

13

1. Earth and Space Science

Toss Up: Multiple Choice

At above what size, in cm, does a rock need to be in order to be a boulder?

W) 15.3

X) 25.6

Y) 40.2

Z) 22.9

Toss Up Answer: X

Bonus: Short Answer

At which two zones of Earth's atmosphere does the temperature rise as the altitude increases?

Bonus Answer: Stratosphere and Thermosphere

=====

2. Chemistry

Toss Up: Multiple Choice

Which would be the easiest way to burn an iron nail?

W) Hold an iron nail with crucible tongs, and heat strongly in the flame of a bunsen burner.

X) Use the above method with an oxyacetylene torch to reach highest temperatures.

Y) Grind the nail into very small, dust-sized particles and spray them into a flame.

Z) Dissolve the nail in acid to make the oxide.

Toss Up Answer: Y

Bonus: Multiple Choice

What is a reasonable and safe substitute for zinc in reduction reactions in aqueous solutions?

W) S

X) F2

Y) K

Z) Cd

Bonus Answer: Z

=====

3. Biology

Toss Up: Multiple Choice

The phenomenon by which diploid cells cease to divide is known as

W) parthenogenesis

X) alternation of generations

Y) cellular senescence

Z) lysis

Toss Up Answer: Y

Bonus: Short Answer

What country has the highest human life expectancy?

Bonus Answer: Japan

=====

4. Earth and Space Science

Toss Up: Multiple Choice

What is the name of the igneous rock that is a porous volcanic glass formed by rapidly cooling lava?

- W) Obsidian
- X) Gabbro
- Y) Basalt
- Z) Pumice

Toss Up Answer: Z

Bonus: Short Answer

What are the three general types of magma?

Bonus Answer: Basaltic magma, Andesitic magma, and Rhyolitic magma

=====

5. Mathematics

Toss Up: Short Answer

What is the probability of, in no particular order, flipping exactly 2 heads and 2 tails when flipping 4 coins?

Toss Up Answer: $\frac{3}{8}$ (accept .375 or 37.5%)

Bonus: Short Answer

Given a circle centered at 1,2 what is the slope of a tangent line which passes through the point (3,3)

Bonus Answer: -2

=====

6. Chemistry

Toss Up: Multiple Choice

Choose the best choice below to fill in the blanks. When a system reaches equilibrium, the concentrations of the products and reactants are [blank] and the rate of the forward and reverse reactions are [blank].

- W) constant, equal
- X) equal, constant
- Y) unequal, unconstant
- Z) constant, unequal

Toss Up Answer: W

Bonus: Short Answer

Which of the following acids are polyprotic: nitrous acid, nitric acid, sulfurous acid, sulfuric acid and hypochlorous acid.

Bonus Answer: 3 and 4 (sulfurous acid and sulfuric acid)

=====

7. Biology

Toss Up: Short Answer

What term describes the number of times a normal human cell population can divide?

Toss Up Answer: Hayflick limit

Bonus: Multiple Choice

What controls the Hayflick limit?

- W) apoptosis
- X) length of telomeres
- Y) genomic instability

Z) genetic drift

Bonus Answer: X

=====

8. Mathematics

Toss Up: Short Answer

What is the tangent of $(27\pi)/4$

Toss Up Answer: -1

Bonus: Short Answer

With a 5 percent compound interest rate, how long, to the nearest year, will it take a sum of money to double?

Bonus Answer: 14 years

=====

9. Chemistry

Toss Up: Multiple Choice

Which of the following is not commonly produced by eletrolysis?

W) NaOCl

X) Al

Y) Fe

Z) NaOH

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following pairs of constants are not mathematically related to eachother?

W) Equilibrium constant and Gibbs Free Energy

X) Rate Constant and Activation Energy

Y) Standard Cell Voltage and Equilibrium Constant

Z) Standard Cell Voltage and Rate Constant

Bonus Answer: Z

=====

10. Biology

Toss Up: Short Answer

Name the syndrome caused by a partial deletion of chromosome 5 that results in an abnormal cry in the patient.

Toss Up Answer: Cri Du Chat

Bonus: Multiple Choice

If nondisjunction occurs in a cell during meiosis I, how many of the 4 daughter cells will have an abnormal chromosome number?

W) 1

X) 2

Y) 3

Z) 4

Bonus Answer: Z

11. Chemistry

Toss Up: Short Answer

What is the common oxidation state of Radium?

Toss Up Answer: +2 (don't accept 2)

Bonus: Short Answer

List the following atoms in order of increasing electron affinity: oxygen, boron, and fluorine.

Bonus Answer: (1) BORON, (2) OXYGEN, (3) FLUORINE

12. Mathematics

Toss Up: Multiple Choice

The sum $(1+3+3^2+\dots+3^n)$ is equal to which of the following?

W) $2 \cdot 3^n$

X) $4 \cdot 3^n$

Y) $(3^{n+1}+1)/2$

Z) $(3^{n+1}-1)/2$

Toss Up Answer: Z

Bonus: Short Answer

In space, what is the graph of the equation $x^2 = y$?

Bonus Answer: A parabolic cylinder

13. Physics

Toss Up: Short Answer

What law most directly states that the total of the electric flux out of a closed surface is equal to the charge enclosed divided by the permittivity?

Toss Up Answer: Gauss's Law

Bonus: Short Answer

When a magnet is moved into a coil of wire, changing the magnetic field and magnetic flux through the coil, a voltage will be generated in the coil according to which law?

Bonus Answer: Faraday's Law

14. Earth and Space Science

Toss Up: Short Answer

Name the wave that you would typically feel during an earthquake if you were standing on the ground after feeling the first primary wave.

Toss Up Answer: S-wave (secondary wave)

Bonus: Short Answer

An earthquake is measured to have a Richter scale value of around 4. Another earthquake is measured to have a Richter scale value of 7. How much smaller is the first earthquake to the second earthquake?

Bonus Answer: 1000 times smaller (accept 1000)

15. Physics

Toss Up: Short Answer

Given that the specific heat capacity of water is 11 times that of copper, calculate the mass of copper at a temperature of 100 °C required to raise the temperature of 200 g of water from 20.0 °C to 24.0 °C, assuming no energy is lost to the surroundings.

Toss Up Answer: 0.116 kg

Bonus: Short Answer

1 kg of water at a temperature of 45 °C is mixed with 1.5 kg of alcohol at 20 °C. Find the final temperature of the mixture.

Take the specific heat capacity of water to be 4200 J kg⁻¹ K⁻¹ and the specific heat capacity of alcohol to be 2400 J kg⁻¹ K⁻¹. Assume no other exchange of heat occurs.

Bonus Answer: 33°C

=====

16. Earth and Space Science

Toss Up: Multiple Choice

The North Pacific Gyre is mostly located within what latitudinal zone?

- W) The North Frigid Zone
- X) The Torrid Zone
- Y) The Horse Latitudes
- Z) The North Temperate Zone

Toss Up Answer: Z

Bonus: Short Answer

What ocean current keeps Western Europe relatively warm for its latitude?

Bonus Answer: North Atlantic Current (accept North Atlantic Drift, but not Gulf Stream)

=====

17. Physics

Toss Up: Multiple Choice

Who discovered radioactivity in 1896?

- W) Wilhelm Rontgen
- X) Henri Becquerel
- Y) Marie Curie
- Z) Albert Einstein

Toss Up Answer: X

Bonus: Multiple Choice

What is made by joining an N-type and P-type semiconductor material?

- W) Transistor
- X) Diode
- Y) Capacitor
- Z) Collector

Bonus Answer: X

=====

18. Biology

Toss Up: Short Answer

What is the purpose of SSBs (single strand binding proteins) in DNA replication?

Toss Up Answer: To prevent hybridisation of original parent strands

Bonus: Short Answer

What is the origin of replication called?

Bonus Answer: Ori

=====

19. Mathematics

Toss Up: Multiple Choice

How many roots (real or complex) does $x^4 - x^3 - 9x^2 + 7x + 14 = 0$ have?

W) 1

X) 2

Y) 3

Z) 4

Toss Up Answer: Z

Bonus: Short Answer

Find all real roots of $x^4 - x^3 - 9x^2 + 7x + 14 = 0$

Bonus Answer: -1, 2, +/- (sqrt 7)

=====

20. Earth and Space Science

Toss Up: Multiple Choice

Where is the Sea of Tranquility?

W) Near the Bermuda Triangle

X) In the Atlantic Ocean

Y) In the Pacific Ocean

Z) On the Moon

Toss Up Answer: Z

Bonus: Multiple Choice

The outermost layer of the sun is called the:

W) Ionosphere

X) Chromosphere

Y) Corona

Z) Photosphere

Bonus Answer: Y

=====

21. Physics

Toss Up: Multiple Choice

A 5 kg ball is ejected from a spring and it rolls 8m up a frictionless incline at 30 degrees before coming to a stop. Assuming that $g = 10 \text{ m/s}^2$ (READ AS 10 meters per second squared) and that the spring constant is 100N/m, how far does the spring has to be compressed initially?

W) 1m

X) 2m

Y) 4m

Z) 6m

Toss Up Answer: X

Bonus: Short Answer

The potential energy of a 1kg particle is represented by $U(x,y,z) = 2xy + 3z^2$ (READ AS: U of x, y, z equals 2xy plus 3 z squared). What is the magnitude of the force acting on the particle at position (0,4,1)?

Bonus Answer: 10 N

=====

22. Biology

Toss Up: Multiple Choice

Which of the following is not an phyla in the kingdom animalia?

W) Chordata

X) Lycophyta

Y) Bryozoa

Z) Cnidaria

Toss Up Answer: X

Bonus: Short Answer

What is the order of the house mouse, mus musculus?

Bonus Answer: Rodentia

=====

23. Chemistry

Toss Up: Multiple Choice

Which of the following hydrocarbons have the highest boiling point.

W) CH₄

X) C₂H₆

Y) C₃H₈

Z) C₄H₁₀

Toss Up Answer: Z

Bonus: Multiple Choice

Alloys are mixtures of metallic substances. Which of the following pairs are matched INCORRECTLY?

W) Steel - iron and copper

X) Brass - copper and zinc

Y) Pewter - tin, copper, bismuth, and antimony

Z) Sterling silver - silver and copper

Bonus Answer: W

=====

24. Mathematics

Toss Up: Multiple Choice

In the Christmas carol "The 12 Days of Christmas", the singer says that for every day of Christmas, their significant other gives them a quantity of a new gift equal to the current day of Christmas, plus the previous gifts given. For example, on the second day onward, the singer receives 2 turtledoves on each

day until the end of Christmas. What is the greatest quantity of a single gift given during the 12 days?

- W) 36
- X) 40
- Y) 42
- Z) 48

Toss Up Answer: Y

Bonus: Short Answer

How many total gifts are given in the 12 days of Christmas?

Bonus Answer: 364

=====

25. Physics

Toss Up: Short Answer

A 10 farad capacitor is used in a circuit. The voltage difference between the plates of the capacitor is 20 volts. What is the magnitude of the charge on each of the capacitor's plates?

Toss Up Answer: 200 Coloumbs

Bonus: Multiple Choice

A circuit which employs a DIRECT CURRENT source has a branch which contains a capacitor. After the circuit has reached a steady state, what is the magnitude of the current in the circuit branch which contains the capacitor?

- W) 0
- X) havled
- Y) doubled
- Z) infinity

Bonus Answer: W

=====