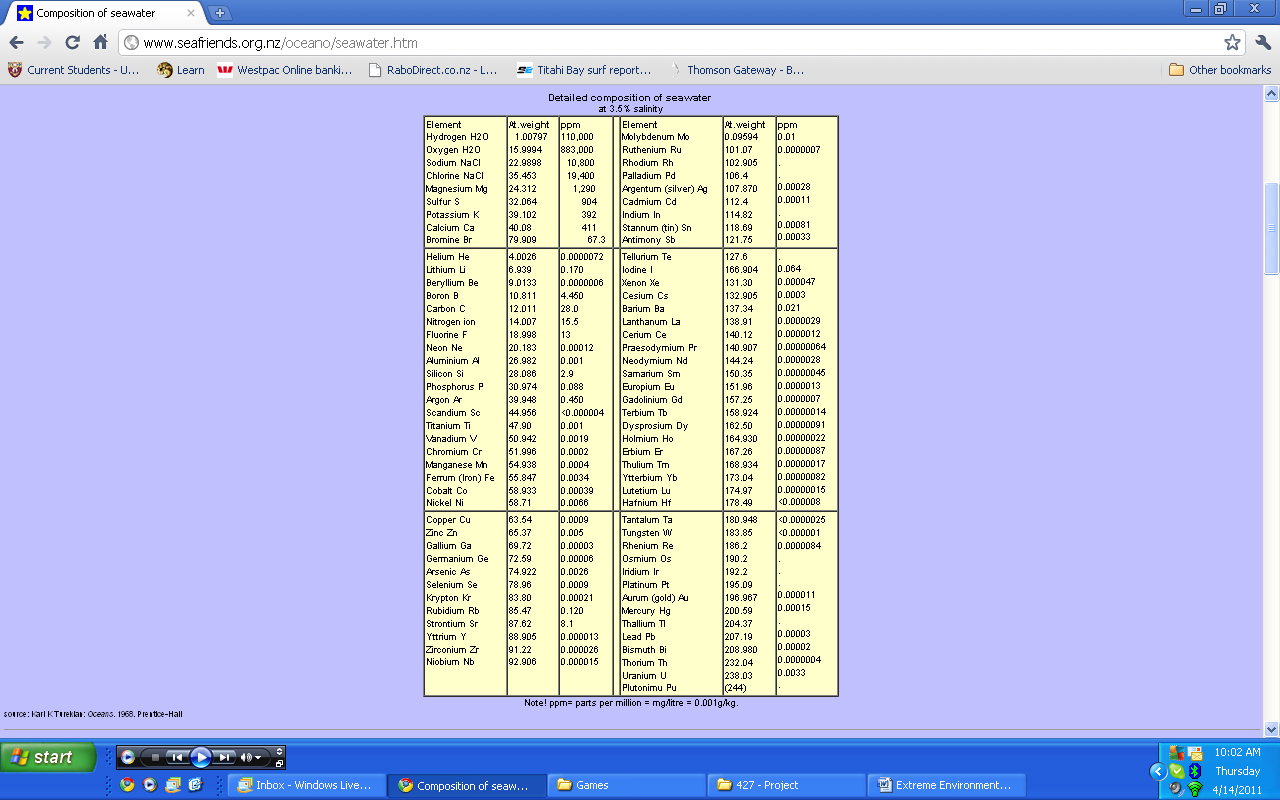
# Extreme Environment Power Generation

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| --- | --- |
| Criteria | Answer |
| Extreme Environment | Deep Sea |
| Extremity | High Pressure, intense cold |
| Chemical Properties | Water, hydrogen and oxygen, also deep sea sediments (see below) |
| Temperature Range (From Bottom to Top) | 3-21 ̊C |
| pH | Around 8 |
| Possible Energy sources (Choose by end term 1)–  Pressure | Pressure (need differential) therefore need transducer. Maybe piezoelectric?  10m -> 1 amos |
| Currents (kinetic) |  |
| Chemical | Differential |
| Temperature | Differential |
| Application | Underwater Sonar  Peter Gough -> Towfish |
| Design (Finish By end of term 2) | Build during Holidays |
| Testing | During Term 3 |



<http://www.seafriends.org.nz/oceano/seawater.htm>

# Background

## Pressure

No known way to convert ‘static pressure’ to energy. Hence there has to be a differential. Such a differential can be found in two ways a) to have two devices connected with one at a higher pressure than the other or b) to use currents pressing against the device to induce a pressure differential.

Piezoelectric technology would probably be the most useful in terms of energy harvesting from pressure. In fact piezoelectric technology has already been used in hydrophones.

The piezoelectric effect requires a change in pressure to create voltage and thus a constant high pressure won’t work: <http://books.google.co.nz/books?id=az1RYaJr5HsC&pg=PA5&dq=piezoelectric+effect&hl=en&ei=35ybTdLYHouycd3X0PkG&sa=X&oi=book_result&ct=result&resnum=1&ved=0CDEQ6AEwAA#v=onepage&q=piezoelectric%20effect&f=false>

## Temperature

Once again there is no known way to convert static heat to energy; hence there must be a differential. In our deep sea environment the only way to find this is by having two devices connected with one at a higher temperature than the other and then bringing the two temperatures together. If temperature energy harvesting were the way then a heat exchanger system would most likely be used.

## Currents

Currents are abundant in the sea and even more so in the specific application of the Towfish. As with all energy harvesting techniques there must be some type of differential which comes in the form that the Towfish is moving and the water is still or even better the water is moving in the opposite direction. In any case the Towfish is moving relative to the water.

## Chemicals

In sea water there are a lot of chemicals about in varying forms; Table 1 shows the makeup of water at deep sea. As can be seen there are many different chemicals but in very small amounts. However to get energy from these chemicals a reaction would need to be caused. With only the chemical currently in the water a reaction cannot be achieved because it would have happened already. So expecting it to react again is like expecting to burn ash from a fire. Thus to get a reaction it would require bringing other chemicals down to react with; very much like a battery which would deplete over time.