Name: ..... Date: .....

Nanochemistry

On 29th December 1959 a famous physicist called Richard Feynman gave a talk called 'There's plenty of room at the bottom'. He described his vision for science done at an atomic level. At the time, this was very 'futuristic' and daring. Here are two sections of the talk.

There's plenty of room at the bottom

'There's plenty of room at the bottom'
by Richard Feynman

'I would like to describe an area of science, in which little has been done, but in which an enormous amount can be done... What I want to talk about is the problem of manipulating and controlling things on a small scale.... It is a staggeringly small world that is below. In the year 2000, when they look back at this age, they will wonder why it was not until the year 1960 that anybody began seriously to move in this direction.'

Near the end of the talk he said,

'...we can do chemical synthesis. A chemist comes to us and says, 'Look, I want a molecule that has the atoms arranged like this, so make me that molecule.' The chemist does a mysterious thing when he wants to make a molecule. He ...mixes this and that, and he shakes it, and he fiddles around. And at the end of a difficult process, he usually does succeed in making what he wants..... But it would be possible for a physicist to make any chemical substance that the chemist writes down. Give the orders.... put the atoms down where the chemist says and so you make the substance. The problems of chemistry and biology can be greatly helped if our ability to see what we are doing and to do things on an atomic level is ultimately developed – a development which I think cannot be avoided.'

Questions

1. What world did Feynman mean when he said 'It is a staggeringly small world that is below'?

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2. Feynman gave this talk in 1959. How long ago (in years) was it? Why is this talk regarded as a 'classic'? .....

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3. In the second section Feynman talks about chemistry. What are the two ways he describes for making a molecule? .....

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4. Is it now possible to put 'atoms down where the chemist says'? Why might this help solve the 'problems' of chemistry and biology? .....

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5. Do you think Feynman's vision for nanoscience is now real? Explain your answer. .....

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6. Is it important that scientists have visions for the future of their subject? Explain your answer.

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