KNOWLEDGE QUESTIONS I: EULER RELATION

- What are the essential differences between equations like the Euler formulation and the applied mathematics of physics and engineering?

- Based on your own mathematical education so far, do you think that Euler invented or discovered his equation?

- It has often been said that the Euler relation is the most beautiful equation in all of mathematics. What is meant by beauty and elegance in mathematics?

KNOWLEDGE QUESTIONS II: IDEAL GAS LAW

1. What are the similarities and differences between these two equations?

2. Are both equations examples of pure mathematics? Are both firmly in the domain of abstract, analytical knowledge? Do they both convey certainty?

3. The first equation is called Euler's relation and the second equation is known as the Ideal Gas Law. Does knowing the names of the equations change your responses to the previous two questions?

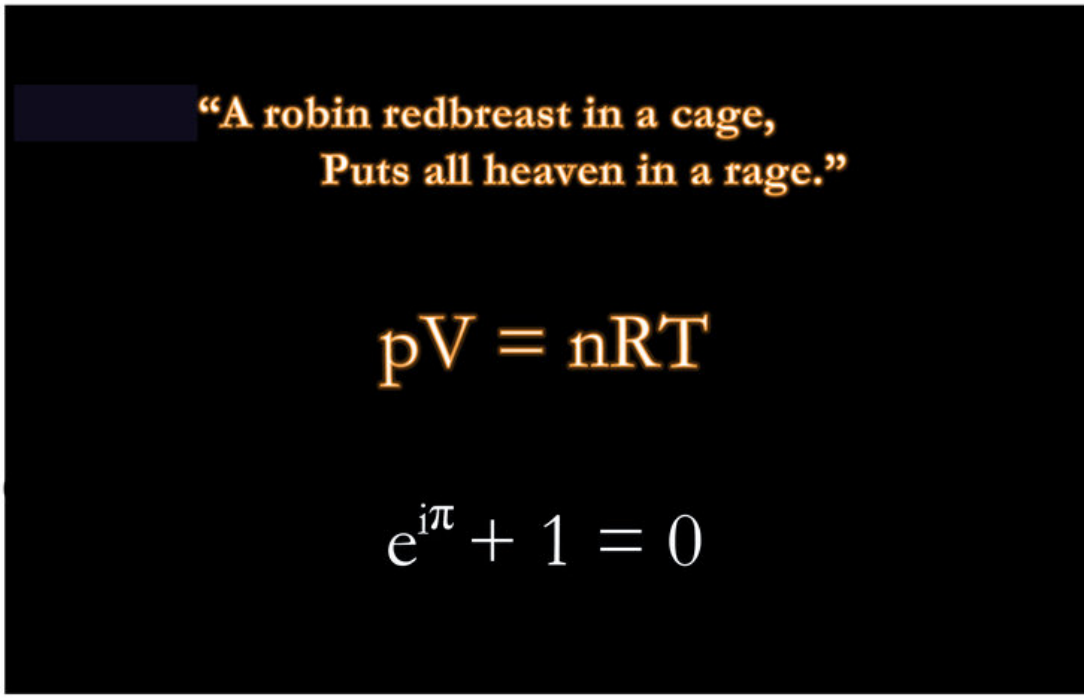
4. For the Ideal Gas Law; what do each of the symbols represent? Why do physicists use lower case letters for p and n? What are the SI units for each of the components?

KNOWLEDGE QUESTIONS III: WRITTEN REFLECTION

5. What is “ideal” about the Ideal Gas Law?

6. When chemists do real world experiments based on the Ideal Gas Law, *actual* results come close to *predicted* results, but they are never identical. Why?

7. What has this got to do with the idea that "The Map is Not the Territory"?



KNOWLEDGE QUESTIONS IV: METAPHOR TO ALGORITHM

- Can we agree that the Blake couplet has much more in common with the Ideal Gas Law than the Ideal Gas Law does with the Euler Relation (despite the superficial resemblance of being expressed in mathematical symbols)? *Whether you agree or disagree, you must argue your case.*

- Can we say that the Ideal Gas Law, the Krebs' Cycle, the definition of Osmosis, the Law of Supply and Demand and, for that matter, all

other models in the natural and human sciences, have more in common with a Shakespeare soliloquy or a Rembrandt self-portrait than they do with the Euler Relation, the Theorem of Pythagoras or the Sine Rule?

TWO BRONOWSKI QUOTES

A Robin Redbreast in a Cage
Puts all Heaven in a Rage.

[L]et no one tell you that this quotation is only a particular statement. It derives its general appeal to us all from its high specificity, and that is the miracle of this kind of remark; but it is a statement which says something about the human situation and not just about a robin or a cage…

When Newton saw the moon as a ball that had been thrown round the earth, he was initiating a gigantic metaphor. And when it finished up, it… it was an algorithm (a formula with which you can calculate).

— Bronowski, Jacob (1978: 45) The Origins of Knowledge and Imagination. Yale University Press, Princeton.

NEWTON'S INVERSE SQUARE LAW OF GRAVITATION

The gravitational attraction between two massive bodies is proportional to the product of those two masses and inversely proportional to the square of the distance between them.