**NWI2 RR2**

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**TOSS-UP**

1) Chemistry - *Multiple Choice* Which of the following compounds would you expect to burn red in a flame test?up

W) Copper
X) Magnesium
Y) Potassium
Z) Strontiumltech

ANSWER: Z) STRONTIUM

**BONUS**

1) Chemistry - *Multiple Choice* Oscar accidentally poured Sodium Bicarbonate into a beaker of 1M hydrochloric acid. Which of the following would you be likely to observe?

W) A violent explosion
X) The solution effervesces
Y) The solution turns blue
Z) No visible reaction occurs

ANSWER: X) THE SOLUTION EFFERVESCES

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**TOSS-UP**

2) PHYSICS - *Multiple choice* Which of the following is not a state function?

W) Entropy
X) Enthalpy
Y) Pressure
Z) Work
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ANSWER: Z) WORK

**BONUS**

2) PHYSICS - *Short Answer* A ball is thrown at a 30-degree angle with respect to the horizontal at a speed of 100 meters per second. At what time, to the nearest whole second, does the ball reach the highest point in its trajectory?

ANSWER: 5

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**TOSS-UP**

3) MATH - *Short Answer* How many factors does 56 have?

ANSWER: 8

**BONUS**

3) MATH - *Short Answer* On circle O, chord AB and CD intersect at point E. If AE = 6 inches, and BE=4 inches, what is the value of CE, if CE is 2 inches longer than DE?

ANSWER: 6 inches

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**TOSS-UP**

4) EARTH AND SPACE - *Short Answer* In what general area of the Hertzsprung-Russell Diagram would red supergiants be found?

ANSWER: top right

**BONUS**

4) EARTH AND SPACE - *Multiple Choice* Which of the following is a type of protostar?
W) Herbig Haro object

X) T Tauri
Y) Cepheid
Z) Blazar

ANSWER: X) T Tauri

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**TOSS-UP**

5) ENERGY – *Short Answer* Researchers at Brookhaven National Lab are using the Relativistic Heavy Ion Collider to study quark-gluon plasma. Quark-gluon plasma forms when a material's temperature is high enough that what force no longer holds quarks together?

ANSWER: Strong force (ACCEPT: Strong, strong nuclear)

**BONUS**

5) ENERGY – *Multiple Choice* Scientists at the National Energy Technology Laboratory are extracting rare earth elements from coal sources in North Dakota. Which of the following types of coal is generally most useful for extracting rare earth elements?

W) Anthracite
X) Bituminous
Y) Sub-bituminous
Z) Lignite

ANSWER: Z) Lignite

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**TOSS-UP**

6) BIOLOGY - *Short Answer* By name or number, identify all of the following three codons in which a single point mutation can cause a nonsense mutation: 1) UCG, 2) UUU, 3) UAC

ANSWER: 1 AND 3

**BONUS**

6) BIOLOGY - *Multiple Choice* One of the modifications made to mRNA after transcription is the addition of a poly-A tail, consisting of up to 250 adenine nucleotides. Which of the following best describes the purpose of the poly-A tail?

W) It allows the mRNA to attach to the ribosome

X) It guides spliceosomes to the correct sequences to be removed

Y) It prevents degradation of the mRNA

Z) It moves with the help of ATP hydrolysis to propel the mRNA through the cytoplasm

ANSWER: Y) IT PREVENTS DEGRADATION OF THE MRNA

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**TOSS-UP**

7) CHEMISTRY - *Multiple Choice* Which of the following sets of quantum numbers $n$, $l$, $m_l$, $m_s$ could not be seen in a ground state Arsenic atom?

W) 3, 2, 1, ½

X) 2, 1, -1, ½

Y) 3, 2, 2, -½

Z) 2, 2, 1, -½

ANSWER: Z) 2, 2, 1, -½

7) CHEMISTRY - *Short Answer* By name or number, rank the following three compounds by increasing bond angle: 1) $CH_4$, 2) $NH_3$, 3) $H_2O$

ANSWER: 3, 2, 1

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**TOSS-UP**

8) PHYSICS - *Multiple Choice* If you stand at rest on a bench, the bench exerts a normal force on you, equal and opposite to your weight. Which force is related to this normal force by Newton's third law?

W) The gravitational force from the earth on you

X) The gravitational force from you on the earth

Y) The normal force from you on the bench

Z) None of the above

Answer: Y) The normal force from you on the bench

**BONUS**

8) PHYSICS - *Short Answer* Oscar throws a ball upward. After the ball has reached half the total height, what is its velocity in terms of this height called h.

ANSWER: $\sqrt{gh}$

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**TOSS-UP**

9) MATH - *Multiple Choice* According to the Rational Root Theorem, which of the following values is a possible root of the equation $3x^2 + 2x - 15$ (Read as: 3 x squared plus 2 x minus 15)

W) 4/3

X) 5/3

Y) 8/3

Z)10/3

ANSWER: X) 5/3

**BONUS**

9) MATH – *Short Answer* A standard six-sided die is rolled three times. What is the probability that the sum of the three rolls is exactly 10?
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ANSWER: ⅛

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**TOSS-UP**

10) EARTH AND SPACE - *Multiple Choice* Which of the following types of volcanoes is characterized by lightly sloping sides and effusive eruptions?

W) composite

X) plinian

Y) cinder cone

Z) shield

ANSWER: Z) shield

**BONUS**

10) EARTH AND SPACE - *Multiple Choice* Which of the following methods of radiometric dating would be most useful to date an igneous rock thought to be billions of years old?

W) radiocarbon dating

X) oxygen isotope dating

Y) potassium-argon

Z) uranium-lead dating

ANSWER: Z) uranium-lead dating

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**TOSS-UP**

11) ENERGY - *Short Answer* Researchers at CalTech's Kavli Nanoscience Institute are using meteorites to study the evolution of the martian atmosphere. By name or number, rank the following three gases in increasing order of percent composition of the martian atmosphere: 1) nitrogen, 2) argon, 3) carbon dioxide

ANSWER: 2, 1, 3

**BONUS**

11) ENERGY - *Multiple Choice* Researchers at the Plikus Lab at the University of California, Irvine are studying chondrocytes, which compose cartilage. They have found that these cells are filled with large deposits of lipids located in which of the following cellular organelles?

W) Golgi apparatus

X) Peroxisome
Y) Endoplasmic reticulum
Z) Vacuole

ANSWER: Z) VACUOLE

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**TOSS-UP**

12) BIOLOGY - *Short Answer* Identify all of the following structures in which ribosomes can be found

I) Cytoplasm
II) Mitochondria
III) Chloroplasts

Answer: I, II, III (ALL)

**BONUS**

12) BIOLOGY - *Short Answer* At which stage of meiosis are fetal mammalian oocytes arrested until puberty?

ANSWER: PROPHASE 1

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**TOSS-UP**

13) CHEMISTRY - *Short Answer* When Oscar was adding 1M NaCl into a solution containing 1M KCl, he found that he could not add as much NaCl to the solution as he could to pure distilled water. What is the name of the effect that predicts this behavior?

ANSWER: COMMON-ION EFFECT

**BONUS**

13) CHEMISTRY - *Short Answer* Rank the following four molecules by increasing normal boiling point: 1) HF, 2) HCl, 3) HBr, 4) HI

ANSWER: 2, 3, 4, 1

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**TOSS-UP**

14) PHYSICS - *Short answer* A concave mirror has a focal length of 10 cm. If an object is placed 30 cm from the mirror, in centimeters, what is the image distance?

ANSWER: 15

**BONUS**

14) PHYSICS - *Short Answer* A 10-meter-long stick with negligible mass has blocks of 30 kg and 60 kg placed at positions 2 meters and 8 meters respectively from the left end. How many meters from the left should a pivot be placed so that the stick is in static equilibrium?

ANSWER: 6

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**TOSS-UP**

15) MATH - Short Answer: Oscar invents a machine that when inputted a number n, it will output 3n-1 . If Oscar inputs 1 then uses the machine a total of 3 times, what will his final output be?

ANSWER: 14

**BONUS**

15) Math - *Short Answer* Oscar the pirate found treasure while exploring an island. If the treasure contains 8 gold coins and he must split it with two other people, how many different ways is this possible, if everyone needs to get at least one coin?

ANSWER: 21 ways

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**TOSS-UP**

16) EARTH AND SPACE - *Short Answer* The Big Dipper is an asterism found within what constellation?

ANSWER: Ursa Major

**BONUS**

16) EARTH AND SPACE - *Short Answer* Name all of the following 3 exoplanet characteristics that can be measured using only its transit:

1) atmosphere composition

2) revolution direction

3) mass

ANSWER: 1 and 2

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**TOSS-UP**

17) ENERGY - *Short Answer* Students in Niskayuna High School's AP Biology class are performing gel electrophoresis on a DNA sample. In gel electrophoresis, the cathode is placed closest to the wells, while the anode is placed furthest. This allows the negatively charged DNA to move through the agar. DNA's negative charge is caused by the presence of what functional group?

ANSWER: PHOSPHATE (ACCEPT: $PO_4^{3-}$)

**BONUS**

17) ENERGY - *Short Answer* Researchers at the National Oceanic and Atmospheric Administration are studying polar vortices, which are high-altitude areas of low pressure that are bounded by what bands of strong westerly winds which occur in the upper levels of the troposphere?

ANSWER: JET STREAM

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**TOSS-UP**

18) BIOLOGY - *Short Answer* By name or number, identify all of the following three statements that are true of CRISPR-Cas9: 1) CRISPR sequences allow a bacteria to identify a bacteriophage that has previously infected it, 2) Cas9 refers to an endonuclease that cuts desired parts of the DNA, 3) CRISPR-Cas9 can only modify prokaryotic DNA

ANSWER: 1 AND 2

**BONUS**

18) BIOLOGY - *Multiple Choice* Despite being the causative agent of chickenpox, the varicella-zoster virus is a herpesvirus rather than a poxvirus. Which of the following is not a similarity between herpesviruses and poxviruses?

W) Presence of an envelope

X) Presence of double-stranded DNA

Y) Both replicate in the cytoplasm

Z) Both can cause diseases in humans

ANSWER: Y) BOTH REPLICATE IN THE CYTOPLASM

**TOSS-UP**

19) CHEMISTRY - *Short Answer* Identify all of the following three acids that are diprotic: 1) Oxalic acid, 2) Phosphoric acid, 3) Citric acid

ANSWER: 1 ONLY

**BONUS**

19) CHEMISTRY - *Short Answer* Oscar would like to figure out the lattice energy for his favorite ionic compound, MgO. What process would he use to calculate it?

ANSWER: BORN-HABER CYCLE

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**TOSS-UP**

20) PHYSICS - *Short Answer* Identify all of the following that are conservative forces:

1) Gravitational force

2) Friction

3) Spring force

ANSWER: 1 and 3 (Accept: Gravitational and spring force)
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**BONUS**

20) PHYSICS - *Short Answer* A circuit consists of one 8 volt battery and 2 resistors A and B connected in series. If the resistance of resistor A is 3 ohms and the resistance of resistor B is 4 ohms, what is the voltage through resistor A and B respectively?

ANSWER: 24/7 and 32/7 ohms.