

ROUND 17A

TOSS-UP

1) LIFE SCIENCE *Multiple Choice* During the Deep Water Horizon oil spill, marine microbes were observed to consume some of the released hydrocarbons. Which of the following crude oil components is most likely to be degraded quickly by marine microbes?

- W) Naphthalene
- X) Dodecane [**doh-DE-kayn**]
- Y) Xylene [**ZY-leen**]
- Z) Ethane

ANSWER: Z) ETHANE

BONUS

1) LIFE SCIENCE *Multiple Choice* Which of the following is the most detrimental type of point mutation?

- W) Silent mutation
- X) Nonsense mutation
- Y) Missense mutation
- Z) Frameshift mutation

ANSWER: Z) FRAMESHIFT MUTATION

TOSS-UP

2) PHYSICAL SCIENCE *Multiple Choice* What property must be known to calculate the de Broglie [**duh broh-GLLEE**] wavelength of a particle?

- W) Pressure
- X) Electric charge
- Y) Probability
- Z) Momentum

ANSWER: Z) MOMENTUM

BONUS

2) PHYSICAL SCIENCE *Short Answer* Determine the speed of sound, in m/s to two significant figures, traveling through air at a temperature of 50°C.

ANSWER: 360

TOSS-UP

3) ENERGY *Short Answer* Identify the maximum power point tracking algorithm that is easier to implement, does not require any voltage or current sensors, and tends to oscillate around the solution point once one is found.

ANSWER: PERTURB AND OBSERVE

BONUS

3) ENERGY *Multiple Choice* The energy in a thunderstorm comes from which of the following?

- W) Evaporation of water drops
- X) Temperature gradients in the atmosphere
- Y) Condensation of water drops that form the cloud
- Z) Electrical energy from charged particles in the cloud

ANSWER: Y) CONDENSATION OF WATER DROPS THAT FORM THE CLOUD

TOSS-UP

4) GENERAL SCIENCE *Multiple Choice* Which of the following instruments can take measurements as small as one microliter and is used in a laboratory setting to transport specific amounts of liquid?

- W) Beaker
- X) Pipette
- Y) Graduated cylinder
- Z) Burette

ANSWER: X) PIPETTE

BONUS

4) GENERAL SCIENCE *Multiple Choice* What is the primary control device when using flammable and toxic chemicals in the laboratory?

- W) Gloves
- X) Fume hood
- Y) Fire extinguisher
- Z) Goggles

ANSWER: X) FUME HOOD

TOSS-UP

5) EARTH AND SPACE *Short Answer* When limestone is exposed to increasing pressure and temperature; it metamorphoses into what metamorphic rock?

ANSWER: MARBLE

BONUS

5) EARTH AND SPACE *Short Answer* Typically, how many spring tides occur during a month?

ANSWER: TWO

TOSS-UP

6) MATH *Short Answer* Find the solutions of the quadratic equation: $x^2 - 4x - 12 = 0$.

ANSWER: -2, 6

BONUS

6) MATH *Multiple Choice* A student leaves for school on the bus. Her bus travels 25 miles per hour, but stops for 1 minute after every 2 minutes of travel. The route is 8 miles. To the nearest whole number, how many minutes does the trip take?

ANSWER: 28

TOSS-UP

7) LIFE SCIENCE *Multiple Choice* You are constructing a simple ecosystem model to predict microbial growth in a marine environment. Which of the following elements are you least likely to include in your model as a possible limiting nutrient?

- W) Phosphorous
- X) Nitrogen
- Y) Sulfur
- Z) Iron

ANSWER: Y) SULFUR

BONUS

7) LIFE SCIENCE *Short Answer* Tiktaalik [*tik-TA-lik*] is a transitional fossil that serves to fill the gap between what two types of animals?

ANSWER: FISH AND AMPHIBIANS

TOSS-UP

8) PHYSICAL SCIENCE *Multiple Choice* A particular gem has no refraction at angles above 40.7° , there is only total internal reflection. Therefore, 40.7° corresponds to which of the following for this gem?

- W) Angle of refraction
- X) Critical angle
- Y) Angle of incidence
- Z) Maximum angle

ANSWER: X) CRITICAL ANGLE

BONUS

8) PHYSICAL SCIENCE *Multiple Choice* The discovery that stars emit energy across the entire electromagnetic spectrum spurred the development of what technology?

- W) Radio telescope
- X) Microwave oven
- Y) Cellular telephone
- Z) Satellite communication

ANSWER: W) RADIO TELESCOPE

TOSS-UP

9) GENERAL SCIENCE *Short Answer* What medical equipment uses high powered magnets and radio waves to produce high resolution images of the body?

ANSWER: MAGNETIC RESONANCE IMAGING (ACCEPT: MRI, NUCLEAR MAGNETIC RESONANCE IMAGING, NMRI, MAGNETIC RESONANCE TOMOGRAPHY, MRT)

BONUS

9) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT a function of the hypothalamus [*hy-puh-THAL-uh-muhs*]?

- W) Regulating involuntary movements
- X) Regulating body temperature
- Y) Regulating hunger and salt cravings
- Z) Regulating blood pressure

ANSWER: W) REGULATING INVOLUNTARY MOVEMENTS

TOSS-UP

10) EARTH AND SPACE *Short Answer* What kind of nebula is the Cat's Eye Nebula?

ANSWER: PLANETARY NEBULA

BONUS

10) EARTH AND SPACE *Multiple Choice* Which of the following wavelengths of light best passes through Earth's atmosphere and thus is frequently observed using telescopes on Earth's surface?

- W) Radio
- X) UV
- Y) IR
- Z) Gamma

ANSWER: W) RADIO

TOSS-UP

11) MATH *Short Answer* Assuming that x is not 0, simplify the expression $-3x^0 - (2)^{-3}$ [**negative 3 times x raised to the power of 0 minus 2 raised to the power of negative 3**]:

ANSWER: $-25/8$ (ACCEPT: $-3\ 1/8$)

BONUS

11) MATH *Multiple Choice* A fair coin is flipped three times. Given that one of the flips is a head, what is the probability that at least two flips are heads?

- W) $1/4$
- X) $1/2$
- Y) $4/7$
- Z) $3/4$

ANSWER: Y) $4/7$

TOSS-UP

12) ENERGY *Multiple Choice* In a regenerative fuel cell system, the byproducts of a fuel cell are utilized to do which of the following?

- W) Produce electricity via electrolysis
- X) Provide power to a solar energy system
- Y) Provide power to a wind energy system
- Z) Produce reactants that are resupplied to the fuel cell via electrolysis

ANSWER: Z) PRODUCE REACTANTS THAT ARE RESUPPLIED TO THE FUEL CELL VIA ELECTROLYSIS

BONUS

12) ENERGY *Multiple Choice* Researchers are beginning to focus on butanol instead of ethanol as a replacement for gasoline. What is the primary reason for this shift in focus?

- W) Butanol is more cost-effective than ethanol
- X) Butanol is easier to work with
- Y) Butanol can be used in cars without any modifications
- Z) Butanol contains more chemical energy than ethanol

ANSWER: Y) BUTANOL CAN BE USED IN CARS WITHOUT ANY MODIFICATIONS

TOSS-UP

13) LIFE SCIENCE *Short Answer* The nutrient flow in an ecosystem can often be represented with a simple box model. What is the description for the ecosystem when the sources into and sinks out of the box are equal?

ANSWER: STEADY STATE (ACCEPT: EQUILIBRIUM OR STEADY STATE SYSTEM)

BONUS

13) LIFE SCIENCE *Multiple Choice* Where would you find squalene?

- W) In the head of a sperm whale
- X) In the intestines of a sperm whale
- Y) In the liver of a shark
- Z) In the stomach of a shark

ANSWER: Y) IN THE LIVER OF A SHARK

TOSS-UP

14) PHYSICAL SCIENCE *Multiple Choice* Which of the following is a property that is shared by both mixtures and compounds?

- W) They always contain the same ratio of component atoms
- X) They consist of atoms bound together
- Y) They retain many of the properties of their components
- Z) They can be broken down into their individual components

ANSWER: Z) THEY CAN BE BROKEN DOWN INTO THEIR INDIVIDUAL COMPONENTS

BONUS

14) PHYSICAL SCIENCE *Multiple Choice* A neon light does NOT produce which of the following?

- W) Line spectrum
- X) Photons
- Y) Absorption spectrum
- Z) Emission spectrum

ANSWER: Y) ABSORPTION SPECTRUM

TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* What fossil type is formed when a mineral replaces the plant or animal tissue of the organism?

- W) Petrified
- X) Cast
- Y) Imprint
- Z) Mold

ANSWER: W) PETRIFIED

BONUS

15) GENERAL SCIENCE *Short Answer* Name the three main protein filaments that make up the cytoskeleton.

ANSWER: MICROFILAMENTS, INTERMEDIATE FILAMENTS, MICROTUBULES

TOSS-UP

16) ENERGY *Multiple Choice* Beta Pictoris has a mass about 2 times that of the Sun. In this star, how is hydrogen turned into helium?

- W) CNO cycle
- X) PPI
- Y) PPII
- Z) PPIII

ANSWER: W) CNO CYCLE

BONUS

16) ENERGY *Multiple Choice* Which of the following elements is commonly reduced from its oxide with electricity?

- W) Iron
- X) Cobalt
- Y) Aluminum
- Z) Lead

ANSWER: Y) ALUMINUM

TOSS-UP

17) EARTH AND SPACE *Multiple Choice* Rounding your answer to the nearest tenth, a difference of one in the apparent magnitudes of two stars means that the brighter star appears how many times as bright as the dimmer one?

- W) 2.0
- X) 2.5
- Y) 3.2
- Z) 10.0

ANSWER: Y) 2.5

BONUS

17) EARTH AND SPACE *Short Answer* What part of a sundial is responsible for casting a shadow on the dial?

ANSWER: GNOMON (ACCEPT: STYLE)

TOSS-UP

18) MATH Math *Short Answer* Find the product of 111 and 89.

ANSWER: 9879

BONUS

18) MATH *Short Answer* What is the y-intercept of the line that passes through (5, 10) and is perpendicular to the segment with endpoints (1, 4) and (5, 10)?

ANSWER: $40/3$ (ACCEPT: $13 \frac{1}{3}$)

TOSS-UP

19) LIFE SCIENCE *Multiple Choice* Which of the following is the difference between a viroid [**VY-roid**] and a virus?

- W) Viroids do not contain a protein coat; viruses do
- X) Viroids only contain RNA; viruses also contain protein
- Y) Viroids only contain DNA; viruses also contain protein
- Z) Viroids contain DNA; viruses do not

ANSWER: W) VIROIDS DO NOT CONTAIN A PROTEIN COAT; VIRUSES DO

BONUS

19) LIFE SCIENCE *Short Answer* What is the ecological term for the phenomenon of a harmless species mimicking a harmful one?

ANSWER: BATESIAN MIMICRY

TOSS-UP

20) PHYSICAL SCIENCE *Short Answer* What fictitious curved motion force is present only in rotating reference frames?

ANSWER: CENTRIFUGAL (ACCEPT: CENTRIFUGAL FORCE; DO NOT ACCEPT: CENTRIPETAL)

BONUS

20) PHYSICAL SCIENCE *Multiple Choice* The magnitude of the velocity of an object in uniform circular motion is tripled. What will happen to its centripetal [**sen-TRIP-i-tl**] force?

- W) It will be multiplied by 3
- X) It will be multiplied by 9
- Y) It will stay the same
- Z) It will be multiplied by 1/3

ANSWER: X) IT WILL BE MULTIPLIED BY 9

TOSS-UP

21) GENERAL SCIENCE *Multiple Choice* How many nucleotide **[NOO-klee-uh-tyd]** base pairs are there in the haploid human genome?

- W) 320,000 base pairs
- X) 3.2 million base pairs
- Y) 3.2 billion base pairs
- Z) 3.2 trillion base pairs

ANSWER: X) 3.2 BILLION BASE PAIRS

BONUS

21) GENERAL SCIENCE *Multiple Choice* A proper understanding of our genetic make-up can help us understand disorders that are present in a family. If a disorder is transmitted genetically from parent to offspring, the disorder is known to be which of the following?

- W) Heritable
- X) Chronic
- Y) Congenital
- Z) Communicable

ANSWER: W) HERITABLE

TOSS-UP

22) EARTH AND SPACE *Short Answer* What type of solar eclipse occurs when the Moon passes completely in front of the Sun, but subtends a smaller angle than the Sun?

ANSWER: ANNULAR

BONUS

22) EARTH AND SPACE *Multiple Choice* A star with a declination of 23.5 degrees and a right ascension of 6 hours will be eclipsed by the Sun on what day of the year?

- W) Vernal equinox
- X) Summer solstice
- Y) Autumnal equinox
- Z) Winter solstice

ANSWER: X) SUMMER SOLSTICE

TOSS-UP

23) MATH *Short Answer* A cycloid is generated by tracing a point on the edge of a circle as the circle is rolled along a line. The formula for finding the area under a single lobe of this figure is $3\pi r^2$ [**3 times pi times r squared**], where r is the radius of the circle. What fraction of the area of a cycloid generated by a circle of radius r is the area of a cycloid generated by a circle of radius $r/2$ [**r divided by 2**]?

ANSWER: $1/4$

BONUS

23) MATH *Short Answer* The point $(4, 5)$ is reflected across the graph of $y = 1$ and the resulting point is then reflected across the graph of $y = -x$. What are the coordinates of the final image point?

ANSWER: $(3, -4)$