TOSS-UP

1) MATH If two graphs have the same sets of vertices but if an edge is in one graph only if it is not in the other, what are they called?

W) Isomorphic

X) Inverse

Y) Complementary

Z) Adjacent

ANSWER: Y) Complementary

# BONUS

MATH 1) In graph 2, find an Eulerian trail. 2) Using the degrees of the vertices only, determine whether or not graph 1 has an Eulerian circuit. 3) Using Euler’s relation, if a graph has 5 vertices and 8 regions, how many edges does it have?

ANSWER: 1)1641245734 2) The degree of some of the vertices is odd, no circuit.

3) 11

# TOSS-UP

2) Energy Which of the following would decrease the capacitance of a parallel-plate capacitor? Using smaller plates, decreasing the voltage between the plates, and replacing the dielectric material between the plates with one that has a smaller dielectric constant?

ANSWER: The first and the third

# BONUS

2) Energy 1) What type of energy plant is this? 2) What is the structure in yellow? 3) What is the structure in red?

ANSWER: 1) Nuclear reactor 2) Generator 3) Steam Turbine

**TOSS-UP**

3) Earth and Space Science Earth and Space Science What is the level below which a stream cannot erode its valley?

Answer: Base level

# BONUS

3) Earth and Space Science 1) What is the fault at the top 2) Name the red and blue lines

ANSWER: 1) Left lateral strike slip fault 2) Red: Fault Scarp Blue: Foot wall

# TOSS-UP

4) Biology What principle states that given certain rules about DNA changes over time a tree can be found that reflects the best sequence of evolutionary events?

W) Maximum likelihood

X) Maximum parsimony

Y) Phylogenic bracketing

Z) Shared Ancestral Character

ANSWER: W) Maximum likelihood

# BONUS

4) Biology 1) What is this? 2) What types of bonds are in this?

ANSWER: 1) tertiary structure 2) Disulfide, Hydrogen, Ionic, Hydrophobic Interactions/Vander walls

**TOSS-UP**

5) Chemistry *Short Answer* What is the phase change from gas to plasma called?

ANSWER: Ionization

# BONUS

5) Chemistry 1) What order rate law does this substance have? 2) If the equation for the line is ln A0 = 3t, what is the half life of this reaction to two significant figures?

ANSWER: 1) First 2) 0.231

# TOSS-UP

6) Physics *Short Answer* What is the average power developed when moving a 3 kg block from rest 8 m in 2 seconds by a 12 newton horizontal force on a frictionless surface?

W) 24 W

X) 32 W

Y) 48 W

Z) 96 W

ANSWER: Y) 48 W

# BONUS

6) Physics Using Kirchoff’s laws, 1) What is I\_R1 2) What is I\_R4?

ANSWER: 1) 2 2) 0.714

**TOSS-UP**

7) Math What is the sum of the series: 1, 1/3, 1/9, 1/27, 1/81, 1/243, 1/729, and so on?

W) 3/2

X) 3/5

Y) ¾

Z) 4/3

ANSWER: W) 3/2

# BONUS

7) Math 1) What are the two operations in the two Cayley tables above? (specific) 2) What is the function below from X -> Y called? 3) What is Y -> Z called?

ANSWER: 1) Multiplication modulo 5, addition modulo 5 2) Injection, Bijection/One-to-one, Onto

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# TOSS-UP

8) Energy What country exports the most coal?

W) China

X) US

Y) India

Z) Australia

ANSWER: Z) Australia

# BONUS

8) Energy 1) What substance enters the system at the red dot? 2) What goes through the recycle blower at the blue dot? 3) What comes out at the yellow dot that is eventually distributed for resale?

1) Air, 2) CO2, 3) Sulfur

**TOSS-UP**

9) Earth and Space Science What generates about 90% of Earth’s magnetic field?

W) Crust

X) Inner Core

Y) Lower Mantle

Z) Fluid Outer Core

ANSWER: Z) Fluid Outer Core

# BONUS

9) Earth and Space Science Name the three angles represented by dots.

ANSWER: Green – colatitude, zenith angle, blue- azimuth

# TOSS-UP

10) Biology Visual pigments in the rods or cones of the eyes consist of light-absorbing molecules called retinal bound to membrane proteins called what?

ANSWER: Opsin

# BONUS

10) Biology Name the three unlabeled parts (2 of them are pointing at the same thing)

ANSWER: Endodermis , cortex (in back), Casparian STRIP

**TOSS-UP**

11) Chemistry What is the phase change from gas to solid called?

ANSWER: Deposition

# BONUS

11) Chemistry 1) Name this structure 2) Name #4

ANSWER: 1) Electrolytic cell 2) Anode

# TOSS-UP

12) Physics What is the function of the work done on an object if the force on the object is 3x^2 + 6x + 5?

Answer: x^3+3x^2+5x+C

# BONUS

12) Physics What is the Thevenin-equivalent voltage through this circuit?

ANSWER: 7.5 V