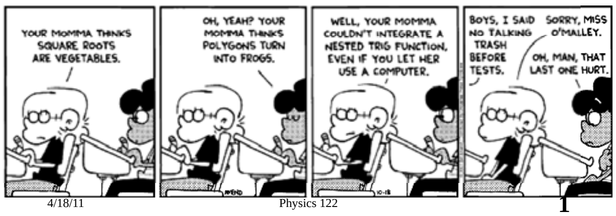
April 18, 2011 Physics 122 Prof. E. F. Redish

- **Theme Music:** Un Bel Di
  Mirella Freni (from Puccini's Madama Butterfly
- **Cartoon:** Bill Arendt
  FoxTrot



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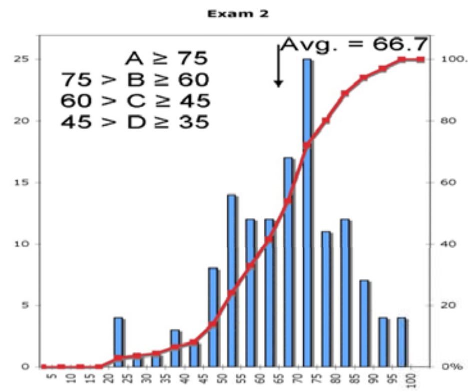

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Results on individual problems

Problem 1	76%
Problem 2	77%
Problem 3	27%
Problem 4	63%
Problem 5	73%

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Problem 1

	1.1	1.2	1.3	1.4	1.5	1.6
a	5%	3%	11%	36%	1%	13%
b	85%	1%	72%	32%	4%	74%
c	4%	84%	7%	21%	91%	8%
d	2%	8%	4%	1%	3%	1%
e	0%	0%	0%	0%	1%	1%
ab	1%	0%	1%	7%	0%	0%
bc	0%	1%	0%	0%	0%	0%
bd	1%	1%	2%	1%	0%	0%
cd	0%	1%	1%	0%	0%	0%
bcd	1%	0%	1%	0%	0%	0%

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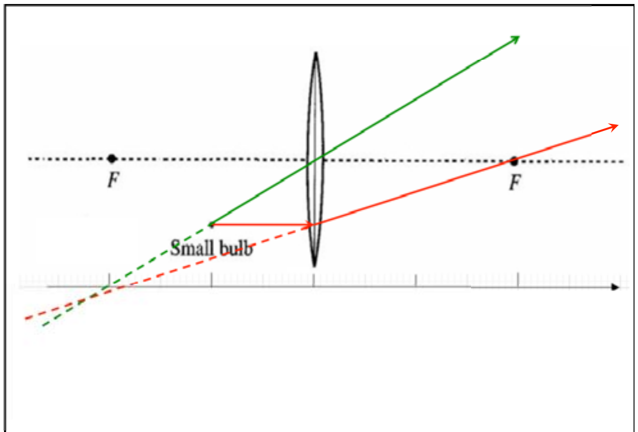

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Sample Essay

On one quiz we had to find where the fish in the water was in relation to its image. We'd just started learning refraction and Snell's law so I didn't remember whether light bent towards or away from the normal in water. We also had only done Newton's explanations for refraction which is counterintuitive because it said light goes faster in denser medium. We needed to know if light bends towards or away from the normal in water to know if the fish appears higher or lower and I didn't have that memorized. But I remembered the principle of total internal reflections, which is where the light bends so much it has to reflect because it can't refract. I remembered we'd done it where the light couldn't escape the water, so from that I figured light bends away from the normal when it goes from water to air… Otherwise the light would not be 'trapped" in the water because it was bending > 90^o from the normal. This gave me the correct result that light bends towards the normal going into water from air and I was able to find where the fish was.

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Sample Essay

I would say that the biggest instance where I have tried to memorize scenarios would be in our study of electrical force and electrical fields. When give two charges, A&B, we have been asked to describe what happens to the magnitude of the force and field when we change each charge. Originally, I told myself that force is dependent on the size of the individual charges while field is not, but after examining the equation I now see that when it comes to fields, it depends on <u>which</u> charge I change.

For force, we can easily follow Coulomb's law ($F = kqQ/r^2$) and see that as either one of our charges changes, the magnitude of the force changes. However, when looking at fields, it is insufficient to say, "the field does not depend on the individual changes." For fields, we used $E = F/q$ meaning that <u>one</u> of the charges (the test charge) does not affect the field. Plugging Coulomb's law into the numerator shows us that the field does depend on the size of the charge <u>generating</u> the field, but not on the size of the charge we use to <u>measure</u> the field.

SO if we have A and B, and are examining the field that A feels, then doubling the charge of A has no effect on the strength of the field, because we are examining the field generated by B. If we double B, though, then the strength of the field will double no matter what size charge is at A.

Memorizing the effects of changing the system is insufficient – we can use the equation to see that the field is independent of the test charge, and then must determine which is the test charge and which charge generates the field.