

MIDDLE SCHOOL - ROUND 11A

TOSS-UP

1) Earth and Space – *Short Answer* What is the term for a failed star that has a minimum mass of approximately 12 Jupiter-masses?

ANSWER: BROWN DWARF

BONUS

1) Earth and Space – *Short Answer* The Maunder Minimum refers to a period of time during which very few of what features were observed?

ANSWER: SUNSPOTS

TOSS-UP

2) Math – *Short Answer* A number is 12 more than 4 times the number. What is the number?

ANSWER: -4

BONUS

2) Math – *Short Answer* Two cards are drawn at random without replacement from a standard deck. What is the probability that they share the same color or the same face value?

ANSWER: 9/17

TOSS-UP

3) Life Science – *Short Answer* What type of plant ground tissue primarily consists of cells with thick, strong cell walls that are dead at maturity?

ANSWER: SCLERENCHYMA [*skluh-REN-kim-uh*]

BONUS

3) Life Science – *Short Answer* In grasshoppers, air enters and leaves their bodies through small openings on the side of their bodies called what?

ANSWER: SPIRACLES

TOSS-UP

4) Energy – *Short Answer* Biologists at Oak Ridge National Lab were the first to identify and culture a novel oral pathogen *Desulfobulbus oralis* [*dee-sulfoh-bulb-us or-AL-is*]. In what domain of life is this Gram-negative organism found?

ANSWER: BACTERIA (ACCEPT: EUBACTERIA)

BONUS

4) Energy – *Multiple Choice* Scientists at the National Renewable Energy Laboratory are trying to prevent corrosion in the next generation of instruments concentrating solar power, which require the use of high temperature fluids like molten salts. Which of the following is the purpose of these high temperature fluids?

- W) Heat thermoelectric materials
- X) Cool down the solar cells
- Y) Boil water to steam
- Z) Heat residential buildings

ANSWER: Y) BOIL WATER TO STEAM

TOSS-UP

5) Physical Science – *Short Answer* What is the main component of gas bubbles in boiling water?

ANSWER: WATER (ACCEPT: WATER VAPOR)

BONUS

5) Physical Science – *Multiple Choice* Which of the following pairs of types of solids and their properties is NOT correctly matched?

- W) Ionic solid, brittle
- X) Metallic solid, malleable
- Y) Network covalent solid, malleable
- Z) Molecular covalent solid, soft

ANSWER: Y) NETWORK COVALENT SOLID, MALLEABLE

TOSS-UP

6) Life Science – *Short Answer* Tobacco is highly addictive because it contains what acetylcholine [*ah-see-til-KOH-leen*]-mimicking compound?

ANSWER: NICOTINE

BONUS

6) Life Science – *Short Answer* In the fight-or-flight response, there is a release of what neurotransmitter that is directly synthesized from dopamine [*DOPE-ah-meen*]?

ANSWER: NOREPINEPHRINE (ACCEPT: NORADRENALINE, DO NOT ACCEPT: ADRENALINE, EPINEPHRINE)

TOSS-UP

7) Earth and Space – *Multiple Choice* Which of the following mass movement events occurs when rock layers fall down-slope along weak bedding planes?

- W) Rockfall
- X) Rockslide
- Y) Rock avalanche
- Z) Earthflow

ANSWER: X) ROCKSLIDE

BONUS

7) Earth and Space – *Short Answer* What is the chemical formula for the mineral fluorite?

ANSWER: CaF₂

TOSS-UP

8) Math – *Short Answer* Identify all of the following 3 types of numbers that both $\frac{5}{13}$ and $\frac{1}{8}$ are: 1) Rational; 2) Irrational; 3) Real.

ANSWER: 1 AND 3

BONUS

8) Math – *Short Answer* 79 teams play in a single-elimination tournament; that is, each game is played by two teams, and the losing team is eliminated. Some teams have byes in the first round and don't have to play, but, after the first round, each remaining team plays every round until they are eliminated. How many games are played in the first round?

ANSWER: 15

TOSS-UP

9) Physical Science – *Short Answer* What law of circuits states that the current drawn in a circuit is equal to the voltage divided by the resistance?

ANSWER: OHM'S LAW

BONUS

9) Physical Science – *Short Answer* Identify all of the following three quantities that are always constant for an object as it undergoes free-fall near the Earth's surface: 1) Velocity; 2) Acceleration; 3) Force.

ANSWER: 2, 3

TOSS-UP

10) Energy – *Short Answer* Scientists at Argonne National Lab are studying the secondary metabolites of *Streptococcus [strep-toh-KAW-kus]*, a bacterium with a large amount of peptidoglycan [*pep-tid-oh-GLY-cun*] in its cell wall. In a classical Gram stain, what color would this bacterium be stained?

ANSWER: PURPLE (ACCEPT: VIOLET)

BONUS

10) Energy – *Short Answer* Scientists at Idaho National Lab have developed a new method to recycle rare metals present in electronics. Their method involves using an electric current to reduce the precious metals and reform them at the cathode. What is this general process of metal refining called?

ANSWER: ELECTROLYSIS

TOSS-UP

11) Math – *Multiple Choice* What is the equation of the axis of symmetry for the graph of $y = x^2 - 10x - 24$?

W) $x = -12$

X) $x = -5$

Y) $x = 5$

Z) $x = 12$

ANSWER: Y) $x = 5$

BONUS

11) Math – *Short Answer* A regular polygon with 24 sides has exterior angles of what degree measure?

ANSWER: 15

TOSS-UP

12) Earth and Space – *Short Answer* What is the primary mode of energy transport near the Sun's core?

ANSWER: RADIATION

BONUS

12) Earth and Space – *Short Answer* Giving your answer to the nearest day, how many days after a new moon is a third quarter moon?

ANSWER: 22

TOSS-UP

13) Life Science – *Short Answer* Cyanobacteria and plants are able to move directionally in response to light sources through photoreceptor-modulated signal cascades. What is the name for this motion?

ANSWER: PHOTOTAXIS

BONUS

13) Life Science – *Short Answer* In the Cnidarian [*nye-DARE-ee-un*] life cycle, what is the term for the stage in which the organism remains attached to a surface and does not swim around?

ANSWER: POLYP

TOSS-UP

14) Math – *Short Answer* Two triangles have identical corresponding angle measures. The larger triangle has sides of lengths 6, 8, and 10. The smaller triangle has smallest side of length 5. What is the perimeter of the smaller triangle?

ANSWER: 20

BONUS

14) Math – *Short Answer* Given the linear function $f \text{ of } x = -5x + b$, where b is a real number, if $f \text{ of } 2 = 13$, what is $f \text{ of } 7$?

ANSWER: -12

TOSS-UP

15) Life Science – *Short Answer* Red tides are a type of algal bloom associated with what group of organisms?

ANSWER: DINOFLAGELLATES

BONUS

15) Life Science – *Multiple Choice* In which of the following organs would one find the greatest amount of keratin proteins?

- W) Heart
- X) Skin
- Y) Stomach
- Z) Lung

ANSWER: X) SKIN

TOSS-UP

16) Physical Science – *Short Answer* What is the term for molecules with the same molecular formula, but different structural formulas?

ANSWER: ISOMERS

BONUS

16) Physical Science – *Short Answer* Rank the following three substances in terms of increasing total mass: 1) Twelve moles of hydrogen atoms; 2) One mole of iron atoms; 3) Three moles of carbon atoms.

ANSWER: 1, 3, 2

TOSS-UP

17) Energy – *Multiple Choice* Scientists at Savannah River National Lab are studying new ways of separating and storing tritium [*TRIH-tee-um*] gas. Which of the following correctly describes the constituent particles in a nucleus of tritium?

- W) One proton and one neutron
- X) One proton and two neutrons
- Y) Two protons and one neutron
- Z) Two protons and three neutrons

ANSWER: X) ONE PROTON AND TWO NEUTRONS

BONUS

17) Energy – *Short Answer* Researchers at Ames Lab are using the Mossbauer effect to study metals. In this effect, a nucleus absorbs what particle without experiencing any recoil?

ANSWER: PHOTON

TOSS-UP

18) Earth and Space – *Multiple Choice* Which of the following molecules contributes the most to the absorption of UV light in the stratosphere?

- W) Carbon dioxide
- X) Water vapor
- Y) Methane
- Z) Ozone

ANSWER: Z) OZONE

BONUS

18) Earth and Space – *Multiple Choice* What silicate group is first to crystallize from a cooling magma?

- W) Inosilicates [*INN-oh-sillih-kets*]
- X) Cyclosilicates
- Y) Phyllosilicates [*FILL-oh-sill-ih-ket*]
- Z) Nesosilicates

ANSWER: Z) NESOSILICATES

TOSS-UP

19) Math – *Short Answer* If f of x equals $x + 4$ and g of x equals $2x - 3$, what is f of g of 5?

ANSWER: 11

BONUS

19) Math – *Short Answer* What is the median of the first 10 cubes of positive integers?

ANSWER: 170.5 (ACCEPT: $341/2$, $170 \frac{1}{2}$)

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**TOSS-UP**

20) Physical Science – *Multiple Choice* Which of the following reactions is endothermic?

- W) Chlorine gas reacts with hydrogen gas to form hydrogen chloride gas
- X) Liquid water vaporizes to yield steam
- Y) Sodium metal reacts with water to yield sodium hydroxide and hydrogen gas
- Z) Liquid water freezes to yield solid ice

ANSWER: X) LIQUID WATER VAPORIZES TO YIELD STEAM

**BONUS**

20) Physical Science – *Multiple Choice* A student is performing an electroplating experiment in which he places two nickel electrodes in a solution of copper sulfate and connects the electrodes to a battery. He notes that the electroplating only occurs on one of the electrodes, while the other electrode remains pure nickel. Which of the following would cause the other electrode to participate in the plating instead?

- W) Changing the nickel to a metal with a higher reduction potential
- X) Changing the nickel to a metal with a lower reduction potential
- Y) Waiting until the entirety of the first electrode has been plated
- Z) Switching the terminals of the battery to which the electrodes are connected

ANSWER: Z) SWITCHING THE TERMINALS OF THE BATTERY TO WHICH THE ELECTRODES ARE CONNECTED

**TOSS-UP**

21) Life Science – *Short Answer* In certain adverse conditions, a bacterium will form an internal structure around its DNA that enables it to remain dormant for years while waiting for the environment to become more favorable. What is the term for this structure?

ANSWER: ENDOSPORE

**BONUS**

21) Life Science – *Short Answer* What blood type is considered to be the universal receiver?

ANSWER: AB (ACCEPT: AB+)

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TOSS-UP

22) Earth and Space – *Short Answer* What is the term for the region around a star in which orbiting planets can sustain liquid water, and therefore, potentially life?

ANSWER: HABITABLE ZONE (ACCEPT: GOLDBLOCKS ZONE)

BONUS

22) Earth and Space – *Short Answer* What planet in our solar system has an axial tilt closest in degree measure to that of Earth?

ANSWER: MARS

TOSS-UP

23) Physical Science – *Short Answer* A proton is being repelled by a certain charged particle that is a distance D away from it. If the proton is moved to distance $2D$, by what factor is the force on the proton multiplied?

ANSWER: ONE-FOURTH (DO NOT ACCEPT: FOUR)

BONUS

23) Physical Science – *Short Answer* Two charges each have their magnitudes tripled, and the distance separating them is doubled. By what factor is the magnitude of the electric force between them multiplied?

ANSWER: $9/4$ (ACCEPT: $2\frac{1}{4}$, 2.25)