

MIDDLE SCHOOL - ROUND 11A

TOSS-UP

1) Earth and Space – *Multiple Choice* Cape Town, South Africa has a Mediterranean climate. Which of the following statements best describes the climate of Cape Town on average?

- W) Winters have higher temperature and more precipitation than summers
- X) Winters have higher temperature and less precipitation than summers
- Y) Winters have lower temperature and more precipitation than summers
- Z) Winters have lower temperature and less precipitation than summers

ANSWER: Y) WINTERS HAVE LOWER TEMPERATURE AND MORE PRECIPITATION THAN SUMMERS

BONUS

1) Earth and Space – *Short Answer* The Rio Tinto river in Spain is so named because of its red hue, which is derived from what abundant dissolved ion?

ANSWER: IRON THREE (ACCEPT: IRON THREE PLUS, FERRIC IRON; DO NOT ACCEPT: IRON))

TOSS-UP

2) Math – *Short Answer* Giving your answer in base 8, what is ONE-SEVEN base 8 plus FIVE-SIX base 8?

ANSWER: SEVEN-FIVE (ACCEPT: 75)

BONUS

2) Math – *Short Answer* A right circular cylinder has a radius of 3 and a height of 12. A second right circular cylinder has a radius of 5 and a height of 7. What is the larger lateral surface area of the two cylinders?

ANSWER: 72π

TOSS-UP

3) Life Science – *Multiple Choice* Which of the following exhibits quaternary [*QUAH-tur-nairee*] protein structure?

- W) Myoglobin [*MY-oh-glow-bin*]
- X) Bilirubin [*BIL-ih-roo-bin*]
- Y) Hemoglobin
- Z) Adenosine [*ah-DEN-oh-seen*] triphosphate

ANSWER: Y) HEMOGLOBIN

BONUS

3) Life Science – *Short Answer* Identify all of the following three statements that are true of the domains of life: 1) Eukaryotic [*YOU-care-ee-AW-tic*] ribosomes [*RYE-beh-sohms*] are larger than bacterial ribosomes; 2) Bacterial ribosomes are larger than archaean [*ar-KEE-en*] ribosomes; 3) Bacteria initiate translation of mRNA with methionine [*meth-IOH-neen*] codons.

ANSWER: 1 AND 3

TOSS-UP

4) Energy – *Short Answer* What is the name for the value that is used to rate the performance of diesel fuels?

ANSWER: CETANE NUMBER (ACCEPT: CETANE RATING, CN)

BONUS

4) Energy – *Short Answer* Scientists at Pacific Northwest National Lab are studying a new generation of catalysts that accelerate the polymerization [*pawl-ih-mer-eh-ZAY-shun*] of ethylene [*ETH-il-een*] to form plastic water bottles, windshield glass, and other modern polymers. What is the empirical formula of the polymer product polyethylene?

ANSWER: CH₂

TOSS-UP

5) Physical Science – *Short Answer* Brian drives from his home to work, and then back home in a total of 3 hours. In miles per hour, what is the average velocity of his round trip, if his home and work are separated by 60 miles?

ANSWER: 0

BONUS

5) Physical Science – *Short Answer* An object has fallen 30 meters in the past 2 seconds. To the nearest meter per second, what is its current vertical speed?

ANSWER: 25

TOSS-UP

6) Life Science – *Multiple Choice* What type of solution can cause plasmolysis of a plant cell when the cell is immersed in the solution?

- W) Isotonic
- X) Nontonic
- Y) Hypertonic
- Z) Hypotonic

ANSWER: Y) HYPERTONIC

BONUS

6) Life Science – *Short Answer* An amoeba [*ah-MEE-bah*] creates a vesicle by phagocytosis [*fag-oh-sye-TOW-sis*]. The next step for the vesicle is fusion with what organelle?

ANSWER: LYSOSOME

TOSS-UP

7) Earth and Space – *Short Answer* Thalassa [**thah-LAH-sah**] is a natural satellite of what planet?

ANSWER: NEPTUNE

BONUS

7) Earth and Space – *Multiple Choice* Which of the following is true of the Great Red Spot of Jupiter?

- W) It does not vary significantly in latitude
- X) It varies significantly in latitude within the Northern Hemisphere
- Y) It varies significantly in latitude within the Southern Hemisphere
- Z) It frequently migrates between the Northern and Southern Hemisphere

ANSWER: W) IT DOES NOT VARY SIGNIFICANTLY IN LATITUDE

TOSS-UP

8) Math – *Short Answer* Evaluate the following expression: 8 minus 3 times 4

ANSWER: -4

BONUS

8) Math – *Short Answer* The bases of a right trapezoid have lengths 5 and 8. The non-perpendicular side connecting them has length 12. What is the height of the trapezoid?

ANSWER: $3\sqrt{15}$

TOSS-UP

9) Physical Science – *Short Answer* What is the only element not in the halogen family that forms a noble-gas electron configuration with the addition of one electron?

ANSWER: HYDROGEN

BONUS

9) Physical Science – *Short Answer* How many fatty acid chains are present in one molecule of a phospholipid?

ANSWER: 2

TOSS-UP

10) Energy – *Multiple Choice* Argonne National Lab researchers are developing techniques to better annotate genomes [**JEE-nomes**] of organisms. In this case, to what does annotation refer?

- W) Adding information about the functions of different sequences
- X) Adding information about similar genes in other organisms
- Y) Converting the genome to amino acid code
- Z) Converting the genome to RNA code

ANSWER: W) ADDING INFORMATION ABOUT THE FUNCTIONS OF DIFFERENT SEQUENCES

BONUS

10) Energy – *Multiple Choice* Researchers at Princeton Plasma Physics Lab recently developed a device that can manufacture on demand technetium-99m [**tek-NEE-shee-um 99 M**], a radioactive isotope with a half-life of 6 hours. For what purpose will this technetium isotope be used?

- W) Research into nuclear shell structure
- X) Source for high-energy X-rays
- Y) Medical diagnostics
- Z) Research into CP violation in the weak force

ANSWER: Y) MEDICAL DIAGNOSTICS

TOSS-UP

11) Math – *Short Answer* The endpoints of a diameter of a circle have coordinates (7, 4) and (-5, -8). What are the coordinates of the center of the circle?

ANSWER: (1, -2) (ACCEPT: $x = 1$ AND $y = -2$)

BONUS

11) Math – *Short Answer* If a 40-degree sector of a circle has area 30 pi, then, to the nearest whole number, what is the radius of the circle?

ANSWER: 16

TOSS-UP

12) Earth and Space – *Short Answer* Spectroscopic [*spek-troh-SCAW-pik*] binary stars can only be differentiated by oscillations [*aw-sill-AY-shuns*] in their spectra caused by their rotation around their center of mass. What is the name of the effect that causes this oscillation in their observed spectra?

ANSWER: DOPPLER

BONUS

12) Earth and Space – *Short Answer* Jupiter's mass is approximately 320 Earth masses, and its average density is a quarter of Earth's. To the nearest whole number of Earth diameters, what is the diameter of Jupiter?

ANSWER: 11

TOSS-UP

13) Life Science – *Short Answer* Trichinosis [*trih-kin-OH-sis*] is a parasitic [*para-SIT-ik*] disorder that is usually caused by the consumption of what meat?

ANSWER: PORK (ACCEPT: PIG, HOG)

BONUS

13) Life Science – *Multiple Choice* Which of the following is least likely to be found in a hot desert climate?

- W) A plant with broad flat leaves
- X) A plant with few leaves
- Y) A plant with thick fleshy leaves
- Z) A plant with thin needle-like leaves

ANSWER: W) A PLANT WITH BROAD FLAT LEAVES

TOSS-UP

14) Math – *Short Answer* A triangle has sides of length 10, 10, and 4. Connecting the midpoints of the sides of this triangle forms a smaller triangle. What is the perimeter of the smaller triangle?

ANSWER: 12

BONUS

14) Math – *Short Answer* To the nearest whole number, 130 kilometers per hour is how many meters per second?

ANSWER: 36

TOSS-UP

15) Life Science – *Multiple Choice* Some plants have bacteria within their root nodules that perform nitrogen fixation. What conversion does nitrogen fixation involve?

- W) Nitrite to nitrate
- X) Nitric acid to ammonium nitrate
- Y) Dinitrogen to ammonia
- Z) Nitrate to dinitrogen

ANSWER: Y) DINITROGEN TO AMMONIA

BONUS

15) Life Science – *Short Answer* Lacteals [*LAK-teels*] are fat-absorbing structures that are a part of what human organ system?

ANSWER: LYMPHATIC (ACCEPT: SMALL INTESTINE)

TOSS-UP

16) Physical Science – *Short Answer* What group of elements react violently with water and have one electron in their valence shell?

ANSWER: ONE (ACCEPT: ALKALI METALS)

BONUS

16) Physical Science – *Short Answer* Rank the following three atoms in terms of increasing number of valence electrons: 1) Carbon; 2) Beryllium; 3) Fluorine.

ANSWER: 2, 1, 3

TOSS-UP

17) Energy – *Short Answer* Researchers at Princeton Plasma Physics Lab are studying a structure composed of gas and dust surrounding and feeding the Sagitarrius A-star black hole. What is the name given to such a disk of material?

ANSWER: ACCRETION DISK

BONUS

17) Energy – *Multiple Choice* Researchers at Argonne National Lab are developing tools to assign functions to sequence data that are being generated at a faster and faster pace. Most of the diversity in these data comes from what classification of organisms?

- W) Animals
- X) Prokaryotes [*PRO-care-ee-oats*]
- Y) Plants
- Z) Fungi [*fun-ji*]

ANSWER: X) PROKARYOTES

TOSS-UP

18) Earth and Space – *Multiple Choice* What type of volcano is Mt. Fuji in Japan?

- W) Shield
- X) Volcanic dome
- Y) Cinder cone
- Z) Stratovolcano

ANSWER: Z) STRATOVOLCANO

BONUS

18) Earth and Space – *Short Answer* Identify all of the following three rock types that are metamorphic:
1) Slate; 2) Quartzite; 3) Monzonite.

ANSWER: 1 AND 2

TOSS-UP

19) Math – *Short Answer* How many integers are there between -6 and 8, inclusive?

ANSWER: 15

BONUS

19) Math – *Short Answer* If x varies inversely as the square root of y and x equals 10 when y equals 4, what is the value of x when $y = 49$?

ANSWER: 20/7 (ACCEPT: 2 6/7)

TOSS-UP

20) Physical Science – *Multiple Choice* Which of the following compounds will be most soluble in water at 50 degrees Celsius?

- W) Sucrose
- X) Calcium carbonate
- Y) Vegetable oil
- Z) Benzene

ANSWER: W) SUCROSE

BONUS

20) Physical Science – *Short Answer* Identify all of the following three elements that methylamine contains: 1) Carbon; 2) Nitrogen; 3) Oxygen.

ANSWER: 1 AND 2

TOSS-UP

21) Life Science – *Short Answer* In mammals, the major thermoregulatory center is in what part of the brain?

ANSWER: HYPOTHALAMUS

BONUS

21) Life Science – *Short Answer* In DNA, what is the nucleotide base that pairs with adenine [*AD-eh-neen*]?

ANSWER: THYMINE

TOSS-UP

22) Earth and Space – *Short Answer* What spectral class is classified by the strongest hydrogen Balmer lines?

ANSWER: A

BONUS

22) Earth and Space – *Short Answer* In which corner of a Hertzsprung-Russell diagram can one find Betelgeuse [*BAY-tel-jews*]?

ANSWER: TOP RIGHT

TOSS-UP

23) Physical Science – *Short Answer* What is the general term for devices that transform radiant energy into electrical energy, such as solar panels?

ANSWER: PHOTOVOLTAIC

BONUS

23) Physical Science – *Short Answer* Identify all of the following three statements that are true regarding sound waves: 1) They travel faster in warm air than in cold air; 2) They travel faster in gases than in solids; 3) They travel faster in liquids than in gases.

ANSWER: 1 AND 3