**SLIDES 1 -3:**

Introduction to Natural Sciences

**SLIDE 4:**

Illustrates how diverse the natural sciences are but what they have in common is that they are [hard science](http://en.wikipedia.org/wiki/Hard_science), or fields seen as relying on experimental, [quantifiable](http://en.wikipedia.org/wiki/Quantification) data or the [scientific method](http://en.wikipedia.org/wiki/Scientific_method) and focusing on accuracy and objectivity. These usually include physics, chemistry and biology.

By contrast, [soft science](http://en.wikipedia.org/wiki/Soft_science) is used as a [pejorative](http://en.wikipedia.org/wiki/Pejorative) term to describe fields more reliant on [qualitative research](http://en.wikipedia.org/wiki/Qualitative_research), including the social sciences.

**SLIDE 5:**

Students can guess who the scientists are:

Goodall; Ibn Rushd; Mendeleev; Attenborough

**SLIDE 6:**

**PARADIGM:**

**Simple common analogy:** A simplified analogy for *paradigm* is a habit of reasoning, or "the box" in the commonly used phrase "[thinking outside the box](http://en.wikipedia.org/wiki/Thinking_outside_the_box)". Thinking inside the box is analogous with [normal science](http://en.wikipedia.org/wiki/Normal_science). The box encompasses the thinking of normal science and thus the box is analogous with *paradigm.* "Thinking outside the box" would be what Kuhn calls revolutionary science. Revolutionary science is usually unsuccessful, and very rarely leads to new paradigms. However, when they are successful they lead to large scale changes in the scientific worldview. When these large scale shifts in the scientific view are implemented and accepted by the majority, it will then become "the box" and science will progress within it.

Paradigm shifts in the natural sciences-

* Newtonian Mechanics to special relativity
* Creationism to Evolution
* Geocentric- Heliocentric

<http://www.ted.com/talks/lang/en/elaine_morgan_says_we_evolved_from_aquatic_apes.html>

Paradigm shifts in the human sciences

* Short run Pillips curve- LR Phillips curve
* Keynesian versus neo-classical economics

Kuhn also maintained that, contrary to popular conception, typical scientists are not objective and independent thinkers. Rather, they are conservative individuals who accept what they have been taught and apply their knowledge to solving the problems that their theories dictate. Most are, in essence, puzzle-solvers who aim to discover what they already know in advance - "The man who is striving to solve a problem defined by existing knowledge and technique is not just looking around. He knows what he wants to achieve, and he designs his instruments and directs his thoughts accordingly."

During periods of normal science, the primary task of scientists is to bring the accepted theory and fact into closer agreement. As a consequence, scientists tend to ignore research findings that might threaten the existing paradigm and trigger the development of a new and competing paradigm. For example, Ptolemy popularized the notion that the sun revolves around the earth, and this view was defended for centuries even in the face of conflicting evidence. In the pursuit of science, Kuhn observed, "novelty emerges only with difficulty, manifested by resistance, against a background provided by expectation."

And yet, young scientists who are not so deeply indoctrinated into accepted theories - a Newton, Lavoisier, or Einstein - can manage to sweep an old paradigm away. Such scientific revolutions come only after long periods of tradition-bound normal science, for "frameworks must be lived with and explored before they can be broken." However, crisis is always implicit in research because every problem that normal science sees as a puzzle can be seen, from another perspective, as a counterinstance and thus as a source of crisis. This is the "essential tension" in scientific research.

**SLIDES 7 & 8:**

**SLIDE 9:**

Solution:

1. The universe could have started out in a smooth and ordered ... or lumpy and disordered state.
2. Neither of these possibilities agrees with what we observe...
3. One has to use a quantum theory of gravity ....
4. The universe would ... become lumpy and disordered as time went on
5. It seems to me much better ... if you admit in print that you were wrong
6. Some people never admit they are wrong….
7. I had made a mistake...

**Slide 11:**

Students research an example then feedback to class

**Slide 12:**

**Falsifiability** or **refutability** of an assertion, [hypothesis](http://en.wikipedia.org/wiki/Hypothesis) or [theory](http://en.wikipedia.org/wiki/Theory) is the logical possibility that it can be [contradicted](http://en.wikipedia.org/wiki/Contradicted) by an observation or the outcome of a physical experiment. That something is "falsifiable" does not mean it is false; rather, that if it is false, then some observation or experiment will produce a reproducible result that is in conflict with it.

For example, the assertion that "all swans are white" is falsifiable, because it is logically possible that a swan can be found which is not white. Not all statements that are falsifiable in principle are falsifiable in practice.[[1]](http://en.wikipedia.org/wiki/Falsifiability#cite_note-0) For example, "it will be raining here in one million years" is theoretically falsifiable, but not practically so.

A inductivist

B disprove

C testable

D conjectures

E refutations

F critical

G falsificationism

**SLIDE 13:**

Solution:

Violet, Blue, Orange, Yellow, Green, Indigo, Red

**SLIDE 21:**

Pseudo science- see resources on wiki