

2025 Texas Science Bowl Invitational

Round Robin 1



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TOSS UP

1) PHYSICS *Short Answer* A train is accelerating on a train track. Identify all of the following three forces that stay constant in time:

- 1) Gravity
- 2) Air Resistance
- 3) Normal Force

ANSWER: 1 and 3 only

BONUS

1) PHYSICS *Short Answer* A ball rolls along a floor at a speed of 10 meters per second for 5 seconds, before uniformly decelerating to a stop in 5 more seconds. How much distance has the ball traveled, in meters?

ANSWER: 75

TOSS UP

2) MATH *Short Answer* For an advent calendar, Daniel will do 1 push-up on the first day, then 4 on the second day, then 7 on the third day, and so on, increasing by 3 push-ups each day. How many push-ups will Daniel do on the 25th day?

ANSWER: 73

BONUS

2) MATH *Short Answer* Adam and 5 of his friends are trying to sit in a row of 6 chairs. If all people choose a seat at random, what is the probability that Adam ends up sitting in the leftmost seat?

ANSWER: $1/6$

TOSS UP

3) BIOLOGY *Short Answer* Sieve tube elements and companion cells make up what type of vascular tissue found in plants responsible for the transport of sugars?

ANSWER: Phloem

BONUS

3) BIOLOGY *Multiple Choice* Which of the following is NOT a necessary condition for a population to be in Hardy-Weinberg Equilibrium?

- W) No mutation
- X) Equal sex ratio
- Y) No gene flow
- Z) No allele recombination

ANSWER: X) Equal sex ratio

TOSS UP

4) EARTH AND SPACE *Short Answer* Order the following three planets in order of increasing radius:

- 1) Saturn
- 2) Uranus
- 3) Neptune

ANSWER: 3, 2, 1

BONUS

4) EARTH AND SPACE *Short Answer* What charged particle accounts for approximately 90% of all cosmic rays?

ANSWER: Protons

TOSS UP

5) CHEMISTRY *Short Answer* What is the mass number of the daughter nuclide product after Uranium-235 undergoes alpha decay?

ANSWER: 231

BONUS

5) CHEMISTRY *Short Answer* Aidan wants to dilute 100 milliliters of a 2-molar hydrochloric acid solution to a concentration of 0.5 molar. How many milliliters of deionized water should he add to the solution?

ANSWER: 300

TOSS UP

6) PHYSICS *Multiple Choice* Two point charges are a distance d away and exert a Coulombic force F on each other. If the distance increases to $3d$, what is the new force?

W) $F/9$

X) $F/3$

Y) $3F$

Z) $9F$

ANSWER: W) $F/9$

BONUS

6) PHYSICS *Short Answer* A 4-kilogram block is being pulled to the right by a constant 10 Watt power source. If the surface is frictionless, what is the instantaneous speed of the block after 5 seconds in meters per second?

ANSWER: 5

TOSS UP

7) MATH *Multiple Choice* A rectangle has an area of 64. If all of its sides are scaled down by a factor of 4, what will be the new area of the rectangle?

- W) 1
- X) 4
- Y) 16
- Z) 32

ANSWER: 4

BONUS

7) MATH *Short Answer* John walks 6 miles north, 4 miles east, 2 miles south, then 3 miles east. To the nearest integer, in miles, how far is John from where he started?

ANSWER: 8

TOSS UP

8) BIOLOGY *Multiple Choice* Which phase of the cell cycle is typically the longest?

- W) G1
- X) S
- Y) G2
- Z) M

ANSWER: W) G1

BONUS

8) BIOLOGY *Short Answer* Identify all of the following three statements that are true about aquaporins:

- 1) They transport both ions and water
- 2) They function in active transport
- 3) They can transport water in or out of the cell

ANSWER: 3 only

TOSS UP

9) EARTH AND SPACE *Multiple Choice* Which of the following scales is used to measure earthquakes?

- W) Beaufort (*BOW-fort*) scale
- X) Fujita (*FEW-gee-ta*) scale
- Y) Saffir-Simpson (*SAFF-er-SIMP-son*) scale
- Z) Modified Mercalli (*mer-CAH-li*) scale

ANSWER: Z) Modified Mercalli scale

BONUS

9) EARTH AND SPACE *Multiple Choice* Which of the following reasons best explains why Pluto is characterized as a dwarf planet and not a regular planet?

- W) Its mass is too low to form it into a sphere
- X) Its orbit is too eccentric
- Y) Its orbit is out of alignment with the ecliptic
- Z) Its orbit has not been cleared of other similar mass objects

ANSWER: Z) Its orbit has not been cleared of similar mass objects

TOSS UP

10) CHEMISTRY *Short Answer* What is the IUPAC name for the compound with atomic formula HBrO?

ANSWER: Hypobromous Acid

BONUS

10) CHEMISTRY *Short Answer* What gas law states that the volume of a gas is proportional to its absolute temperature at constant pressure?

ANSWER: Charles's Law

TOSS UP

11) PHYSICS *Short Answer* To one significant figure, what is the index of refraction of a liquid in which light moves at a speed of exactly one hundred million meters per second?

ANSWER: 3

BONUS

11) PHYSICS *Short Answer* A horizontal spring has a spring constant of 200 Newtons per meter. If a 500 gram block compresses the spring by 10 centimeters, what is the speed in meters per second of the block at the instant it leaves the spring?

ANSWER: 2

TOSS UP

12) MATH *Short Answer* Maria has 6 colors of socks in her drawer, and there are 8 socks per color. How many socks must she pull out of the drawer to guarantee that she can make a pair of socks with the same color?

ANSWER: 7

BONUS

12) MATH *Short Answer* A cube's faces are randomly colored black or white. What is the probability that no face is the same color as an adjacent face?

ANSWER: 0

TOSS UP

13) BIOLOGY *Short Answer* In *C. elegans*, the inactivation of Ced9 in the outer mitochondrial membrane triggers what highly regulated and controlled process of cellular death?

ANSWER: Apoptosis

BONUS

13) BIOLOGY *Short Answer* Rounding your answer to the nearest whole number, what is the expected number of times the sequence ATTC is found in a 1-kilobase long random DNA strand?

ANSWER: 4

TOSS UP

14) EARTH AND SPACE *Short Answer* What atmospheric circulation cell drives the trade winds?

ANSWER: Hadley Cell

BONUS

14) EARTH AND SPACE *Short Answer* Deep-sea fans are formed by the deposition of sediments transported by what downslope currents of dense, sediment-laden water originating from the continental shelf?

ANSWER: Turbidity Currents

TOSS UP

15) CHEMISTRY *Short Answer* What is the oxidation number of Manganese in the compound KMnO_4 ?

ANSWER: +7 or 7, do not accept -7

BONUS

15) CHEMISTRY *Short Answer* By name or by number, identify which of the following three elements are liquids at 25 degrees Celsius and one atmosphere:

- 1) Bromine
- 2) Technetium
- 3) Gallium

ANSWER: 1 only

TOSS UP

16) PHYSICS *Short Answer* A disk is spun on a table at an angular speed of ω . If the radius of the disk doubles, and angular momentum is conserved, what is its new angular speed?

ANSWER: $\omega/4$

BONUS

16) PHYSICS *Multiple Choice* A circuit has two resistors each with resistance R in parallel, which are then connected to a third resistor of resistance $2R$ in series. What is the equivalent resistance of the circuit?

- W) $R/2$
- X) $3R/2$
- Y) $5R/2$
- Z) $7R/2$

ANSWER: Y

TOSS UP

17) MATH *Short Answer* In a round robin style tournament of 6 teams, each team plays every other team twice. In total, how many matches are played?

ANSWER: 30

BONUS

17) MATH *Short Answer* A pound of peanuts costs \$5.99, and an ounce of peanuts costs \$0.39. How many cents will you save if you buy a pound of peanuts in bulk instead of individual ounces of peanuts?

ANSWER: 25

TOSS UP

18) BIOLOGY *Multiple Choice* Which of the following descriptions does not describe a dicot?

- W) Net-like venation on leaves
- X) Floral parts are often in multiples of 4 or 5
- Y) Vascular bundles are arranged in a ring in the stem
- Z) Rarely undergoes secondary growth

ANSWER: Z) Rarely undergoes secondary growth

BONUS

18) BIOLOGY *Short Answer* Order the following three parts of the small intestine in order from earliest to latest:

- 1) Jejunum
- 2) Duodenum
- 3) Ileum

ANSWER: 2, 1, 3

TOSS UP

19) EARTH AND SPACE *Multiple Choice* Sinkholes and disappearing streams would be common in a topography that is predominantly composed of which of the following rocks?

- W) Chert
- X) Siltstone
- Y) Basalt
- Z) Limestone

ANSWER: Z) Limestone

BONUS

19) EARTH AND SPACE *Short Answer* Order the following three objects in terms of increasing orbital eccentricity:

- 1) Halley's comet
- 2) Ceres
- 3) Pluto

ANSWER: 2, 3, 1

TOSS UP

20) CHEMISTRY *Multiple Choice* Under which of the following conditions does a real gas behave most ideally?

- W) Low temperature, low pressure
- X) Low temperature, high pressure
- Y) High temperature, low pressure
- Z) High temperature, high pressure

ANSWER: Y

BONUS

20) CHEMISTRY *Short Answer* Identify which of the following three statements are true about a copper-zinc battery.

- 1) Zinc is the cathode
- 2) Zinc is the anode
- 3) Copper is the cathode

ANSWER: 2 and 3 only
