# THUMB: ROUND ROBIN 4

1) Earth and Space – *Short Answer* Rank the following three latitudes in the northern hemisphere by increasing gradient of their thermocline: 1) 0º 2) 30º 03) 60º

ANSWER: 3, 2, 1 [FJ]

2) Physics – *Short Answer* Which conserved quantity supports the hypothesis that a planet's areal velocity stays constant because no net torque acts upon the planet relative to the center of force?

ANSWER: Angular momentum [AX]

3) Chemistry – *Multiple Choice* Which of the following is a strong reducing agent?

W) Potassium permanganate
X) Lithium aluminum hydride
Y) Potassium dichromate
Z) Hydrogen peroxide

ANSWER: X) Lithium aluminum hydride [DS]

4) Biology - *Multiple Choice* Immediately after finishing a stressful Geophysics final, Flora encounters a bear named Freddy and watches it play from a distance. Knowing that she is comforted by bears and thinks they are cute, which of the following is LEAST likely to occur after this encounter?

W) Glucagon release
X) Decreased blood pressure
Y) Increased digestion
Z) Decreased conduction velocity in heart

Answer: W) Glucagon release [SY]

5) Math – *Multiple Choice* The square root of 3 equals 5 in which of the following prime modulo?

W) 3
X) 5
Y) 7
Z) 11

Answer: Z) 11 [AX]

6) Earth and Space – *Multiple Choice* The majority of coal on Earth originates from which of the following geological periods?

W) Cambrian
X) Ordovician
Y) Carboniferous
Z) Cretaceous

ANSWER: Y) Carboniferous [FJ]

7) Physics – *Multiple Choice* Which of the following statements regarding magnetic fields and charged particles is false?

W) Magnetic fields do not exert forces on stationary particles
X) Magnetic fields cannot do work on stationary or moving particles
Y) The magnitude of the force exerted by a magnetic field is proportional to the mass of the particle
Z) The magnitude of the force exerted by a magnetic field is unrelated to the sign of the charge of the particle

ANSWER: Y) The magnitude of the force exerted by a magnetic field is proportional to the mass of the particle [AX]

8) Chemistry – *Multiple Choice* Which of the following molecules contains an sp3 hybridized atom?

W) Acetylene
X) Diatomic Nitrogen
Y) Formaldehyde
Z) Chloroform

ANSWER: Z) Chloroform [DS]

9) Biology - *Multiple Choice* Austin is culturing an unknown bacteria in a thioglycolate broth in a 15 mL culture tube. After allowing the bacteria ample time to grow, he notices that the bacteria were all concentrated at the very bottom of the tube, with zero growth anywhere else. Which of the following is most likely the oxygen requirement of this unknown bacteria?

W) Obligate aerobe
X) Obligate anaerobe
Y) Facultative anaerobe
Z) Microaerophile

ANSWER: X) Obligate anaerobe [SY]

10) Math – *Short Answer* In the THUMB lottery, each participant randomly chooses three ordered numbers from 1 through 50 with replacement. What is the probability that exactly two numbers match up with the ordered, drawn numbers?

ANSWER: 147/125000 [AX]

11) Earth and Space – *Short Answer* Star A and Star B are in a binary orbit. At any given time, Star A is located 250 kilometers from the barycenter while Star B is located 400 kilometers from the barycenter. What is the ratio of Star A's mass to that of Star B's?

ANSWER: 8:5 (Accept: 8/5; Do not accept: 5:8) [FJ]

12) Physics – *Short Answer* A Carnot heat engine operates between a high-temperature reservoir at 427°C and a low-temperature reservoir at 27°C. Expressing your answer as a fraction, what is the efficiency of this engine?

ANSWER: 4/7 [AX]

13) Chemistry – *Short Answer* In the branched alkane 2,2-dimethyloctane, how many hydrogen atoms are there in total? (ENFORCE STALLS)

ANSWER: 22 [DS] [SY]

14) Biology – *Multiple Choice* Which of the following terms describes cancer originating from epithelial tissue?

W) Carcinoma
X) Sarcoma
Y) Melanoma
Z) Leukemia

ANSWER: W) Carcinoma [SY]

15) Math – *Short Answer* Giving your answer in slope intercept form, what is the equation of the line tangent to the function f(x) = x^2 – 4 at the point (3,5)?

ANSWER: y = 6x – 13 [AX] (do not accept: 6x–13)

16) Earth and Space – *Short Answer* The Nice Model suggests that gas giants such as Jupiter have experienced an outward migration. Jupiter was able to form closer to the Sun than its current position because what boundary was located further inward in the early solar system compared today?

ANSWER: Snow line (Accept: Frost line, ice line) [FJ]

17) Physics – *Multiple Choice* Cooling a material below its Curie point generally involves which of the following transitions in magnetism?

W) Ferromagnetism to paramagnetism
X) Paramagnetism to ferromagnetism
Y) Diamagnetism to ferromagnetism
Z) Ferromagnetism to diamagnetism

ANSWER: X) Paramagnetism to ferromagnetism [FJ]

18) Chemistry – *Multiple Choice* By name or number, arrange the following three metals by increasing melting point: 1) Mercury 2) Tungsten 3) Cobalt

ANSWER: 1, 3, 2 [DS]

19) Biology - *Short Answer* Primarily composed of pectins and pectate salts, what is the name of the layer that links the primary cell wall of different plant cells together?

ANSWER: Middle Lamella [SY]

20) Math - *Short Answer* How many edges does a regular icosahedron **[ai·kow·suh·hee·druhn]** with 12 vertices and 20 faces have?

ANSWER: 30 [OM]