graph above, what is the **percentage decrease** in blood alcohol level from 2 hours to 6 hours after consumption of alcohol?

*Working*

After 2 hours the blood alcohol level is 120mg/100ml.
After 6 hours the blood alcohol level is 60 mg/100ml.

The actual decrease is (120-60) = **60**mg/100ml

The **percentage** decrease is

**the actual decrease ÷ the amount at the start x 100.**
 60 ÷ 120 x 100 = 50%

*Answer*: The percentage decrease in blood alcohol level from 2 hours to 6 hours after
 consumption of alcohol is **50%**

**Calculating Percentages**

Jim has increased his weight by consuming too many kilocalories per day.
For lunch he consumes 960 kilocalories. This is 30% of his normal daily amount.
How many kilocalories is he consuming per day?

*Working*

*(Think of the answer as being 100%.
So the question could read “What is 100% of the kilocalories he is consuming per day.”)*

You are told that 30% = 960 kilocalories 30% = 960
Find 10% by dividing this number of kilocalories by 3 10% = (960 ÷3) = 320
Now find 100% by multiplying the 10% answer by 10 100% = (320 x 10) = **3200**

 *Answer:* Jim is consuming **3200 kilocalories** per day

**4 Averages**
**Add up all the numbers in the category and divide by the number of entries.**

**5** **Calculating ratios**

 Ratios are used to compare different quantities. The symbol used to show rations is **:** The : symbol is placed between the two quantities being compared.



There are 8 apples and 2 oranges.
 The ratio can be written 8:2

Ratios have to be **simplified**. The easiest way to simplify ratios is to divide both numbers by the smallest number. The result of doing this will **always show as 1** **on one side of the ratio**.

The ratio is 8 apples to 2 oranges

*Working*

 8 apples: 2 oranges
 8:2
Divide **both sides** by the smallest number, 2. 8÷2 = **4** : 2÷2 = **1
Final ratio 4:1**

**Whole numbers in Ratios**

If the ratio had been 39 apples :6 oranges
 39:6
Divide by the smallest number, 6 **6.5:1**

Ratios can be adjusted to avoid decimals by **multiplying** or **dividing** **both sides** of the ratio by the **same number**.

 6.5:1
Multiply both sides by 2 **13 :2**

1 The graph shows the maximum (highest) recommended pulse rate for humans of
 different ages.



a) What is the maximum recommended pulse rate for a person aged 15?

 \_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

b) At what age does the maximum recommended pulse rate fall below 200 beats per minute?

 Above \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years

c) Calculate the percentage decrease in the maximum recommended pulse rate between the
 ages of 20 and 60 years.

 *Working*

Answer: \_\_\_\_\_\_%

2 Yeast cells were gown and their numbers recorded over a 35 hour period.
 The results are shown below.



How many times greater was the maximum number of yeast cells compared to the number at the start?

 *Working*

Answer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ times greater

3 The activity of soil organisms was investigated. Some leaves were placed in bags of
 different mesh sizes and buried in the soil for three months.

 Each bag was dug up at one month intervals and the percentage decomposition of the
 leaves recorded. The results are shown on the graph.



After three months, what percentage of the leaves had decomposed in each bag?

 Large mesh bag \_\_\_\_\_\_\_ %

 Medium mesh bag \_\_\_\_\_\_\_%

 Small mesh bag \_\_\_\_\_\_\_%

4 The graph shows the average wheat yields in the USA and in Europe from 1750 to 2000.



a) Describe the pattern of average wheat yield for the USA from 1750 to 2000.

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b) During which 50 year period was there the greatest increase in average wheat yield in Europe?

 From \_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_

c) Calculate the simple whole number ratio of average wheat yield in Europe to that in the
 USA in 2000

*Working*

\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_
Europe USA

5 Peak flow is the maximum rate at which an individual can exhale (breathe out).
The graph shows normal average peak flow rates for females of similar heights but varying weights.



a) Describe the relationship between age and average peak flow rate in females.

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b) The peak flow rate for a female during an asthma attack was found to be 234 litres per
 minute. This is only 60% of her maximum rate.

 Calculate her maximum peak flow rate.

 *Working*

 \_\_\_\_\_\_\_\_ litres per minute

6 The graph shows the volume of air breathed per minute by a rugby player at rest,
 during 10 minutes of exercise and during his recovery time.



a) At what time did the rugby player begin to exercise? \_\_\_\_\_\_\_\_\_\_\_\_ minutes

b) During the rest period before exercise, the player breathed 12 times per minute.
 Calculate the **average** volume of each breath.

 *Working*

 \_\_\_\_\_\_\_\_\_\_\_\_ litres

c) Calculate the simplest whole number **ratio** of the **highest** volume breathed per minute
 to the **lowest.**

*Working*

 \_\_\_\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_\_\_\_
 Highest : Lowest

7 The graph shows the relationship between average bone strength and age in human
 females.



a) Describe the changes in average bone strength after age 40.

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b) At what age is average bone strength the greatest?

 \_\_\_\_\_\_\_\_\_\_ years

c) For how long does average bone strength remain above a value of 160 MPa

 *Working*

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ years

8 The graph shows the rate of water gain and water loss by a plant during a 24 hour
 period in summer.



a) How long after the time of maximum water loss did the plant show its maximum
 water gain?

  *Working*

 \_\_\_\_\_\_\_\_\_\_\_\_\_ hours

b) At what time in the morning did the rate of water gain exactly balance the rate
 of water loss?

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9 The graph shows the relationship between pH and the rate of activity of two
 different enzymes.



a) Between which pH values are both enzymes active?

Between \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_

b) How many times greater is the rate of activity of enzyme B at pH 7 than at pH 8?

 *Working*

\_\_\_\_\_\_\_\_\_\_\_\_ times

10 The graph shows the world production of plastics.



Describe the **general trend** in the production of plastics from 1960 to 2000.

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11 The graph shows the mass of polythene used in a European country.



 Describe the general trend in the mass of polythene used between 2000 and 2006.

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12 The graph shows the solubility of sodium chloride and potassium nitrate at different
 temperatures.



a) At what temperature do sodium chloride and potassium nitrate have the same solubility?

\_\_\_\_\_\_\_\_\_\_\_ºC

b) Write a general statement describing the effect of temperature on the solubility of
 potassium nitrate.

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