TOSS-UP

1. ASTRONOMY: Multiple Choice: What ancient Greek spawned astronomy research from his famed Academy?

W) Aristotle
X) Aristarchus of Samos
Y) Empedocles
Z) Plato

ANSWER: **Z) Plato**

BONUS

1. ASTRONOMY: Short Answer: Give the title of Carl Sagan's 1970's 13-part PBS series on astronomy and the companion best-selling book.

ANSWER: ***Cosmos***

TOSS-UP

2. BIOLOGY: Multiple Choice: In what phase of mitosis do the chromatids first separate from the spindle?

W) anaphase
X) telophase
Y) metaphase
Z) prophase

ANSWER: **W) anaphase**

BONUS

2. BIOLOGY: Short Answer: He discovered the final pathway by which food molecules are broken down into energy in living tissues. Identify this German-born chemist who has the cycle named for him.

ANSWER: Hans **Krebs**

TOSS-UP

3. MATH: Multiple Choice: Which of these containers holds the most volume?

W) a 1500-cc graduated cylinder
X) a two-liter bottle
Y) a 46-ounce can
Z) a half-gallon jug

ANSWER: **X) two-liter bottle** (67.6 oz; 1500 cc = 50.7 oz, half-gallon = 64 oz.)

BONUS

3. MATH: Short Answer: A true one requires 4 dimensions, but the 3-D ones still look pretty cool. Name this item made (theoretically) by sewing two Mobius strips together to create a one-sided figure with no boundary.

ANSWER: **Klein Bottle**

TOSS-UP

4. PHYSICS: Short Answer: One example of this idea is that flow speeds up in a nozzle when the pressure drops. What concept named for a Swiss scientist also explains how the pressure difference on the surfaces of an airplane wing causes the plane to lift off the ground?

ANSWER: **Bernoulli's** [bur-NOO-leez] Principle

BONUS

4. PHYSICS: Multiple Choice: In 1928, Max Born said, "Physics, as we know it, will be over in 6 months" after he heard that the electron had been perfectly described through equations derived by what physicist and mathematician?

W) Werner Heisenberg
X) Niels Bohr
Y) Paul Dirac [DEER-ack]
Z) Georg Riemann [REE-mawn]

ANSWER: **Y)** Paul **Dirac**

TOSS-UP

5. GENERAL SCIENCE: Multiple Choice: Its current standard appeared in 1995, 12 years after its first edition. Name this computer language first adopted by the federal government in 1983 and named for the daughter of Lord Byron.

W) Algol
X) Java
Y) Lisa
Z) Ada

ANSWER: **Z) Ada**

BONUS

5. GENERAL SCIENCE: Short Answer: The Polish gave their information on it to Britain just before Hitler began World War II. Within a year, the British had figured out most of its secrets in their headquarters at Bletchley Park. Give the name of this German machine whose dials allowed trillions of possible secret codes.

ANSWER: **Enigma**

TOSS-UP

6. CHEMISTRY: Short Answer: With a methyl group attached, it is called a "toluene" [TALL-u-een]. With an OH group attached, it is called a "phenol" [FEE-nall]. Name this carbon compound whose molecules are shaped like rings.

ANSWER: **benzene**

BONUS

6. CHEMISTRY: Short Answer: Its bichromate is used in tanning leather and turns the edges of treated leather a bluish-green color. What metallic element needed in the human diet can be found in foods like bananas?

ANSWER: **potassium**

TOSS-UP

7. EARTH SCIENCE: Multiple Choice: One way of learning the approximate age of an object is by using the known 5,730-year half-life of the 14 isotope of:

W) nitrogen
X) carbon
Y) helium
Z) sulfur

ANSWER: **X) carbon**

BONUS

7. EARTH SCIENCE: Multiple Choice: If you drop a crystalline mineral and it breaks into ugly pieces of trash, you are said to have "fractured" the rock. Give the term for when a rock cracks along its break patterns so as to be both pleasing to the eye and useful:

W) cleavage
X) separation
Y) geode
Z) breakage

ANSWER: **W) cleavage**

TOSS-UP

8. MATH: Short Answer: The number e is called e (instead of some other letter) because it was the first letter of the last name of--what legendary Swiss mathematician who discovered it?

ANSWER: Leonhard **Euler** [OY-ler]

BONUS

8. MATH: Short Answer: To write the fraction 1/3 as a repeating decimal, write .3 and put a bar over the three to indicate that the three is repeating. What is the mathematical term for the bar that goes over the 3?

ANSWER: **vinculum** [VINK-ya-lum]

TOSS-UP

9. BIOLOGY: Short Answer: It is the most common genetic disorder in America and is named for the British scientist who published a paper on it in 1866. Name this disease once called "mongoloidism".

ANSWER: **Down Syndrome**

BONUS

9. BIOLOGY: Multiple Choice: People with Down Syndrome have an extra copy of which of the 23 human chromosomes?

W) 6
X) 12
Y) 19
Z) 21

ANSWER: **Z) 21**

TOSS-UP

10. CURRENT EVENTS: Multiple Choice: When NASA's Mars rover *Spirit* had problems in January 2004, which twin rover took over much of the work?

W) *Discovery*
X) *Opportunity*
Y) *Challenger*
Z) *Red Planet*

ANSWER: **X) *Opportunity***

BONUS

10. CURRENT EVENTS: Short Answer: What country's top scientist, Abdul Qadeer Khan, announced in February 2004 that he had arranged to share nuclear technology with Iran, Libya and North Korea?

ANSWER: **Pakistan**

TOSS-UP

11. ASTRONOMY: Short Answer: Identify the American astronomer whose namesake 1929 law says that the size of the universe is constantly expanding.

ANSWER: Edwin **Hubble**

BONUS

11. ASTRONOMY: Short Answer: The astronomical symbol for the planet Pluto is a combination of the letters P and L, not only because they're the first 2 letters of "Pluto", but because they are the initials of what scientist who spent years trying to find Pluto before he died in 1916?

ANSWER: Percival **Lowell**

TOSS-UP

12. GENERAL SCIENCE: Short Answer: Its "white" variety is made of serpentine and its "blue" variety of sodium iron silicate. Name this general group of fibrous minerals used as insulation that can cause cancer when inhaled.

ANSWER: **asbestos**

BONUS

12. GENERAL SCIENCE: Short Answer: Five times stronger than steel, its discovery earned Stephanie Kwolek a place in the National Inventors Hall of Fame and the everlasting gratitude of thousands of DuPont shareholders. Identify this polymer most commonly used in bullet-proof vests.

ANSWER: **Kevlar**

TOSS-UP

13. CHEMISTRY: Short Answer: When Ernest Rutherford tried alchemy in 1919, he didn't try to convert lead into gold. Instead, he converted nitrogen into what other gaseous element that is next to it in the periodic table?

ANSWER: **oxygen**

BONUS

13. CHEMISTRY: Short Answer: What chemical indicator turns red in the presence of a strong acid and yellow in the presence of a weaker acid?

ANSWER: **methyl orange**

TOSS-UP

14. PHYSICS: Multiple Choice: What letter of the Greek alphabet is generally used to denote frictional coefficient?

W) phi
X) mu
Y) alpha
Z) gamma

ANSWER: **X) mu** (μ)

BONUS

14. PHYSICS: Short Answer: He served as London's Chief Surveyor after its Great Fire, created the universal joint, and discovered the cell. Name this British scientist whose law says that $F = kx$, where k is the spring constant.

ANSWER: Robert **Hooke**

TOSS-UP

15. MATH: Short Answer: Formed by taking a conic section with a plane diagonally intersecting one of the cones, it is ideal for acoustics because sound reverberates at its foci. Name this conic section with general form $x^2/a^2 + y^2/b^2 = 1$.

ANSWER: **ellipse**

BONUS

15. MATH: Multiple Choice: In the standard equation for an ellipse, what conic section do you get if you change the plus sign in the addition to a minus sign?

W) hyperbola
X) spiral
Y) parabola
Z) circle

ANSWER: **W) hyperbola**

TOSS-UP

16. BIOLOGY: Short Answer: It is the three-letter stock symbol of the biotech firm Genentech. Give this acronym for the genetic substance whose double-helix shape was discovered by Watson and Crick.

ANSWER: **DNA**

BONUS

16. BIOLOGY: Multiple Choice: Barnacles attached to whales, seaweed growing on turtles, and birds nesting in trees are all examples of--what type of relationship in which one species gains benefits from another without affecting it?

W) symbiosis
X) parasitism
Y) mutualism
Z) commensalism

ANSWER: **Z) commensalism**

TOSS-UP

17. EARTH SCIENCE: Multiple Choice: What type of cloud consists of ice crystals, looks thin and wispy, and only appears at high altitudes?

W) nimbus
X) stratus
Y) cirrus
Z) cumulus

ANSWER: **Y) cirrus**

BONUS

17. EARTH SCIENCE: Multiple Choice: Name the gem, found most in Afghanistan, that when crushed yields the shade of blue called "ultramarine."

W) ruby
X) quartz
Y) lapiz lazuli
Z) turquoise

ANSWER: **Y) lapiz lazuli**

TOSS-UP

18. GENERAL SCIENCE: Short Answer: Named for a British mathematician, it involves judging between a human response to conversation and a computer's response to the same conversation. Identify this test that a computer is said to "pass" if a human judge can't tell the two responses apart.

ANSWER: **Turing test**

BONUS

18. GENERAL SCIENCE: Short Answer: It was constructed in the 1940's at the University of Pennsylvania. Give either the acronym or the full name of this machine that, in 1946, proved that high-speed digital computing could be done with vacuum tubes.

ANSWER: **ENIAC** or **Electronic Numerical Integrator and Computer**

TOSS-UP

19. CHEMISTRY: Multiple Choice: The drugs ephedrine [EFF-a-dreen], atropine [ATRA-peen], morphine, caffeine and nicotine are all examples of what type of nitrogen compound?

W) ethers
X) aldehydes
Y) alkenes
Z) alkaloids

ANSWER: **Z) alkaloids**

BONUS

19. CHEMISTRY: Short Answer: It contains one correction for the attractive forces between molecules of a gas and another correction for the size of each molecule. Name this equation that expands the $PV = nRT$ into $(P + n^2a/V^2)(V - nb) = nRT$.

ANSWER: **Van der Waals** equation

TOSS-UP

20. MATH: Multiple Choice: A container has 24 balls in it: 6 red, 8 blue and 10 yellow. If you grab one ball without looking, what are your chances, in lowest terms, of grabbing a yellow ball first and then a red one?

W) 5/12
X) 6/23
Y) 5/46
Z) 1/3

ANSWER: **5/46** (10/24 x 6/23)

BONUS

20. MATH: Short Answer: Divide the polynomial $6x^5 + 27x^4 + 37x^3 + 83x^2 - 17x - 40$ by the quantity $(2x^2 + 9x + 5)$.

ANSWER: **$3x^3 + 11x - 8$**

TOSS-UP

21. CURRENT EVENTS: Short Answer: In February 2004, British researchers may have discovered the hull of what ship, used to travel the world in the 1830's by Charles Darwin?

ANSWER: *HMS* ***Beagle***

BONUS

21. CURRENT EVENTS: Multiple Choice: In February 2004, what is said to be the world's oldest fossil was found, 400-million-year-old *Rhyniognatha Hirsti* [rye-nee-OG-na-tha HURST-ee]. What kind of creature was it?

W) reptile
X) fish
Y) mammal
Z) insect

ANSWER: **Z) insect**

TOSS-UP

22. MATH: Short Answer: Consider a particle traveling through space with a velocity of $3x^2 + 13x - 5$ inches per second. Calculate the particle's acceleration at time = 1 second.

ANSWER: **19** in./sec^2 ($6x + 13$)

BONUS

22. MATH: Short Answer: Given the same equation, calculate the distance the particle travels between time = 0 and time = 1 second.

ANSWER: **2.5** (or **5/2**) inches (integrate between 1 and 0)

TOSS-UP

23. BIOLOGY: Multiple Choice: The line named for British naturalist Alfred Wallace separates the animal species of what two continents?

W) Asia and Australia
X) Europe and Africa
Y) North America and South America
Z) Australia and Antarctica

ANSWER: **W) Asia and Australia**

BONUS

23. BIOLOGY: Multiple Choice: The DNA nitrogen base thymine [THIGH-meen] always pairs up with:

W) guanine [GWAH-neen]
X) cytosine [SY-ta-seen]
Y) thymine [THY-meen]
Z) adenine [AD-a-neen]

ANSWER: **Z) adenine**

TOSS-UP

24. PHYSICS: Short Answer: You stand at your bedroom window and drop a 4-kilogram basketball a distance of 3.5 meters to your friend on the ground. Assuming that gravity is 9.8 meters per second squared, how much potential energy, in joules, must your friend absorb to catch the ball without dropping it?

ANSWER: **137.2 J** (4 x 3.5 x 9.8)

BONUS

24. PHYSICS: Short Answer: If the frequency of electromagnetic radiation is too low, the radiation cannot knock off loose electrons from metal no matter how intense the radiation is. Give the two-word term for this concept that won Albert Einstein his Nobel Prize.

ANSWER: **photoelectric effect**

TOSS-UP

25. CHEMISTRY: Multiple Choice: What British scientist is credited with the idea that the pressure of a gas mixture is equal to the sum of their partial pressures?

W) Joseph Priestley
X) Michael Faraday
Y) John Dalton
Z) Humphrey Davy

ANSWER: **Y)** John **Dalton**

BONUS

25. CHEMISTRY: Short Answer: Nowadays, it contains antimony and copper because they are known to be safer for people than lead is. Name this chemical alloy that is still more than 90% tin, just as it was in the days of the Revolutionary War.

ANSWER: **pewter**

END OF ROUND 3