**Pearson Edexcel Level 3 Certificate in Mathematics in Context**

**Comprehension teaching and practice material**

These materials are designed to support teaching and learning of mathematical comprehension skills. They may be used for classroom discussion, teaching and learning and/or student practice. They provide comprehension practice on four topics as follows:

Waste and recycling

**Earthquakes**

Winter Olympics

Ebola

Each zip file contains four types of material as follows:

Teacher notes

Comprehension passage and questions

Mark scheme

Spreadsheet(s)

These teacher notes suggest other supporting resources including videos. The teacher notes also provide a mapping of the task questions to GCSE Mathematics (9-1) and the current GCSE Statistics and indicate where skills specific to Mathematics in Context are required. Some tasks’ questions include more challenge than others and this is made clear within the teacher notes.

Students should have access to formulae where required. The formulae sheet is  provided in the specification (Appendix 3) and in the sample assessment materials.

**Earthquakes**

**Background**

With instant global news and the ability to record events as they happen, everyone can now see at first hand the human impact and the ensuing damage caused by earthquakes.

This task explores, using mathematics, some of the issues around earthquakes.  
Students will need to be comfortable with using powers of 10, both in converting the magnitude of an earthquake to the approximate energy released and also to deal with the fact that the relationship between the number of earthquakes greater than a given magnitude and their frequency can be modelled by a power of 10 law.

Other technical skills required include being able to calculate with speed, distance and time, to substitute into a given formula and to read values off graphs.

**Resources**

There are several good visuals that could be used as an introduction.

[http://abcnews.go.com/US/video/northern-california-earthquake-napa-building-falling-surrounded-rubble-25116267](http://abcnews.go.com/US/video/northern-california-earthquake-napa-building-falling-surrounded-rubble-25116267%20) has good on-the-spot reporting and an analysis of what is likely to happen next. There are no fatalities.

<http://www.telegraph.co.uk/news/worldnews/asia/japan/8376492/Japanese-earthquake-and-tsunami-in-video.html> This shows on-the-spot film from when the earthquake occurred and also the resulting tsunami. It certainly brings home the scale of the destruction although there is no direct commentary on the number of casualties nor any bodies. Recommend viewing first before deciding to show to class.

Tables 2 and 3 are also included as Excel spreadsheets.

**Comments on the questions**

**1** (a) This question is an exercise using powers of 10 and converting SI units. Knowing a little about standard form would be useful.

(b) (i) Substitute in the formula *E* = 10(4.8 + 1.5*m*) .

(ii) Looking at Table 1, the relationship is roughly multiplying by 4.1 and adjusting the power of 10.

(c) Because magnitude and energy are related by a power law it is more appropriate for comparison to use a ratio. An increase of 1 in magnitude results in an energy release of roughly 30 times greater.

**2** (a) (i) is an exercise in using T = D ÷ S in preparation for (ii).

(ii) is an example to illustrate how distances to earthquakes can be found. To locate the focus requires at least 3 different seismometer stations. (To locate the earthquake epicentre requires 3 readings and is a nice example of using GCSE Loci). It is possible to derive the formula for the distance in terms of the time difference from using T = D/S twice and could be set as an exercise.

(b) Substitute in the formula for *v*, then use T = D*/v* followed by allowing for the time difference. You could ask students to describe the effect on the calculations if the average depth were 4 km instead of 3 km.

**3** (a) (i) Look at *m* = 4.5 and read off the power of 10, then use the 10*x*button

(ii) The data plotted is in powers of 10. For *m* = 8, the power of 10 is 1.23, since 101.23 = 17.

The value of *b* is found from the formula (Σ*my* − Σ*m*Σ*y/n)/* (Σ*m2 –* Σ*m/n).* The mean values of *m* and *y* are found from the table and the value of *a* is found by substituting into *a* = 

(b) (i) Substitute *m* = 3 into 10*a - bm*

(ii) Substitute *m* = 9 into 10*a - bm*. The question asks 'how often', so the answer has to be turned into a frequency (of the type '*n* every 10 years').

**4** (a) There is little correlation (the cost of damage depends on the magnitude of the earthquake and such things as the population density, the resistance of buildings to shock, for example, and the time of day).

(b) (i) Substitute the given values in the formula for standard deviation on the formula sheet.

(ii) Taking out the extreme value will reduce the dispersion.

**Analysis based on GCSE (9–1) Mathematics and GCSE Statistics (current specification)**

**Task: Earthquakes**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Question** |  | **Demand/Content** | | | | |
|  |  | **GCSE Maths** | | **GCSE Stats** | | **Other** |
|  |  | **F** | **H** | **F** | **H** |  |
| **1 (a)** | Compare powers of 10 |  |  |  |  | SG5 |
| **(b)(i)** | Substitute and evaluate using powers of 10 |  |  |  |  | SG5 |
| **(ii)** | Proportionality |  |  |  |  | SG5 Because unstructured |
| **(c)** | Substitute and evaluate using powers of 10 |  |  |  |  | SG5 Because unstructured |
| **2 (a)(i)** | Use of T = D/S |  |  |  |  | F tier |
| **(ii)** | Use of D = S×T in a formula |  |  |  |  | F tier |
| **(b)** | Substitute and evaluate a speed. Then use T = D/S in context |  |  |  |  | F tier |
| **3 (a)(i)** | Read from a graph |  |  |  |  | F tier |
| **(ii)** | Calculate parameters for regression line by substituting into formulas on the formula sheet |  |  |  |  | A9 New |
| **(b)** | Interpret results of aii |  |  |  |  | A9 New ideas but not a new technique |
| **4 (a)** | Interpret a scatter diagram |  |  |  |  | A6 |
| **(b)(i)** | Work out a standard deviation |  |  |  |  | A5 |
| **(ii)** | Interpret the standard deviation |  |  |  |  | A5 |