

big science

competition

Example Questions Big Science Competition

www.asi.edu.au

Big Science Competition.

© Australian Science Innovations ABN 81731558309

Logistical partner:

RioTinto



Junior Paper - Example Questions
(Australian Year 7 and 8)

Netbooks

Netbooks are designed to be small and easily carried. Jane wrote an article about netbook computers for a magazine. She conducted tests to compare several different brands of netbook computer.



She was investigating the question ‘Which brand of netbook computer has the longest battery life?’

Each netbook

- was new; and
- had its own battery.

1 Jane measured how long each new netbook could stay on while it was idle. Exactly the same programs were being run on each netbook.

Before beginning, what else must Jane do to make sure this is a fair test?

- A** Check the brand of battery used.
- B** Check the number of batteries installed.
- C** Make sure the netbooks are fully charged.
- D** Make sure the same brand of netbook computer is used.

2 Jane used the information from her test to place each netbook computer into a ‘battery life category’. She also calculated the average cost of the netbooks in each category.

She made this chart to display her data.

Battery life category	Number of netbooks tested	Average battery life (hours)	Average cost of netbooks (\$)
Excellent	3	10.5	\$550.00
Very good	12	7.8	\$590.00
Good	19	5.4	\$450.00
Poor	8	2.7	\$390.00

Which set of data is likely to be the most reliable?

The data for battery life category

- A** Excellent.
- B** Very good.
- C** Good.
- D** Poor.

Junior Paper - Example Questions

(Australian Year 7 and 8)

Meteorite Mystery

Many hundreds of meteorites strike the Earth every day. Most of these are small. Larger meteorites would cause considerable damage if they landed on a town or city. As human population grows the chances of a meteor landing in a populated area grows.

This report appeared in a newspaper on 21 September 2007.

<p>A large meteorite strike in the south of Peru last week had scientists scratching their heads.</p> <p>Villagers reported seeing a 'ball of fire' in the sky. Moments later, they heard the sound of a huge explosion that caused the ground to shake.</p> <p>The villagers rushed to the point of impact two kilometres away. They found a crater about 5 metres deep and 13 metres wide. Water in the crater boiled for several minutes after impact, releasing steam into the air.</p>	<p>Within hours of the strike, hundreds of villagers became sick. They showed worrying symptoms such as severe nausea and dizziness. The symptoms disappeared after a few days.</p> <p>The meteorite was found to consist mainly of rock, with no harmful materials detected. It was also giving off no radiation.</p> <p>The groundwater in the area of the impact crater was found to contain a high level of arsenic, a highly toxic chemical. Arsenic can cause severe illness if contaminated water is drunk.</p>
---	--

- 3 The symptoms of the mystery illness were like those caused by mild arsenic poisoning. Which of the following is the most likely way people who rushed to the crater came into contact with the arsenic?
- A breathing the air around the impact crater
 - B drinking the groundwater that had come to the surface
 - C eating plants that had absorbed the groundwater through their roots
 - D absorbing it through their skin when they touched the soil around the impact crater
- 4 A huge amount of space debris bombards the Earth's atmosphere every day. Most of it burns up in the Earth's atmosphere before it can strike the ground. What causes the space debris to heat up so much that it burns and disintegrates?
- A the pull of Earth's gravity
 - B friction with Earth's atmosphere
 - C the atmosphere being much hotter than space
 - D gases in the atmosphere reacting with the space debris

Intermediate Paper - Example Questions

(Australian Year 9 and 10)

Touchscreen Technology

Touchscreens are used in a wide variety of devices such as mobile phones and cameras. They allow a user to select applications simply by touching the screen.

New developments in touchscreen technology allow a user to actually ‘feel’ what a screen shows. These screens are known as ‘tactile’ screens.

These tactile touchscreens enable experience such as:

- **Feeling different textures**

A sensation of texture is created by applying a voltage to an electrode on the touchscreen surface. Varying the electrical signal can make the touchscreen feel smooth, rough, flat or bumpy.

- **Experiencing larger files as being ‘heavier’ or harder to move than smaller files**

When you move a large file on the screen with your finger, more friction will be felt for larger files. This creates the sensation that they are ‘heavier’ than smaller files.

1 Why can electrical signals create different sensations on the touchscreen?

- A Human skin is a very good conductor of electricity.
- B Electrical signals are more easily controlled than other types of signals.
- C Electrical impulses are used to transmit information from sense receptors to the brain.
- D ‘Smart’ materials in touchscreens conduct electricity better than other forms of energy.

2 A great deal of research had to be done in order to develop this ‘tactile’ touchscreen technology. What would be the main reason why funding research into touchscreen technology has been relatively easy to obtain?

- A The research required is not as expensive as research in other fields.
- B The product of the research is considered to be commercially valuable.
- C There is not a lot of competition in interactive technology applications.
- D Interactive technologies are developed in countries with strong economies.

3 Many models of touchscreens only work when in contact with human skin or a special type of pen (stylus). For example, if a person was wearing gloves the touchscreen would not work.

Which of the following could explain why this occurs?

At the point of contact the touchscreen responds to

- A changes in levels of light.
- B changes in pressure.
- C objects that can conduct electricity.
- D objects above a certain temperature.

Intermediate Paper - Example Questions
(Australian Year 9 and 10)

Ocean Chemistry

The temperature of some oceans is rising. Figure 1 shows the oxygen concentration in fresh water and sea water with changing temperature. Oxygen is necessary for almost all life on Earth.

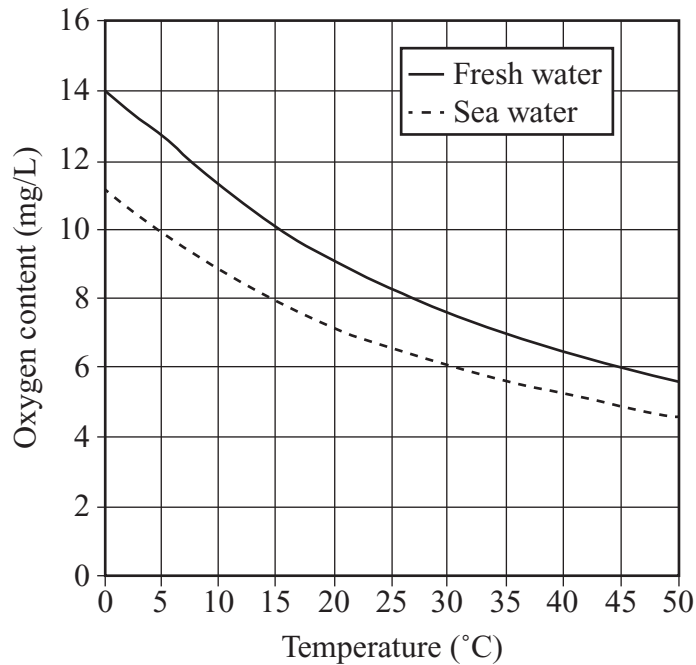


Figure 1: Oxygen concentration of fresh water and sea water at different temperatures

- 4 Which piece of information can be inferred from Figure 1?
- A Oxygen solubility in sea water will be about 2 mg/L at 120 °C.
 - B Oxygen solubility in fresh water will be about 16 mg/L at -5 °C.
 - C Sea water at 15 °C has about 25% more oxygen than fresh water at 40 °C.
 - D Salt tends to repel oxygen so sea water has a lower concentration of salt than fresh water.
- 5 A student tested the corrosion of iron at a depth of 2.0 metres in sea water at 5 °C and fresh water at 10 °C. She observed that there was more rust on the sample of iron in sea water than in fresh water. She concluded that iron rusts more in sea water than in fresh water.
- The student's conclusion was invalid because
- A she did not control enough variables.
 - B the test was with concentrations of oxygen that were about the same.
 - C it confirmed a widely known fact that iron rusts more in sea water.
 - D the temperature of sea water and fresh water is different at 2.0 metres.

Senior Paper - Example Questions

(Australian Year 11 and 12)

Tasmanian Devils

Tasmanian Devils face extinction. This is due to a cancer known as Devil Facial Tumour Disease (DFTD). Cancer cells divide rapidly and this produces a tumour. All the cells in a tumour are identical to each other and are very similar to the other non-cancerous cells in the organism.

- Tasmanian devils with DFTD die of starvation and related problems within 3 to 8 months of contracting the disease.
- The life span of healthy Tasmanian devils is 5 to 6 years.
- In areas where DFTD occurs all of the devils are usually dead within 18 months.
- DFTD is not known to affect any other species.



Photo. Martin Pot, used with permission

Tasmanian devil



Location of Tasmania

To help guard against extinction, populations of disease free Tasmanian devils have been relocated to disease free areas.

Devils that are to be part of these ‘insurance’ populations are kept in quarantine before they are released. This is done to confirm that they are disease free.

- 1 How long should this quarantine period last?
 - A 3 months
 - B 8 months
 - C 18 months
 - D 5 years

- 2 Cells taken from DFTD tumours from different Tasmanian devils are almost identical. However, the cells of DFTD tumours are slightly different from the non-cancerous cells of the infected Tasmanian devil itself.

This suggests that

 - A Tasmanian Devils are a poorly adapted species.
 - B all Tasmanian Devils have identical DNA in their cells.
 - C each Tasmanian Devil with DFTD must have caught the disease from another species with similar DNA.
 - D the cause of DFTD occurred only once and has spread through the population of Tasmanian devils.

Senior Paper - Example Questions

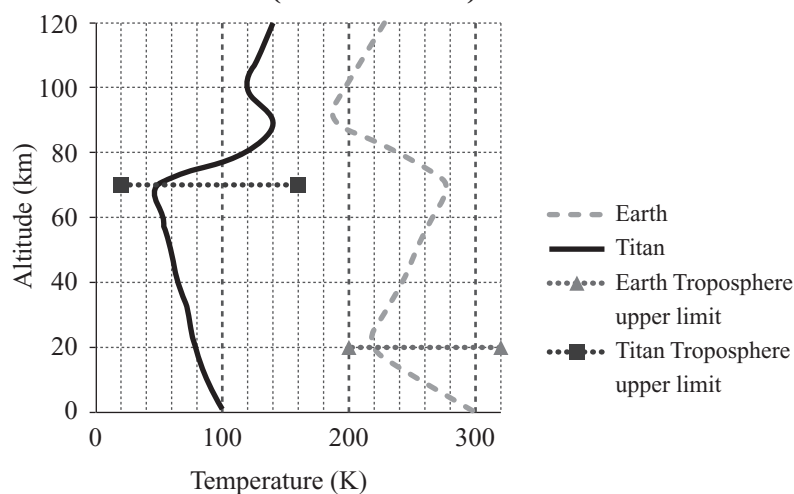
(Australian Year 11 and 12)

Titan and Earth

Saturn's moon Titan is larger than the planet Mercury. It has an atmosphere that is slightly denser than Earth's.

Titan's atmosphere consists of nitrogen (95%), methane (4.9%) and other hydrocarbons (trace). Scientists have discovered that Titan has a weather cycle.

**Temperature on Earth and Titan at different altitudes
(Thermoclines)**



- 3 Which statement best describes the relationship between Earth and Titan's thermoclines?
- A The thermoclines are similar but change direction at different altitudes.
 - B The atmospheres of both Earth and Titan are only 120 km thick.
 - C At about 70 km the same change occurs in both atmospheres.
 - D The thermoclines of Earth and Titan do not show any similarity.

Melting and boiling points for water and methane
(measured at one Earth atmosphere of pressure)

Substance	Melting point (K)	Boiling point (K)
Water	273	373
Methane	91	112

Note: Methane and water vapour will be present at temperatures below boiling point.

- 4 Using the data in the table and the graph to predict, what physical state(s) of methane exist in Titan's troposphere?
- A solid, liquid and gas
 - B solid and liquid only
 - C liquid and gas only
 - D liquid only

