

Round 1

1. PHYSICS

Writer: Granada Hills

Toss Up: Short Answer

What is the spin of a tau neutrino?

Bonus Answer: $\frac{1}{2}$

Bonus: Short Answer

A system contains a capacitor with two plates. The area overlapped by two plates is 5m^2 . The dielectric constant of this system is 3.5. Initially, the capacitance is 20 farads. What is the distance between the plates?

Bonus Answer: $\frac{7}{8}$

2. PHYSICS

Writer: Granada Hills

Toss Up: Short Answer

Name every force that is acting upon a mid-air cannonball that was shot from a cannon at a 45 degree angle, ignoring air resistance

Bonus Answer: Weight (Accept: Force of gravity/Gravitational force)

Bonus: Short Answer

Planet Phi, weighing 100 kg, is 13 meters away from Planet Theta of 1200 grams. In kilograms per meters per second squared, what is the Universal Gravitational Force expressed between the two planets? Round to one significant figure.

Bonus Answer: 5×10^{-11}

3. PHYSICS

Writer: Granada Hills

Toss Up: Multiple Choice

A runner begins a sprint on a perfectly circular track. In 5 seconds, the runner travels exactly $\frac{1}{4}$ of lap. If the runner begins with a velocity of 10m/s, and ends with a velocity of 10m/s, what is the average angular velocity of the runner?

W) 5

X) 12

Y) 13

Z) 18

Toss Up Answer: Z

Bonus: Short Answer

What is the angular momentum of a solid sphere with a mass of 100 Kilograms and a radius of .1 Meters rotating at an angular velocity of 5 radians per seconds about the center of the sphere?

Bonus Answer: 2

4. PHYSICS

Writer: Centennial

Toss Up: Short Answer

According to Darcy's law, by what factor will the fluid velocity change if the pressure gradient is doubled?

Bonus Answer: It will double

Bonus: Short Answer

In turbulent flow, if the velocity of an object doubles and the object is scaled down by a factor of $1/3$, by what factor will the drag force change?

Bonus Answer: $4/9$

5. MATHEMATICS

Writer: Brooklyn Tech

Toss Up: Short Answer

In a triangle, the sides are 13, 14, and 15. Find the altitude of the triangle.

Bonus Answer: 12

Bonus: Multiple Choice

What is 2017 to the second power?

W) 4068290

X) 4068269

Y) 4068279

Z) 4068289

Bonus Answer: Z

6. MATHEMATICS

Writer: Granada Hills

Toss Up: Short Answer

Assuming random chance decides admission, and the acceptance rate for University A is 10% and the acceptance rate for University B is 20%, what is the probability that a student will be rejected from both to the nearest hundredth.

Bonus Answer: 0.72 (Accept 72%)

Bonus: Multiple Choice

A teacher wants to buy pizza for the very hardworking kids of Science Bowl. Which of the following options will provide the least square inches of pizza per dollar?

W) 2 10 inch diameter pizzas for \$15

X) 2 square pizzas with side length 10 inches for \$20

Y) 1 14 inch diameter pizza for \$12

Z) 1 12 inch diameter pizza for \$10

Bonus Answer: X

7. MATHEMATICS

Writer: Granada Hills

Toss Up: Short Answer

What is the sum of coefficients of the expression $(x+1)^3$ (cubed)

Bonus Answer: 8

Bonus: Short Answer

A student is riding a roller coaster. The track resembles the equation $y = \sin(t)$, where y is the height and t is the time elapsed in seconds. At what time, rounded to the nearest second, does the student reach the first peak of the roller coaster? Assume degrees.

Bonus Answer: 90

8. MATHEMATICS

Writer: Centennial

Toss Up: Short Answer

What is the exact average value of x^2+3x-2 from $x=3$ to $x=6$?

Bonus Answer: 195/6

Bonus: Multiple Choice

With which of the following n th terms will an infinite series converge?

- W) $1/n$
- X) $\ln n$
- Y) $\sin n$
- Z) $1/n^3$

Bonus Answer: Z

9. BIOLOGY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

In which phase of meiosis are the chromosomes pulled apart?

- W) Anaphase 1
- X) Prophase 1
- Y) Anaphase 2
- Z) Metaphase

Toss Up Answer: W

Bonus: Short Answer

In what types of organisms does meiosis occur?

Bonus Answer: Eukaryote

10. BIOLOGY

Writer: Brooklyn Tech

Toss Up: Short Answer

What is the largest venomous organism?

Bonus Answer: Komodo Dragon (or Komodo Monitor)

Bonus: Multiple Choice

What composes marine snow?

- W) Discarded manmade products like plastics
- X) Light as it passes through the photic zones in a body of water

- Y) Organic matter such as waste and dead cells
Z) Sulfides and other minerals ejected from hydrothermal vents

Bonus Answer: Y

=====

11. BIOLOGY

Writer: Brooklyn Tech

Toss Up: Short Answer

What is the name of the enzyme that makes ATP from ADP and inorganic phosphate?

Bonus Answer: ATP synthase

=====

Bonus: Short Answer

What is the result of an extra chromosome 21, so that each body cell has a total of 47 chromosomes?

Bonus Answer: Down Syndrome/trisomy 21

=====

12. BIOLOGY

Writer: Centennial

Toss Up: Short Answer

What is the name for the vessel network that supplies the large blood vessels?

Bonus Answer: vasa vasorum

=====

Bonus: Short Answer

Order the following sinuses in the human skull from superior to inferior: maxillary, frontal, ethmoid

Bonus Answer: Frontal, ethmoid, maxillary

=====

13. BIOLOGY

Writer: Granada Hills

Toss Up: Short Answer

Red-green color blindness is a sex-linked recessive disorder. If a color blind father has children with a carrier mother, what percentage of their daughters should be red-green colorblind?

Bonus Answer: 25%

=====

Bonus: Short Answer

Shaggy fur is dominant over straight fur and white fur is dominant over brown fur. If a hamster with straight, white (homozygous) fur is mated with a heterozygous shaggy, white hamster, what percentage of their offspring should have straight, white fur?

Bonus Answer: 50%

=====

14. BIOLOGY

Writer: Granada Hills

Toss Up: Multiple Choice

One mantis shrimp has how many more sets of photoreceptors than one dog?

- W) 2
X) 4
Y) 14
Z) 27

Toss Up Answer: Y

Bonus: Short Answer

By name or number, name all of the following species that produce insulin in the Brockmann body.

- I) Salmon
- II) Chimpanzee
- III) Horse
- IV) Tilapia
- V) Octopus

Bonus Answer: I and IV only

15. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Multiple Choice

Which of the following two compounds will react in an aqueous solution to form a precipitate?

- W) Ammonium Nitrate and Sodium Chloride
- X) Potassium Hydroxide and Calcium Acetate
- Y) Magnesium Bromide and Sodium Chromate
- Z) Lead Chlorate and Potassium Sulfide

Toss Up Answer: Z

Bonus: Short Answer

Which isotope of Uranium is fissile?

Bonus Answer: Uranium-235

16. CHEMISTRY

Writer: Brooklyn Tech

Toss Up: Short Answer

What type of energy release allows the formation of ionic bonds to be an exothermic process?

Bonus Answer: lattice energy

Bonus: Short Answer

How many electrons fill the f orbital?

Bonus Answer: 14

17. CHEMISTRY

Writer: Centennial

Toss Up: Short Answer

How many alkenes have the formula of C_4H_8 ?

Bonus Answer: four

Bonus: Short Answer

Rank the following elements in increasing order of melting point: vanadium, iron, cobalt, tantalum

Bonus Answer: cobalt, iron, vanadium, tantalum

18. CHEMISTRY

Writer: Granada Hills

Toss Up: Short Answer

What element has one electron in the 4f subshell?

Bonus Answer: Lanthanum

Bonus: Multiple Choice

The compound NbCl_5 would have which of the following shapes?

- W) octahedral
- X) seesaw
- Y) square planar
- Z) trigonal bipyramidal

Bonus Answer: W

19. EARTH and SPACE

Writer: Granada Hills

Toss Up: Short Answer

Which scientist is noted with identifying the relationship between a galaxy's distance from a body and its speed?

Bonus Answer: Edwin Hubble

Bonus: Multiple Choice

Which of the following is close to the value of the average temperature of Venus's atmosphere?

- W) 270 C
- X) 390 C
- Y) 470 C
- Z) 590 C

Bonus Answer: Y

20. EARTH and SPACE

Writer: Granada Hills

Toss Up: Short Answer

What two isotopes of hydrogen are used to produce helium in nuclear fusion?

Bonus Answer: Deuterium and Tritium

Bonus: Multiple Choice

Which of the following types of Martian Meteorites are the most commonly found on Earth?

- W) Nakhla
- X) Shergottite
- Y) Zagami
- Z) Chassignite

Bonus Answer: X

21. EARTH and SPACE

Writer: Granada Hills

Toss Up: Multiple Choice

Which of the following elements exist in the highest concentration on the surface of the moon?

W) Aluminum

X) Nickel

Y) Silicon

Z) Iron

Toss Up Answer: Y

Bonus: Short Answer

A sun-like star has an apparent magnitude of 8, and an absolute magnitude of 3. Approximately how far away is the star in kiloparsecs?

Bonus Answer: 0.1

22. EARTH and SPACE

Writer: Granada Hills

Toss Up: Short Answer

Tahiti, an archipelago in the South Pacific, is an example of what type of island?

Bonus Answer: Oceanic

Bonus: Short Answer

CuFeS_2 , one of the most common ores for mining copper, is the chemical formula for what mineral?

Bonus Answer: Chalcopyrite

23. ENERGY

Writer: Granada Hills

Toss Up: Multiple Choice

What type of geothermal power plant relies on highly pressurized water to generate electricity?

W) Dry Steam

X) Binary Cycle

Y) Subsurface reservoir

Z) Flash Steam

Toss Up Answer: Z

Bonus: Short Answer

What nuclear power plant was formerly located on the Pacific Coast of California in San Diego County and was closed in 2013?

Bonus Answer: San Onofre

24. ENERGY

Writer: Granada Hills

Toss Up: Short Answer

In what city was the protocol that phased out the use of chlorofluorocarbons signed?

Bonus Answer: Montreal (Do not accept Vienna)

Bonus: Multiple Choice

At what national laboratory was a Shelby Cobra 3D printed in 2015?

- W) Oak Ridge National Laboratory
- X) Argonne National Laboratory
- Y) Lawrence Berkeley National Laboratory
- Z) Lawrence Livermore National Laboratory

Bonus Answer: W

25. ENERGY

Writer: Centennial

Toss Up: Short Answer

What is the name of the theoretical maximum proportion of energy that can be extracted from an airflow?

Bonus Answer: Betz's law or the Betz limit

Bonus: Short Answer

What is the exact value of the Betz limit?

Bonus Answer: 16/27
