

# Venice

## 1. Chemistry

### Toss Up: Multiple Choice

Which of the following is not a copolymer?

- W) Myoglobin
- X) Polyvinyl chloride
- Y) High-impact polystyrene
- Z) Teflon

**Toss Up Answer: Z**

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### Bonus: Short Answer

If the cathode of a galvanic cell is copper, name all of the following four elements that would not produce a spontaneous current when placed at the other electrode: 1) zinc; 2) manganese; 3) gold; 4) hydrogen

**Bonus Answer: MANGANESE AND GOLD (ACCEPT: 2 AND 3)**

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## 2. Chemistry

### Toss Up: Short Answer

You have a solution with a mixture of common cations. What acid could you add to the solution if you only wanted to remove the silver, lead, and mercurous ions?

**Toss Up Answer: HYDROCHLORIC AID**

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### Bonus: Multiple Choice

Given that the  $K_a$  of hypochlorous acid is  $3.5 \times 10^{-8}$  [three point five times ten to the negative eighth], which of the following best approximates the pH of a 0.1 M solution of hypochlorous acid?

- W) 1.2
- X) 4.2
- Y) 6.4
- Z) 7.6

**Bonus Answer: X**

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## 3. Chemistry

### Toss Up: Short Answer

A combination of which two acids in a 3:1 ratio has a large enough standard reduction potential to dissolve gold and platinum?

**Toss Up Answer: HYDROCHLORIC ACID AND NITRIC ACID**

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### Bonus: Multiple Choice

For which of the following molecules do enantiomers not exist?

- W) 2-butanol
- X) Dichloromethane
- Y) 1,1-chlorofluoropropane
- Z) 3-hexanol

**Bonus Answer: X**

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## 4. Energy

### Toss Up: Multiple Choice

About how efficient is a gas turbine engine?

- W) 30%

X) 40%

Y) 50%

Z) 60%

**Toss Up Answer: X**

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**Bonus: Short Answer**

What two types of nuclear reactors employ water as both coolants and moderators?

**Bonus Answer: BOILING WATER REACTOR AND PRESSURIZED WATER REACTOR**

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**5. Energy**

**Toss Up: Multiple Choice**

Which of the following is the biggest obstacle in nuclear fission?

W) Rare materials

X) Safety

Y) Waste disposal

Z) Coulomb force

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What semiconductor is commonly used for amplifying high frequency signals?

**Bonus Answer: GALLIUM ARSENIDE**

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**6. Energy**

**Toss Up: Multiple Choice**

Which of the following is NOT a danger for a battery?

W) Suddenly stopping a current

X) High ambient temperature

Y) Excessive current during charging or discharging

Z) Pressure buildup within the cell

**Toss Up Answer: W**

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**Bonus: Short Answer**

In terms of crystal structure, what type of silicon cells has the highest efficiency of converting solar energy?

**Bonus Answer: POLYCRYSTALLINE CELLS**

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**7. Mathematics**

**Toss Up: Multiple Choice**

Which of the following could be the correlation coefficient for a negative, weak linear relationship?

W) -0.8

X) 0.8

Y) -0.2

Z) 0.2

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Blue has 10 Pokémon in his box. How many different teams of 6 Pokémon can Blue make?

**Bonus Answer: 210**

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**8. Mathematics**

**Toss Up: Short Answer**

What is the average value of the function  $y=4x + 5$  over the interval  $x=2$  to  $x=6$ ?

**Toss Up Answer: 21**

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**Bonus: Multiple Choice**

What is the volume of the solid made by rotating the area enclosed by the functions  $y=x^2$ ,  $x=1$ ,  $x=2$ , and the  $x$ -axis around the  $x$ -axis?

- W)  $\frac{1}{5}$
- X)  $\frac{1}{3}$
- Y)  $7\frac{1}{3}$
- Z)  $31\frac{1}{5}$

**Bonus Answer: Z**

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**9. Mathematics**

**Toss Up: Short Answer**

If a bag contains 5 red marbles, 3 green marbles, and 2 blue marbles, what is the probability of taking out a red and then blue marble without replacement?

**Toss Up Answer: 1/9**

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**Bonus: Multiple Choice**

McDonald's sells McNuggets in boxes of 6, 9, and 20. What is the greatest number of McNuggets that cannot be bought with combinations of these boxes?

- W) 19
- X) 25
- Y) 31
- Z) 43

**Bonus Answer: Z**

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**10. Biology**

**Toss Up: Short Answer**

In a human heart, what structure does blood enter after leaving the left ventricle?

**Toss Up Answer: AORTA**

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**Bonus: Short Answer**

What is the name for the circulatory adaptation found in many marine mammals, such as the grey whale and dolphin, that allows them to conserve heat using parallel blood vessels flowing in opposite directions such as the extremities of the animal?

**Bonus Answer: COUNTERCURRENT HEAT EXCHANGE (ALSO ACCEPT: COUNTERCURRENT EXCHANGE)**

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**11. Biology**

**Toss Up: Multiple Choice**

What is the name for the clear cell wall made of silicon dioxide and water that is found in diatoms?

- W) Frustule
- X) Lamella
- Y) Xylanes
- Z) Pseudomurein

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Which major group of diatoms is motile?

- W) Coscinodiscophyceae
- X) Elusimicrobiaceae
- Y) Thaumarchaeota
- Z) Bacillariophyceae

**Bonus Answer: Z**

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**12. Biology**

**Toss Up: Short Answer**

Imperfect fungi propagate by what mode of reproduction?

**Toss Up Answer: ASEXUAL**

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**Bonus: Multiple Choice**

What do the hyphae [HY-fee] of coenocytic [see-no-SI-tic] fungi lack?

- W) Lipid bodies
- X) Haustoria
- Y) Septa
- Z) Multiple nuclei

**Bonus Answer: Y**

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**13. Earth and Space Science**

**Toss Up: Multiple Choice**

What percentage of Earth's surface area do the seven major lithospheric plates make up?

- W) 84%
- X) 90%
- Y) 94%
- Z) 97%

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Which of Earth's intermediate-sized plates is surrounded by five major plates?

**Bonus Answer: NAZCA PLATE**

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**14. Earth and Space Science**

**Toss Up: Multiple Choice**

Which planet's existence was first predicted mathematically before being directly observed?

- W) Mercury
- X) Uranus
- Y) Venus
- Z) Neptune

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

What is the force exerted by a neutron star that keeps it from collapsing further?

- W) Electron degeneracy pressure
- X) Gravity

Y) Neutron degeneracy pressure

Z) Strong force

**Bonus Answer: Y**

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## 15. Earth and Space Science

**Toss Up: Short Answer**

After which period of the geologic time scale did dinosaurs become extinct?

**Toss Up Answer: CRETACEOUS**

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**Bonus: Short Answer**

Which of the following mountain ranges are younger than 100 million years? 1) Himalayas; 2) Alps; 3) Andes

**Bonus Answer: ALL OF THEM (ACCEPT: 1, 2, AND 3 OR HIMALAYAS, ALPS, AND ANDES)**

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## 16. Physics

**Toss Up: Multiple Choice**

A barycenter is located at which of the following points on an ellipse in an orbital system?

W) Focus

X) Paryapsis

Y) Center

Z) Apoapsis

**Toss Up Answer: W**

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**Bonus: Short Answer**

What is the eccentricity of an orbit with a semimajor axis of 1000 kilometers and a focal distance of 375 kilometers, to the nearest thousandth?

**Bonus Answer: 0.375**

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## 17. Physics

**Toss Up: Short Answer**

What is the eccentricity of a parabolic escape orbit?

**Toss Up Answer: 1**

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**Bonus: Short Answer**

A planet orbiting a star has a semimajor axis of 2 AU and an orbital period of 3 years. Giving your answer in terms of an improper fraction with radicals, what is the orbital period of a planet of the same mass as the first orbiting the same star but with a semimajor axis of 3 AU?

**Bonus Answer:  $9/(2\sqrt{2})$**

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## 18. Physics

**Toss Up: Short Answer**

What force is exerted on a moving charge by a magnetic field?

**Toss Up Answer: LORENTZ FORCE**

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**Bonus: Short Answer**

If a charged particle is moving forward through a magnetic field whose field lines are moving left, in which direction is the Lorentz Force applied?

**Bonus Answer: UP**

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## 19. Physics

**Toss Up: Short Answer**

What is the name for the lightest hadron?

**Toss Up Answer: PION**

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**Bonus: Short Answer**

Pions are commonly found to act as what in an atomic nucleus?

**Bonus Answer: FORCE CARRIER PARTICLE**

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