Tsunami

STUDENT ACTIVITIES

RUN-UP ON LLEWELLYN

Recommended age: Upper primary to secondary

The Tsunami Warning Centre (TWC) in Bay Town on Llewellyn Island is keeping a close watch on a small volcanic island off the coast called McNamara Island. For the past month a large slope on the island's eastern side has become very unstable. Sara Sertori, head of the Centre, has asked you to be in charge of the evacuation plans for each of the towns on Llewellyn Island if a landslide on McNamara Island causes a tsunami. TWC operates four tsunami recording stations (A, B, C and D on map) which provide information on the arrival times and heights of tsunamis.

In the past, volcanic eruptions and landslides on McNamara Island have caused tsunamis around the coastline of Llewellyn Island. These have caused catastrophic damage to some of the towns.

The map of Llewellyn Island shows heights above sea level using contour lines.

1. **Using a red pen mark a run-up height of 15 metres on the map.**
2. **Which towns on Llewellyn Island would need to be evacuated if a tsunami of this magnitude was approaching the island?**

3. **Knowing that you may only have a few minutes to warn people living in these towns, how could you prepare residents for a possible future evacuation and what methods could you use to warn them that a tsunami was on its way?**

The speed with which these tsunamis travel from McNamara Island can be calculated using the following formula:

$$\text{Average speed} = \frac{\text{Total distance (km)}}{\text{Time taken (hrs)}}$$

The last tsunami in this region occurred five years ago and was caused by a similar landslide on the side of McNamara Island. The site of the landslide is marked on the map with a Z.

4. **The table below shows the arrival times of the tsunami at three tsunami recording stations closest to McNamara Island. Complete the table by:**

   a. **Measuring the distance from the landslide (Z) to each station.**

   b. **Calculating the speed the tsunami travelled to each station using the formula above.**

Remember to convert the times recorded into hours! For example: 9 minutes/ 60 minutes = 0.15 hours.

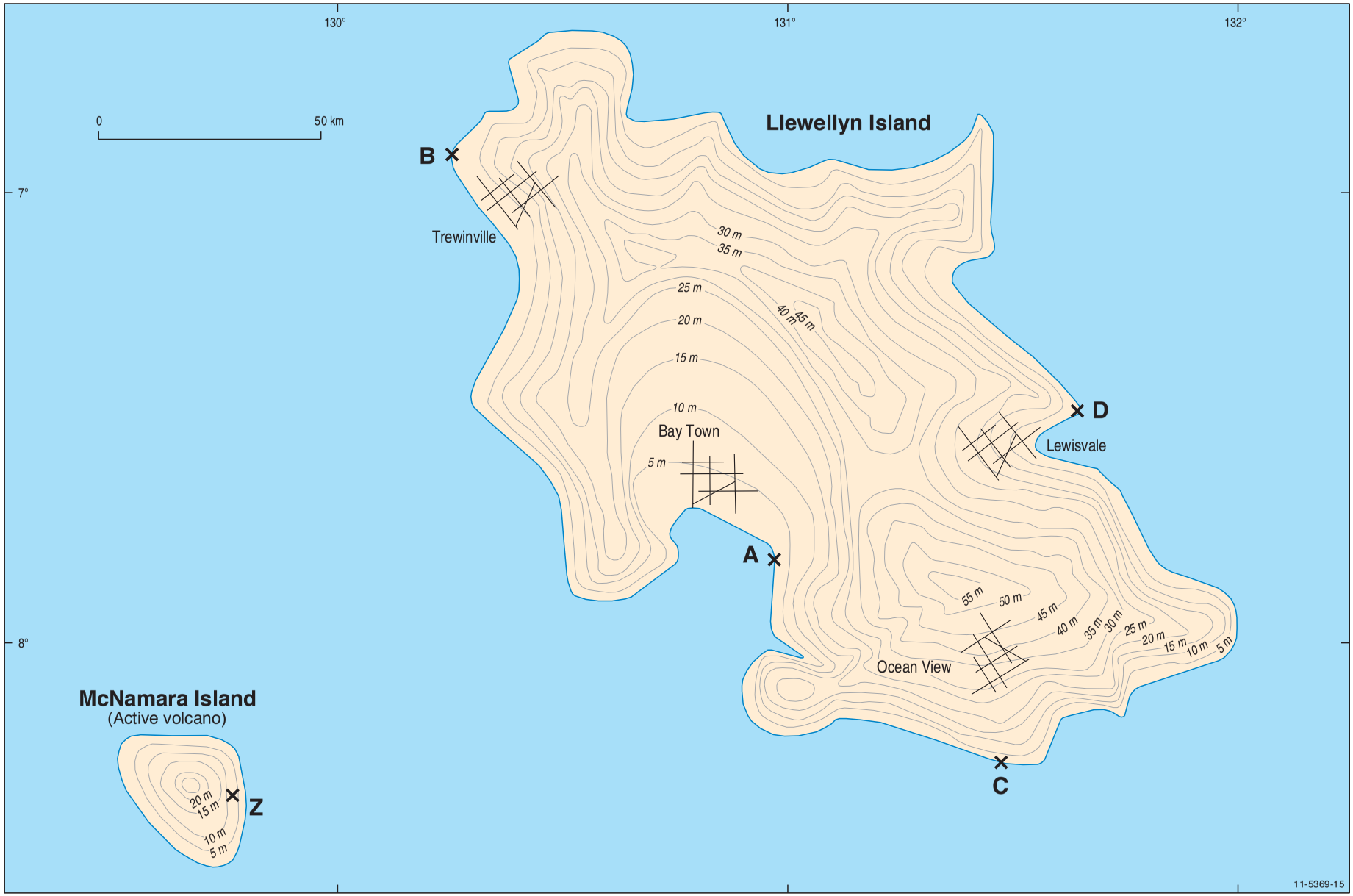
Recording station	Distance (km)	Arrival time after landslide	Tsunami speed (km/h)
A		9 minutes	
B		12 minutes	
C		15 minutes	

5. **What is the average speed this tsunami travelled? (Add the tsunami speed for stations A, B, & C, then divide by three). _____ km/h**

6. **The speed for this same tsunami calculated by data from the recording station (D) near Lewisvale was 575 kilometres/hour. Is this slower or faster than the average speed of the tsunami calculated for stations A, B & C? _____**

7. **The fishing fleet, which uses Bay Town as a port, was out at sea 20 kilometres south east of McNamara Island when a large tsunami reached them. What evidence would the fishermen detect to indicate that a tsunami reached them? What about boats in the harbour?**

Lleyellyn Island



A–D Tsunami recording stations

Note: In order for this activity to work, this sheet must be printed at 100% scale (ie. not fit to page)

2004 INDIAN OCEAN TSUNAMI

Recommended age: Upper primary to secondary

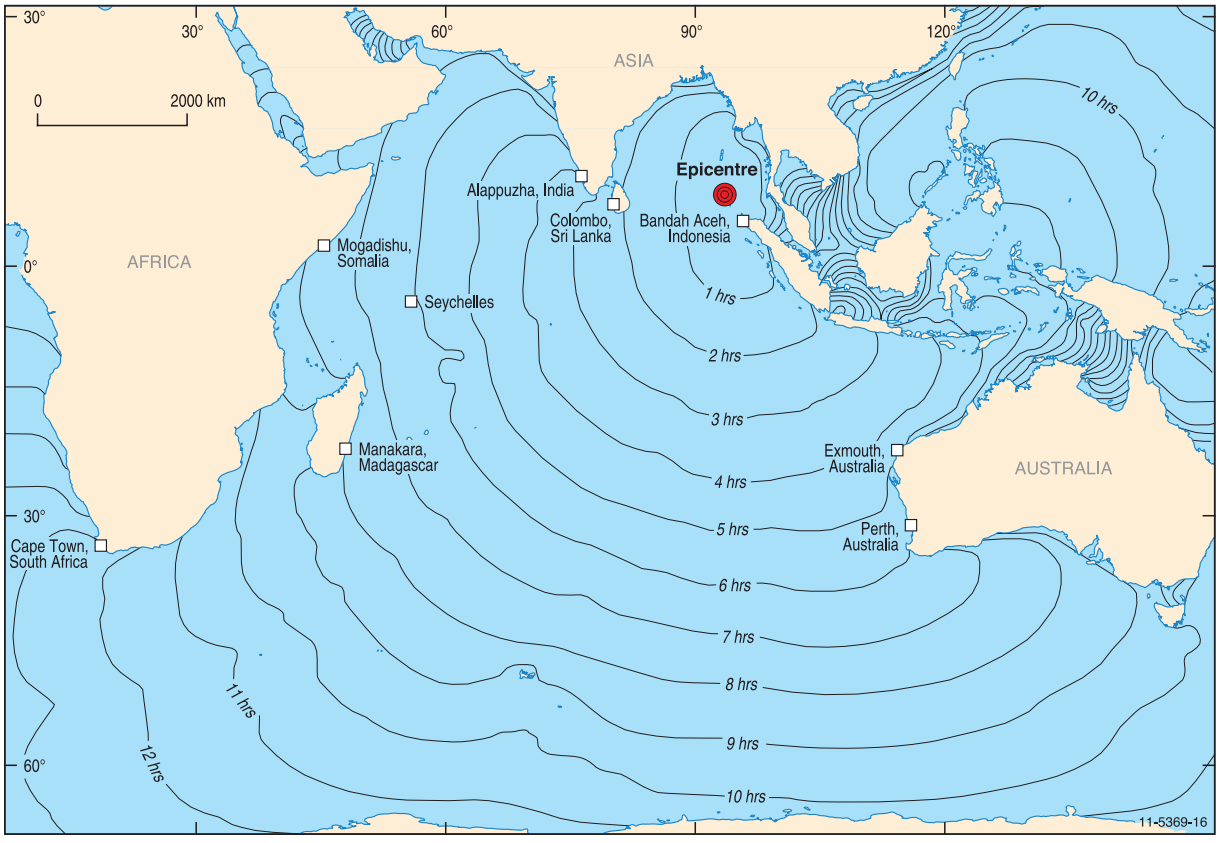
NEWS FLASH

A massive magnitude 9.2 earthquake occurred on Sunday 26 December 2004 at 12:48am off the west coast of northern Sumatra in Indonesia. A 10 metre high tsunami can be expected with an earthquake of this magnitude.

The following is a travel time chart for this tsunami. The lines indicate how far the tsunami travelled each hour. The distance between each line represents 60 minutes. Using the tsunami travel time chart work out how long the tsunami will take to reach the following cities.

Cities	Travel time (hours)
Bandah Aceh, Indonesia	
Alappuzha, India	
Colombo, Sri Lanka	
Mogadishu, Somalia	
Exmouth, Australia	
Perth, Australia	
Cape Town, South Africa	
Seychelles	

Estimated tsunami travel times (in hours)



TIME AND TIDE

Recommended age: Secondary

Close observation and comparison of the tide charts is usually the only indication the National Tidal Facility has that a tsunami has reached the Australian coastline. On average, a tsunami reaches our shores once every two years but most are too small to be noticed.

On the next page is the tide chart record for Vardon Harbour. It is a 24-hour tidal record for Wednesday 27 July and Thursday 28 July. The sea level, in metres, has been recorded every 15 minutes.

Plot the information from the tide chart on to the graph. Once you have plotted the tide information, answer the questions below.

1. **Over a 24-hour period the Harbour usually experiences two high tides and two low tides.**

   i. **At what time is the first low tide?** _____

   ii. **What time would you expect the next low tide?** _____

   iii. **At what time is high tide?** _____

2. **How many waves are in the tsunami 'wave train'?** _____

3. **What is the duration of the tsunami?** _____ **hours**

4. **How long after the first tsunami wave did the 'highest wave' arrive at the coast?** _____ **hours**

5. **Would a tsunami of this size have been destructive for Vardon Harbour? Give reasons.**

   _____

   _____

6a. Draw on the graph a dashed line to show the expected water level if there was no tsunami. How high was each of the tsunami waves compared to the expected water level?

Wave 1 _____ **metres**

Wave 2 _____ **metres**

Wave 3 _____ **metres**

6b. This tsunami occurred during low tide. Predict the tide level for each wave if the first wave arrived at 1200 during high tide:

Wave 1 _____ **metres**

Wave 2 _____ **metres**

Wave 3 _____ **metres**

6c. Describe the problems that could have resulted, in and around the harbour, if the tsunami had occured during high tide.

_____

_____

Tide chart recordings for Vardon Harbour: Wednesday 27 July & Thursday 28 July

Please note: Time is in 24 hour notation (eg 7.00pm = 19.00)

Wednesday, 27 July & Thursday, 28 July					
Time	Sea level (m)	Time	Sea level (m)	Time	Sea level (m)
03.00	1.00	11.00	0.82	19.00	0.80
03.15	0.97	11.15	0.88	19.15	0.35
03.30	0.93	11.30	0.93	19.30	1.00
03.45	0.90	11.45	0.99	19.45	0.95
04.00	0.86	12.00	1.00	20.00	0.92
04.15	0.82	12.15	1.05	20.15	0.41
04.30	0.79	12.30	1.08	20.30	0.43
04.45	0.75	12.45	1.22	20.45	0.47
05.00	0.71	13.00	1.25	21.00	0.52
05.15	0.70	13.15	1.29	21.15	0.55
05.30	0.68	13.30	1.31	21.30	0.58
05.45	0.65	13.45	1.31	21.45	0.60
06.00	0.63	14.00	1.29	22.00	0.63
06.15	0.60	14.15	1.25	22.15	0.67
06.30	0.59	14.30	1.22	22.30	0.69
06.45	0.55	14.45	1.18	22.45	0.71
07.00	0.50	15.00	1.13	23.00	0.75
07.15	0.48	15.15	1.00	23.15	0.79
07.30	0.45	15.30	0.97	23.30	0.82
07.45	0.44	15.45	0.94	23.45	0.86
08.00	0.41	16.00	0.91	00.00	0.90
08.15	0.42	16.15	0.87	00.15	0.93
08.30	0.44	16.30	0.82	00.30	0.97
08.45	0.48	16.45	0.78	00.45	1.00
09.00	0.52	17.00	0.72	01.00	1.03
09.15	0.57	17.15	0.90	01.15	1.07
09.30	0.64	17.30	0.90	01.30	1.10
09.45	0.67	17.45	0.70	01.45	1.10
10.00	0.70	18.00	0.40	02.00	1.15
10.15	0.74	18.15	0.45	02.15	1.20
10.30	0.78	18.30	0.90	02.30	1.25
10.45	0.80	18.45	0.95	02.45	1.27

Graph of tide chart for Varon Harbour (27th & 29th July)