Is Science Enough?

The purpose of this lesson is to develop the students' perspective on the scope of science. Several discussion topics are presented, positing situations where an understanding of science is important, but insufficient to resolve the issue.

The class could be divided up into groups to consider each topic, or alternatively the topics divided between groups who then feed back to the class as a whole. It might assist the development of ideas if the discussion topics were presented on cards for the groups to read. Student Resource 3 is a support sheet for the discussion topics, which are also presented below with some comments to help teachers develop the flow of ideas.

Exercise: Discussion topics

- Your doctor advises you to have your child immunised from an infectious disease that, if they caught it, would make them very poorly. However, there is a 1:1000 chance that the child could suffer some bad side effects from the drug. Will you allow the process? (*While impinging on biology rather than physics, this is an important topic and helps to get the discussion process going. Students may not appreciate aspects of the issue relating to the risks of the disease spreading if vaccination rates are too low and only focus on the relevance for their own child. You can help to broaden the discussion by pointing this out.*)
- The government says that, due to the energy crisis and the threat of global warming, it is going to invest heavily in nuclear power. They are going to have a referendum (public vote) to approve the idea. Which way will you vote? *(Nuclear energy and energy resources in general are a part of many Year 10-11 physics courses. Teachers can help the discussion by having some relevant facts and figures to hand, such as the percentage of electricity generated by nuclear power in various countries. Students may already be familiar with some of the technical aspects of nuclear power, but the key points are the efficiency, low level of global warming emissions and the safety issues surrounding the long-term storage of waste. Physics can spell out the advantages and disadvantages, but cannot be the only factor in coming to a decision.)*
- You are visiting a developing country as part of a team that is trying to help them with their hunger and disease problems. There is an ideal site for a solar farm that will generate electricity for fridges (to keep drugs cool) and for water pumping and purification. There are other sites, but they are either too far from the village or there are too many trees. Unfortunately, the ideal site has great cultural / religious significance for the villagers (perhaps it is a burial ground). The group leaders wish to build the solar farm there anyway. What is your view? *(Some students may have a knee-jerk reaction to this and decide that the farm should be built against the*

wishes of the village. However, other factors need to be considered – would the villagers use the power generated in that way or reject it? Would such a decision turn the population against the team, making it harder to work with the village going forward? These are practical aspects of the decision, but the ethical aspects are of crucial importance and could be brought out by presenting the students with other examples: e.g. would they approve of their favourite pizza parlour being knocked down to be replaced by a car park, making it easier to get into town?)

- You are discussing art and music with a friend. They point out that every colour that you see on a painting can be related to wavelengths of light. The eye turns the light into electrical signals sent to the brain. Equally, each note in a piece of music is carried by sound waves in the air. The ear converts those waves into electrical signals that travel along nerve paths to the brain. Your friend claims that physics tells you all that there is to know about art and music. Do you agree? Is there anything more to the experience of seeing a painting or listening to music that is not covered by the physics (or any other science for that matter)? Is it important to understand physics in order to study art and music? *(While this is a classic philosophical debate, it may well be new to the students. This topic raises fundamental questions regarding the extent to which science can capture and explain the content of experience. As a result, it impacts on some of the key issues relating to the scope of science. In the end, such questions lead to thoughts about the nature of consciousness, which is too deep a philosophical hole to venture into here; however, it is worth mentioning in passing as it might stimulate some students to further enquiry. In approaching these questions, it may well help to point out that there are levels of information and understanding. We can analyse the ink on a page to find its chemical composition, but this will not help us distinguish between a page of meaningful text and random splatters on the paper. Information and emotion are the key aspects of art and music that cannot be captured within physics. Another context might help – does an understanding of the physics of motion help you enjoy (or be better at) a game of football? To what extent does the physics impact on the tactics in the game?)*