Tony Hansen / Merton College Occam Lecture / February 25th, 2013

Challenge questions based on Fundamental Principles of Physics

1. What would happen to world climate if ice sank instead of floating on water? (Most other solids sink in their melted liquids)

2. Temperature of block of 'dry ice' is -77'C. Lowest temperature ever recorded at Vostok is -89'C. Why wasn't there "CO2 snow"?

3. Why is a candle flame yellow?

4. Why does the sheet of foil make a 'crack' noise when the photoflash is on the soot-blackened side?

5. 3 familiar objects: ball-point pen, screwdriver, soldering iron

    a. Ball-point pen.
        i. What's inside it? How does it work?
        ii. Why can you write on paper but not on glass?

    b. Screwdriver.
        i. Both parts transmit mechanical torque.
        ii. Handle transmits light, but not electricity.
        iii. Shaft reflects light, transmits electricity.

    c. Soldering iron
        i. Why can you burn yourself but not get an electric shock?

    d. Which of these have you used in the last day/week/month?

6. How would you estimate the power dissipation of a mechanical cuckoo-clock? (what basic principles would you use?)

7. How would you estimate the equivalent power (i.e. rate of energy transfer) when pumping petrol into your car? (Petrol = 46 MJ/kg.) What are the implications of this for the consumer acceptance of electric vehicles?