ROUND 1

TOSS UP

1. ESSC *Multiple Choice* Which of the following statements about glacier movement is true?

W. Plastic flow results from the sliding of a glacier along its base.

X. Valley glaciers in cold regions generally move by basal slip.

Y. A sudden period of fast movement of a valley glacier is called a surge.

Z. Crevasses are more likely to occur in areas of high basal flow.

ANSWER: Y. A SUDDEN PERIOD OF FAST MOVEMENT OF A VALLEY GLACIER IS CALLED A SURGE.

BONUS

1. ESSC *Short Answer* What principle explains why an ice shelf or iceberg floats on the ocean?

ANSWER: PRINCIPLE OF ISOSTASY

**TOSS-UP**

1. ESSC *Multiple Choice* –Which type of cloud-lifting phenomena results in weather associated with mid-latitude cyclones and hurricanes?
   1. Orographic lifting
   2. Convergence
   3. Frontal wedging
   4. Localized convective lifting

ANSWER: X. CONVERGENCE

**BONUS**

1. ESSC *Short Answer –* If abundant feldspar is present in sand, what is the rock that is formed called?

ANSWER: ARKOSE

TOSS-UP

1. ESSC *Multiple Choice* Which of the following correctly described the solar feature called spicules?

W. Long, dark silhouettes seen in an a filtergram of the Sun at the wavelength of the H Balmer line

X. Flamelike jets of gas extending upward into the chromosphere

Y. Rising and falling columns of gas arranged in a honeycomb pattern

Z. A large, bright burst of plasma often extending outward in a loop shape.

ANSWER: X. FLAMELIKE JETS OF GAS EXTENDING UPWARD INTO THE CHROMOSPHERE

BONUS

1. ESSC *VISUAL* Observe the picture taken by the Hubble Space Telescope and determine the following:

1. What is the name of this famous photograph?

2. What is common name of the object seen in this photograph and what is the Messier number?

3. What is the name of the nodules that are circled in white?

ANSWER: 1. “PILLARS OF CREATION” 2. EAGLE NEBULA, M16 3. EVAPORATING GASEOUS GLOBULES

TOSS-UP

4. ESSC *Short Answer* When a turbidity current reaches the continental rise, it slows down, depositing its sediment and forming a

ANSWER: SUBMARINE FAN

BONUS

4. ESSC *VISUAL* Answer the following questions about the type of precipitation shown in this picture:

1. Name Objects A through E.

2. What is the most common cloud that produce object D?

3. Object A is similar in appearance to another form of precipitation. However, this other form of precipitation is formed by the direct deposition from water vapor to solid ice. What is this other form of precipitation

ANSWER: 1. A: RIME, B: SNOW, C: ICE PELLETS or SLEET, D: HAIL, E: RAIN, 2. CUMULONIMBUS, 3. HOAR FROST

TOSS-UP

5. ESSC *Multiple Choice* Which of the following types of radiation would you look for if you were trying to detect a hypernova explosion??

W. X-ray

X. Radio waves

Y. Gamma rays

Z. Microwaves

ANSWER: Y. GAMMA RAYS

BONUS

1. ESSC *Short Answer* What is the name for the phenomenon that describes the manner in which x-ray light from an astronomical object flickers around certain frequencies?

ANSWER: QUASI-PERIODIC OSCILLATION

TOSS-UP

1. BIOL *Multiple Choice* Very prematurely born babies sometimes suffer a major problem where they lack an integral part of the respiratory system. What do they lack that causes this problem?

W. Surfactants on alveoli

X. Cilia on alveoli

Y. Significant air currents within alveoli

Z. Connection to bronchioles.

ANSWER: W. SURFACTANTS ON ALVEOLI

BONUS

1. BIOL *Short Answer* Name the two regions of the brain that set the basic breathing rhythm and moderate the rhythm respectively.

ANSWER: MEDULLA, PONS (must be in that order)

TOSS-UP

1. BIOL *Multiple Choice* Which of the following viruses have the iconic icosahedral head and a tail apparatus?

W. Tobacco mosaic virus

X. Adenovirus

Y. Influenza virus

Z. Bacteriophage T4

ANSWER: Z. BACTERIOPHAGE T4

BONUS

1. BIOL *VISUAL* Answer the following questions about a cellular process:

1. What is the name of the cellular process shown here?

2. What sequences of mRNA would appear at A and B?

3. Which ends of the mRNA strand are denoted by C and D?

ANSWER: 1. POLYPEPTIDE SYNTHESIS, 2. A: UGG, B: UUC, 3. C: 5 PRIME END, D: 3 PRIME END

TOSS-UP

1. BIOLOGY *Multiple Choice* The Irish potato famine was caused by eukaryotes from which of the following phylums?

W. Stramenopiles

X. Haptophytes

Y. Cryptophytes

Z. Ciliates

ANSWER: W. STRAMENOPILES

BONUS

1. BIOLOGY *Short Answer* What is the largest and most complex type of algae, which is also a stramenopile?

ANSWER: BROWN ALGAE

TOSS-UP

1. BIOL *Multiple Choice* Which of the following is not one of Darwin’s original observations of nature, leading to his theory of natural selection?

W. Members of a population often vary greatly in their traits

X. Traits are acquired through the lifetime of an individual

Y. All species produce more offspring than their environment can support

Z. Many of the offspring do not survive.

ANSWER: X. TRAITS ARE ACQUIRED THROUGH THE LIFETIME OF AN INDIVIDUAL

BONUS

1. BIOL *Short Answer* What are species that are found nowhere else in the world called?

ANSWER: ENDEMIC

TOSS-UP

1. BIOL *Multiple Choice* Which of the following neurotransmitters serves solely to facilitate an inhibitory response?

W. Substance P

X. Dopamine

Y. Glutamate

Z. Glycine

ANSWER: Z. GLYCINE

BONUS

1. BIOL *VISUAL* Answer the following questions about the human vertebral column:

1. Name the 5 regions of the vertebral column as they correspond to the colors, red, blue, yellow, green, and purple.

2. Two of the vertebrae have arrows next to them. Give the name for these two vertebrae as they correspond to the pink and black arrows.

3. A patient is diagnosed with an odontoid fracture and a hangman’s fracture. Give the color of the region that the patient has injured.

ANSWER: 1. RED: CERVIAL, BLUE: THORACIC, YELLOW: LUMBAR, GREEN: SACRAL, PURPLE: COCCYGEAL, 2. PINK: ATLAS, BLACK: AXIS, 3. RED

TOSS-UP

1. CHEM *Multiple Choice* Which of the following molecules contains an odd number of electrons and thus can never satisfy the octet rule?

W. NO

X. BF3

Y. SF6

Z. SCl2

ANSWER: W. NO

BONUS

1. CHEM *VISUAL* Answer the following questions about molecular geometry:

1. What is the shape of objects A-D?

2. How many bonding electron pairs are found in objects A-D?

3. What would be the hybridization of objects A and C?

ANSWER: 1. A: TETRAHEDRAL, B: T-SHAPED, C: TRIGONAL BIPYRAMIDAL, D: SEESAW, 2. A: 4, B: 3, C: 5, D: 4, 3. A: *sp3*, B: *sp3d*

TOSS-UP

1. CHEM *Multiple Choice* Which of the following is generally considered to be an advantage in using molarity over molality?

W. Molarity is independent of temperature.

X. Molarity is easier to measure as it is easier to measure the volume of a solution than to weigh the solvent

Y. Molarity more similar to percent by mass than is molality

Z. Molarity requires only the masses of the solute and solvent.

ANSWER: X. MOLARITY IS EASIER TO MEASURE AS IT IS EASIER TO MEASURE THE VOLUME OF A SOLUTION THAN TO WEIGH THE SOLVENT

BONUS

1. CHEM *VISUAL* The following series of question concern various types of laboratory glassware:

1. Name all objects A-E?

2. What type of glass is generally used for this kind of glassware?

3. Which of the 5 objects is generally used to heat liquids?

ANSWER: 1. A: BUCHNER FLASK, B: VOLUMETRIC FLASK, C: BUCHNER FUNNEL, D: ERLENMEYER FLASK, E: FLORENCE FLASK; 2. BOROSILICATE GLASS; 3. OBJECT D

TOSS-UP

1. CHEM *Multiple Choice* Which of the following statements concerning strengths of acids and bases is true?

W. If an acid is strong, its conjugate base is also strong.

X. Weak acids ionize completely with water.

Y. Ammonia is the strongest base that can exist in an aqueous soluton

Z. H3O+ is the strongest acid that can exist in an aqueous solution.

ANSWER: Z. H3O+ IS THE STRONGEST ACID THAT CAN EXIST IN AN AQUEOUS SOLUTION.

BONUS

1. CHEM *Short Answer* Order the following acids from least acidic to most acidic: ammonia, hydrobromic acid, hydrofluoric acid, acetic acid?

ANSWER: AMMONIA, ACETIC ACID, HYDROFLUORIC ACID, HYDROBROMIC ACID

TOSS-UP

1. CHEM *Short Answer* What is the slowest step in a sequence of steps leading to product formation called?

ANSWER: RATE-DETERMINING STEP

BONUS

1. CHEM *Short Answer* If the half life of a first order reaction is represented by ln 32, what would be the rate constant of this reaction?

ANSWER: 0.2 s^-1

TOSS-UP

1. PHYS *Multiple Choice* Which of the following statements concerning convection is true?

W. Airflow at a beach is an example of forced convection.

X. A hot water heating system is an example of natural convection.

Y. An automobile engine uses a combination of conduction and natural convection to maintain a safe operating temperature.

Z. Algal blooms are caused by convection currents lakes

ANSWER: Z. ALGAL BLOOMS ARE CAUSED BY CONVECTION CURRENTS IN LAKES

BONUS

1. PHYS *Short Answer* Order the following substances from least specific heat to most specific heat: mercury, water, ice, silicon.

ANSWER: MERCURY, SILICON, ICE, WATER

TOSS-UP

1. PHYS *Short Answer* What is the name given to the insulating material inserted between the plates of a capacitor in order to increase capacitance?

ANSWER: DIELECTRIC

BONUS

1. PHYS *VISUAL* Answer the following questions on circuitry:

1. In Diagram 1, what do the symbols labeled A-G stand for?

2. In Diagram 2, if R1, R2, and R3 equal 2, 3, and 4 ohms respectively, and the voltage over the battery is 24 volts, what is the current (in amps) flowing through R1?

ANSWER: 1. A: RESISTOR, B: INVERTER, C: CAPACITOR, D: INDUCTOR, E: DIODE, F: TRANSISTOR, G: GROUND; 2. 26/3 AMPERES

TOSS-UP

17. PHYS *Multiple Choice* – Which of the following is not a reason why the Standard Model of Particle Physics fails to be a complete theory of fundamental interactions?

* 1. The Standard Model does not include gravity
  2. The Standard Model does not try to combine general relativity with quantum field theory
  3. The Standard Model is incompatible with neutrino oscillations
  4. The Standard Model does not explain how the Universe is isotropic and homogeneous at large distances

ANSWER: Z. The Standard Model does not explain how the Universe is isotropic and homogeneous at large distances

**BONUS**

17. PHYS *Short Answer* – Which theorem, now readily used in theoretical physics, states that any differentiable symmetry of the action of a physical system has a corresponding conservation law?

ANSWER: Noether’s First Theorem

TOSS-UP

1. PHYS *Multiple Choice* Which series in atomic hydrogen emission spectra covers the ultraviolet region?

W. Lyman

X. Balmer

Y. Paschen

Z. Brackett

ANSWER: W. LYMAN

BONUS

1. HYS *Short Answer* Given that Planck’s constant is 6.6 times 10 to the negative 34 J s, calculate the wavelength associated with a mass of 3.3 times 10 to the negative 30 kg moving at a velocity of 20 meters per second?

ANSWER: 10 TO THE NEGATIVE 5 METERS

TOSS-UP

1. PHYS *Short Answer* This phenomenon was a prediction of late 19th century claccical physics that an ideal black body in thermal equilibrium will emit radiation with infinite power. Einstein pointed out a solution to the problem presented by this prediction. What was the prediction called?

ANSWER: ULTRAVIOLET CATASTROPHE

BONUS

1. PHYS *VISUAL* The following question pertain to subatomic particles:

1. What subatomic particles are represented by figures A-D?

2. If an interaction between figure B and figure C were to occur, what would this interaction be called?

3. Which force is figure D thought to be responsible for?

ANSWER: 1. A: PROTON, B: ANTINEUTRON, C: NEUTRON, D: PION; 2. ANNIHILATION; 3. STRONG NUCLEAR FORCE

TOSS-UP

1. ENER *Short Answer* What type of alternative energy accounts for almost all of the electricity from renewable sources?

ANSWER: HYDROELECTRIC ENERGY

BONUS

1. ENER *VISUAL* The following questions concern wind turbines:

1. Classify the three wind turbines as either HAWT or VAWT.

2. What are the specific names of each of the three turbines?

3. Name any of the three turbines that could be used efficiently in an area of high wind variability.

ANSWER: 1. A: VAWT, B: HAWT; 2. A: SAVONIUS, B: MODERN, C: GIROMILL; 3. A AND C

TOSS-UP

1. ENER *Multiple Choice* What type of nuclear reactor generates new fissible material at a greater rate than it consumes such material, and, unlike normal reactors, is able to use almost all of its initial fissionable material?

W. Fast neutron reactor

X. Breeder reactor

Y. Heavy water reactor

Z. Thermal reactor

ANSWER: X. BREEDER REACTOR

1. ENER *VISUAL* The following questions concern the internal design of nuclear reactors:

1. Name objects A-D.

2. What is the alloy that is most commonly used in Object B?

3. If you were to classify this reactor based on its coolant, what specific type of nuclear reactor would this diagram represent?

ANSWER: 1. A: CONTAINMENT BUILDING, B: CONTROL RODS, C: FUEL RODS, D: REACTION VESSEL; 2. SILVER-INDIUM-CADMIUM; 3. PRESSURIZED WATER REACTOR (PWR)

TOSS-UP

1. MATH *Short Answer* Two cards are drawn one after the other from a standard deck of cards. What is the probability that the second card drawn is an ace of spades?

ANSWER: Z. 1/51

BONUS

1. MATH *Short Answer* There are 7 keys in a key ring. If two more keys are to be added in the ring at random, what is the probability that two keys will be adjacent?

ANSWER: ¼

TOSS-UP

1. MATH *Short Answer* Find the value of the definite integral from -2 to 2 of x cubed plus x dx.

ANSWER: ZERO

BONUS

1. MATH *Short Answer* What is the name for the function named after a German mathematician that describes the relation of the distribution of prime numbers?

ANSWER: RIEMANN-ZETA FUNCTION

TOSS-UP

1. MATH *Multiple Choice* What type of polar equation would the graph of r squared equals a squared times sine 2 theta give?

W. Limacon

X. Lemniscate

Y. Rose curve

Z. Cardioid

ANSWER: X. LEMNISCATE

BONUS

1. MATH *Short Answer* If, in a polar equation, r equals 0.5 and theta equals pi over 6, what does y equal when converted into rectangular form?

ANSWER: 1

TOSS-UP

1. MATH *Multiple Choice* In the partial fraction decomposition for 1/(x5 + x4 – x -1), which of the following polynomials is not one of the denominators of the partial fractions?

W. x - 1

X. (x – 1)2

Y. x + 1

Z. x2 + 1

ANSWER: X. (x – 1)2

BONUS

1. MATH *Short Answer* Write the partial fraction decomposition for 5/(x2 – 5x +6)?

ANSWER: [5/(x-3)] – [5/(x-2)]