7DGr Homework Sheet 5

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If a question has one or a number of * before it then it contains points which are inherently difficult and which will be met more generally in subsequent years.

7 On sleep

Sometimes in science it is important to try to look at something from a completely different point of view (as though you are an alien coming down to the Earth and looking at the thing from outside, for the first time). For this homework, you are going to write an **imaginative** essay, which will require very **careful thinking**.

The Earth is visited by aliens from afar, who do not sleep, but instead are always active. Life on their planet has developed without the need for sleep, and so they have never experienced it. Imagine the suprise when the aliens look down and see funny creatures who have to lie down each day for a certain amount of time and become unconcious! They become very curious about this crazy behaviour and one of them asks you to explain it to them in an essay. Can you answer their questions:

- How does it *feel* to become unconcious (go to sleep)? What *happens* when you go to sleep?
- What about your thoughts? Do ideas just run along and suddenly stop, or do they move less aanndd lleeessss rraaaaaappppppiiddddddll-lllllyyyyyyyyyyyyyyy? How does the mind actually turn off?
- Why do humans need to sleep? What happens if you don't sleep?
- Can you hear or feel when you are asleep?

Feel free to explain anything else about sleep which you think the aliens ought to know about!

8 On solids, liquids and gases

Examine the data in the table below:

Substance	Description	Density of subtance in g per cm^3	Relative mass of the particles which make up the substance
Oxygen	Colourless gas	0.0013	32
Water	Colourless liquid	1.00	18
Aluminium	Silvery metal	2.7	27

In terms of the particles which make up the substance—molecules O_2 and H_2O for oxygen and water, and atoms Al for aluminium—explain the following:

a. The fact that oxygen is so much lighter (almost a thousand times lighter!) than water and aluminium, whearas the densities of liquids and solids are much the same.

b. Oxygen gas is very difficult to contain. You made some oxygen in lessons; what do you think would have happened if you had left the test tube of oxygen open for a few minutes? Where would the oxygen have gone?

c. Water is very easy to contain. When poured into a container, it takes the shape of the container and stays there for a good time.

d. Anything made of aluminium has a fixed shape – it does not need a container.

9 On gas pressure

Consider a gas syringe filled with 48 cm^3 of oxygen gas. There will be about 1.2×10^{21} oxygen molecules trapped in the syringe; all of these molecules together will weigh about 0.064 g, and if we cooled the gas until it became a liquid, the liquid would only have a volume of about 0.1 cm^3.

a. Draw particle diagrams for gas oxygen and liquid oxygen.

b. Why does the piston of the syringe not move even though the oxygen molecules are hitting the inside face of it?

c. If we push on the syringe, the volume goes down and the gas gets harder to compress further – it is difficult to push the volume down below 20 cm^3. Explain why this is the case and put in words the relationship between the volume of a gas and the pressure in it.

d. Predict that happens to the volume of our oxygen when the syringe is heated up. Give a reason for your prediction. Again put in words the relationship between a gas' volume and the temperature.

e. **0°C is unimportant in terms of dealing with gas volumes but 0 K is of absolute significance. Explain why this is so.