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# Is It Easy To Teach Science?

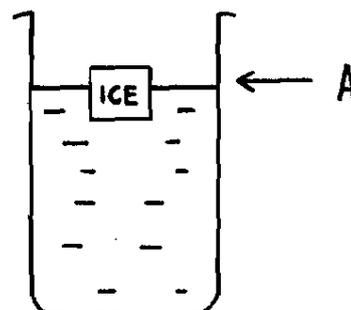
FOONG YOKE YEEN

Is it easy to teach science? Yes, if you have a good knowledge of science and good pedagogical skills or if you do not have a good knowledge of science but you are willing to learn, read and to think more about science. No, you will not make a good science teacher if you do not have a good knowledge of science and good pedagogical skills, nor have the aptitude for science.

I had the privilege of giving a couple of lectures on Heat to Science Instructors (for primary schools) last November and we discussed various questions posed by primary pupils. The topic of Heat in primary science covers the areas expansion of solids, liquids and gases, temperature and thermometers, change of state, and heat transfer, and questions asked by the brighter primary pupils can stump even graduate teachers. Below are some of the type of questions the pupils posed.

You may be a graduate science teacher, but test yourself if you will make a good primary science teacher.

1. If you heat a metallic cube with a hole drilled right through the centre, will the hole be bigger, remain the same or become smaller?
2. What is used in the modern clinical thermometer which changes colour to indicate different temperatures?
3. With reference to the diagram below, when the cube of ice melts, will the new water level be



- a. above A
- b. at A
- c. below A

Explain your answer.

4. Is it better to add salt to your stew? Give reasons for your answer.
5. Why is it that when you add salt to oil when you are frying fish, the fish will be cooked more rapidly and come out in one nice piece?
6. When you make use of a piece of aluminium foil in your cooking, how do you wrap your food – the dull or the shiny side in contact with the food?
7. Your grandmother would probably ask you to add vinegar and/or salt if you wish to make 'uncracked' boiled eggs? Is she correct? Give reasons for your answer.
8. Mercury seems to be the only metal which is a liquid. Does it ever become a solid, and if it does, when does it happen?
9. Are deserts always hot?
10. Can you see water vapour when water boils?

Do not read on further until you have answered the above questions. When you have completed answering the above, count your score. The answers to the above are:

1. The hole in the cube will be larger. According to the kinetic theory of matter, on heating, the intermolecular distance increases. The number of molecules remains the same. In order for the intermolecular distance to increase, the hole will have to be larger. The expansion then is outwards.
2. Liquid crystals are used. The molecular arrangement of liquid crystals is affected by such factors as temperature, pressure and the presence of electric and magnetic fields; changes in the molecular arrangement in turn produce changes in optical properties such as colour, transparency and the amount by which polarized light passing through the liquid crystal is rotated.

3. The answer is b. This is due to the anomalous behaviour of water. As ice melts, its volume shrinks. At very nearly 4°C, water has a maximum density of 1 g/cm<sup>3</sup> and at 0°C, its density is 0.99987 g/cm<sup>3</sup> and on freezing (becoming ice), its density is 0.9168 g/cm<sup>3</sup>.
4. Besides enhancing the flavour of your meats and vegetables, adding salt would decrease cooking time and hence save on fuel bills. Salt, an 'impurity' when added to water, raises its boiling point. Food is cooked more rapidly by boiling in salt.
5. Again, salt is an 'impurity' in oil. It raises the boiling point of oil and also reduces 'bumping'. The skin of the fish will not tear off easily.
6. The dull side should be on the outside to absorb radiant heat. Heat conducted through the aluminium foil will be easily radiated/reflected by the shiny surface (in contact with the food) to the food. Hence the food will be cooked more rapidly.
7. This time, your grandmother is right, though she may not know the reasons for her belief! Adding salt would raise the boiling point of the water. The eggs will be cooked faster and there is less rough boiling to crack the egg shells. Adding vinegar (acetic acid), a weak acid to the eggs, would initiate a chemical reaction. Calcium carbonate, the chief constituent of the egg shell, would be changed to calcium chloride. Hence at least the outside of the egg shell will be less brittle and there is less of a chance of the egg shell becoming cracked.
8. Mercury is a liquid at room temperature. It becomes a solid below -39°C.
9. No. In the daytime, heat is absorbed, raising its temperature. At night, there is no sun. Consequently, no heat is absorbed.

10. No. Very often, the 'cloud' above the boiling water is taken to be the water vapour. This is not water vapour. To find out what it is, place a burner or candle under the cloud. (It is easier if water is boiled in a kettle. The cloud will then be above the spout.) Immediately the cloud disappears showing that in fact it was condensed water vapour, a cloud of water droplets. Water vapour (dry steam) is invisible. Between the surface of the boiling water and the cloud of condensed water vapour, there is water vapour. You cannot see it but you can see where it is.

If you score 9 to 10, congratulate yourself. If you score 7 to 8, you are alright but you can improve yourself further. If your score is 6 and below, it is dangerous! You may be misleading your pupils when they ask you questions. But do not be disappointed. The questions in the test are mainly application type of questions and everyday examples. In order to be good teachers, next time you come across applications of science, do think about the scientific principles involved. With practice and experience, we will have more confidence and become good science teachers.