

## Science Bowl Questions

1) BIOLOGY Short Answer: Which protozoan parasite causes malaria in humans?

ANSWER: Plasmodium falciparum

### BONUS

BIOLOGY Short Answer: Order the following epochs from oldest to youngest: Ediacaran, Paleogene, Permian, and Devonian.

ANSWER: 1, 4, 3, 2

2) BIOLOGY Multiple Choice: Which of the following are parasites which can only survive in animal cells?

W) Cyanobacteria

X) Spirochetes

Y) Chlamydia

Z) Gram-positive

ANSWER: Y) Chlamydia

### BONUS

BIOLOGY Multiple: Which of the following is false?

W) Ciliates have two types of nuclei: tiny micronuclei and large macronuclei.

X) Stramenophiles are known for their flagella.

Y) Diatoms are unicellular algae that have a unique wall made of hydrated silica.

Z) The largest and most complex algae are brown algae, most marine and unicellular.

ANSWER: Z

3) BIOLOGY Multiple: The difference between lycophytes and conifers is that:

W) Lycophytes are bryophytes while conifers are vascular plants.

X) Conifers require seeds to spread while lycophytes lack seeds.

Y) Lycophytes belong to phylum Lycophyta while conifers are in Anthophyta.

Z) Conifers have twice as many species as do lycophytes.

ANSWER: X

### BONUS

BIOLOGY Short Answer: Using numbers or words, denote which of the following belong to phylum coniferophyta. 1) Common juniper 2) Douglas fir 3) European larch 4) Sequoia

ANSWER: All

4) BIOLOGY Short Answer: What is the term for small, raised areas which dot the periderm, in which living cells can exchange gases with outside air?

ANSWER: Lenticels

BONUS

BIOLOGY short: in numbers or words, denote which of the following four are true:

- 1) Tracheids and vessel elements are tubular, short cells that function while alive.
- 2) Collenchyma cells have thicker primary walls than parenchyma and support young parts of the plant shoot.
- 3) Sclerenchyma cells are less rigid than collenchyma cells and can elongate.
- 4) Most parenchyma cells lack secondary walls.

ANSWER: 2, 4

5) BIOLOGY Short: Leukocytes recognize microbes using receptors named what?

ANSWER: TLR or Toll-like receptor

BONUS

BIOLOGY Short Answer: Assume an adult human at rest with a heart rate of about 72 beats per minute. In numbers or words, order the following steps of the cardiac cycle from which takes more time to occur to which takes the least time to occur: 1) Atrial and ventricular diastole 2) Ventricular systole and atrial diastole 3) Atrial systole and ventricular diastole

ANSWER: 123

6) Physics Multiple: The period of a pendulum with length 1000 m is what?

- W) 20 pi
- X) 30 pi
- Y) 40 pi
- Z) 50 pi

ANSWER: W

BONUS

PHYS Short Answer: Calculate the change in entropy if 400 Joules are absorbed during a reversible, constant temperature process between two equilibrium states if the constant temperature is 300 Kelvin.

ANSWER:  $4/3 \text{ J/K}$

7) Physics Multiple: Which of the following is false?

W) In travelling waves travelling along rope, each segment of the rope that's disturbed moves perpendicular to wave motion.

X) In longitudinal waves, displacement is parallel to wave motion.

Y) Sound waves are travelling waves.

Z) When waves meet crest to crest and trough to trough, they undergo constructive interference.

ANSWER: Y) Sound waves are travelling waves.

BONUS

PHYS Short Answer: The reversible method of transforming electrical energy into mechanical energy is called what?

ANSWER: Pizoelectric effect

8) MATH short: The solutions to  $x^3 + 2x^2 - x - 2$  are what?

ANSWER:  $\pm 1, -2$

BONUS

MATH Short Answer: The distance between the foci of  $(x-3)^2/10 - (y-4)^2/20 = 1$  is what? (Radical answers accepted)

ANSWER:  $2 \times \text{root } 30$

9) MATH short: What is the dot product of  $\langle 1, 2, 3 \rangle$  and  $\langle 3, 4, 2 \rangle$ ?

ANSWER: 17

BONUS

MATH Short Answer: The distance asymptotes of  $(x-3)^2/10 - (y-4)^2/20 = 1$  are what?

ANSWER:  $2x-5$  and  $-2x+11$

10) MATH short: What is the dot product of  $\langle 1, 2, 3 \rangle$  and  $\langle 3, 4, 2 \rangle$ ?

ANSWER: 17

BONUS

MATH Short Answer: Find the integral of log base 3, where the product is 5.

ANSWER:  $5 \log \text{base } 3 5 - 5/\log 3 + c$

$$\int \log_a x \, dx = x \log_a x - \frac{x}{\log a} + C$$

11) MATH short: Given polar coordinates 3, pi, convert to Cartesian.

ANSWER: (0, -9)

BONUS

MATH Short Answer: Find the inverse of  $x/\sqrt{x^2+7}$ .

ANSWER:  $\sqrt{7}x/\sqrt{1-x^2}$

12) CHEM Multiple: Ultraviolet rays fall between

W)  $10^2$  and  $10^4$  m

X)  $10^{-2}$  and  $10^{-4}$  m

Y)  $10^{-8}$  and  $10^{-6}$  m

Z)  $10^{-10}$  to  $10^{-8}$  m

ANSWER: Z)  $10^{-10}$  to  $10^{-8}$  m

BONUS

Chem Short Answer: Give the formula for Formic acid.

ANSWER: HCHO<sub>2</sub>

13) CHEM Multiple: Which is false?

W) Methanol is a primary alcohol.

X) Homologous series differ from the next member by a CH group.

Y) Alkanes, aka paraffins or saturated hydrocarbins, only have single covalent bonds between carbons.

Z) Alkyl groups have general formula  $C_n H_{2n+1}$

ANSWER: X) Homologous series differ from the next member by a CH group.

BONUS

Chem Short Answer: Denote in numbers/ words: Which of the following ions has -2 charge?

1) carbonate 2) Dichromate 3)Silicate 4) Manganese

ANSWER: 123

14) CHEM Multiple: What volume in L will 2 L of an ideal gas occupy if the pressure changes from 760 mm Hg to 100 mm Hg?

W) 152

X) 243

Y) 453

Z) 543

ANSWER: W) 152

BONUS

Ch. Short Answer: In numbers or words, denote which of the following have the same electron pair arrangement as molecular shape. 1) Hydrogen sulfide 2) Carbon tetrachloride 3) Aluminum chloride

ANSWER: 2 and 3

15) ENERGY Multiple: Which of the following is not a reason to use AC?

W) Analogs are constantly changing because currents and voltages in electric circuits constantly change.

X) Radio waves are high-frequency radio signals.

Y) DC cannot flow through semiconductors.

Z) Frequencies of wireless communication have advanced from kHz to GHz.

ANSWER: Y) DC cannot flow through semiconductors.

BONUS

Energy Short Answer: Find the total resistance of a parallel circuit with two resistors. The first has a value of 40 ohms and the second a value of 10 ohms.

ANSWER: 8 ohms

16) ENERGY Multiple: In a solar cell, which of the following is true?

W) N-type and P-type silicon attraction cause the electric field that powers the cell.

X) At the junction, it becomes easier for P-type silicon to cross over to the N-type.

Y) The electric field acts as a diode and pushes P-type electrons into N-type.

Z) Photons produce disruptions of neutrality, sending electrons to P-type and causing holes in N-type.

ANSWER: W) N-type and P-type silicon attraction cause the electric field that powers the cell.

BONUS

Energy Short Answer: In numbers or words, denote which of the following is false about biofuels:

- 1) Fermented corn produces ethanol, which is a smog-reducing additive in gasoline.
- 2) The E in E85 for fuel rating is for ethanol.
- 3) Soybeans are more useful than corn for biodiesel.
- 4) Separating glycerin from the oil's fatty acid alkyl esters using a catalyst is a step in creating biodiesel.

ANSWER: None

17) ENERGY Multiple: Which devices extend perpendicular to the direction of wave travel and capture or reflect the power of the wave?

- W) Offshore capture
- X) Oscillating wave device
- Y) Terminator devices
- Z) Point absorber

ANSWER: Y) Terminator devices

BONUS

Energy Short Answer: Calculate the Lagrangian of a ball at height 3 m which has a current velocity of 20 m/s and a mass of 5 kg.

ANSWER: 900

18) Earth/ Astro Short Answer: Metal poor stars are also known as what population type?

ANSWER: Population 2

BONUS

Earth/ Astro Multiple: Which of the following is false about the big bang nucleosynthesis?

- W) It finished when the universe was about 3 minutes old.
- X) The temperature dropped below that of possible nuclear fission.
- Y) Principally, lithium was not produced.
- Z) Deuterium and helium-4 were among the light elements produced.

ANSWER: Y) Principally, lithium was not produced.

19) Earth/ Astro Short Answer: Which type of volcano is the most explosive, producing a caldera after explosions due to vent collapses?

ANSWER: Rhyolite caldera complex

BONUS

Earth/ Astro Multiple: Which of the following is a compact quasi-stellar object associated with a probable supermassive black hole at the center of an active, giant elliptical galaxy?

- W) Quasar
- X) Seyfert galaxies
- Y) Clustered population
- Z) Blazar

ANSWER: Z) Blazar

20) Earth Short: In numbers or words, denote the answer: Which of the following are transverse waves?

- 1) P
- 2) S
- 3) Love
- 4) Raleigh

ANSWER: 2, 3

BONUS

Earth Short Answer: Denote with numbers/ words: which of the following are among the ten most common in the Milky way galaxy?

- 1) Nickel
- 2) Neon
- 3) Nitrogen
- 4) Silicon

ANSWER: 2 3 4