

### TOSS UP-SWITCH WITH THE BONUSvvvvv

1. BIOLOGY *Short Answer* What is the name of the group of mitochondrial proteins which are released into the cytosol following an increase in permeability of the mitochondrial membrane, which binds to inhibitor of apoptosis proteins and deactivates them, preventing the IAPs from arresting the apoptotic process and therefore allowing apoptosis to proceed.

ANSWER: small mitochondria derived activator of caspases (smacs)

### BONUS

2. BIOLOGY *Short Answer* Tumor Necrosis Factor is a cytokine produced mainly by what class of cells?

ANSWER: macrophages

### TOSS UP

3. PHYSICS *Short Answer* Denote by name or number all of the following 3 statements which are true of the photoelectric effect.
  1. For the given frequency of incident radiation, the stopping potential is dependent on its intensity.
  2. For a given frequency of the incident radiation, the stopping potential  $V_0$  is related to the maximum kinetic energy of the photoelectron that is just stopped from reaching plate Q
  3. If  $e$  is the charge on the electron and  $V_0$  is the stopping potential, then the work done by the retarding potential in stopping the electron =  $eV_0$

ANSWER: 2 and 3

### BONUS

4. PHYSICS *Short Answer* What is the name of the high energy analogue of the photoelectric effect, a form of light matter interaction which refers to the creation of an elementary particle and its antiparticle.

ANSWER: PAIR PRODUCTION

### TOSS UP-switch with BONUSvvvvvvv

5. CHEMISTRY *Short Answer* Magnesium and Copper (I) Sulfate are reacted to form Magnesium Sulfate and Copper. If 48 g of Magnesium are present initially and 32 g of Copper are formed, how many grams of Copper (I) Sulfate have reacted?

ANSWER: 56 GRAMS

**BONUS**

6. CHEMISTRY *Multiple Choice* The oxidation of primary alcohols can produce which of the following pairs of products, depending on the reaction?
- W) Aldehydes and Carboxylic Acids
  - X) Ketoens and Carboxylic Acids
  - Y) Aldehydes and Ketones
  - Z) Ketons only

ANSWER: W) ALdejk hdkjfs

**TOSS UP**

7. EARTH AND SPACE SCIENCE *Short Answer* When Type 1b and 1c supernovae are compared to type 1a supernovae, they lack the absorption lines of what metalloid element?

ANSWER: SILICON

**BONUS**

8. EARTH AND SPACE SCIENCE *Multiple Choice* The cosmological constant was proposed by Albert Einstein as a modification of his original theory of general relativity to achieve what type of universe?
- W) Expanding
  - X) Collapsing
  - Y) Stationary
  - Z) Flat

ANSWER: Y) STATIONARY

**TOSS UP**

9. MATH *Short Answer* Find the derivative of of the function  $f(x) = 3\ln(x^3+2)$ ?

ANSWER:  $(9x^2)/(x^3+2)$

**BONUS**

10. MATH *Short Answer* A large basket of fruit contains 3 oranges, 2 apples and 5 bananas. If a piece of fruit is chosen at random, what is the probability of getting an orange or a

banana?

ANSWER: 4/5

**TOSS UP**

11. ENERGY *Short Answer* What measure of a nuclear reactor's performance is defined as the average number of fissile atoms created per fission event?

ANSWER: BREEDING RATIO

**BONUS**

12. ENERGY *Multiple Choice* What is the current accepted leading technique for uranium prospecting with worldwide applications for geological mapping, mineral exploration & environmental monitoring?
- W) Using Geiger Counters
  - X) Using Scintillation Counters
  - Y) Gamma Ray Spectrometry
  - Z) Geophysical Prospecting

ANSWER: y) gamma ray spectrometry

**TOSS UP**

13. BIOLOGY *Short Answer* Denote by name or number all of the following 4 ocean zones which are areas in which echinoderms can be found.

- 1. Intertidal
- 2. Abyssal
- 3. Benthic
- 4. Neritic

ANSWER: ALL

**BONUS**

14. BIOLOGY *Short Answer* What biological kingdom is responsible for the clinical condition known as ringworm?

ANSWER: FUNGI

**TOSS UP**

15. PHYSICS *Short Answer* Light traveling through an optical fiber ( $n=2$ ) reaches the end

of the fiber and exits into a medium with  $n=2$ . If the angle of incidence on the end of the fiber is  $30^\circ$ , what is the angle of refraction outside the fiber?

ANSWER:  $30^\circ$

### BONUS

16. PHYSICS *Short Answer* What form of diffraction is used to model the diffraction of waves when the diffraction pattern is viewed at a long distance from the diffracting object

ANSWER: FRAUNHOFER DIFFRACTION

### TOSS UP

17. EARTH AND SPACE SCIENCE *Short Answer* What type of volcanic eruptions are marked by columns of gas and volcanic ash extending high into the stratosphere, a high layer of the atmosphere? The key characteristics are ejection of large amount of pumice and very powerful continuous gas blast eruptions.

ANSWER: PLINIAN

### BONUS

18. EARTH AND SPACE SCIENCE *Short Answer* Classify the following 4 geological features as characteristic of divergent, convergent or transform boundaries.

1. San Andreas Fault
2. Mid Atlantic Ridge
3. Andes Mountains
4. Mariana Trench

ANSWER: Transform, Divergent, Convergent, Convergent

### TOSS UP

19. ENERGY *Short Answer* What is the type of solar cell, as opposed to silicon wafers, that is made by depositing one or more thin layers of photovoltaic material on a substrate?

ANSWER: THIN FILM SILICON CELLS

### BONUS

20. ENERGY *Short Answer* Denote by name or number all of the following 4 statements

which are disadvantages of photovoltaic solar panels.

1. They contain lead, mercury and cadmium.
2. A solar energy installation requires a large area.
3. Initial cost of the equipment
4. They are not long lasting and require lots of maintenance.

ANSWER: 1, 2, and 3