

Round 7

1. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A horse moves a sleigh 1.00 kilometer by applying a horizontal 2,000-newton force on its harness for 45 minutes. What is the power of the horse?

Bonus Answer: 741 watts

Bonus: Short Answer

A force of 100 newtons is used to move an object a distance of 15 meters with a power of 25 watts. Find the work done and the time it takes to do the work.

Bonus Answer: work = 1,500 joules; time = 60 seconds

2. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

What is the name of the principle that states that 5 avocados cannot be placed in 4 holes without 2 of them being placed in the same one?

Bonus Answer: Pigeonhole Principle

Bonus: Short Answer

In triangle ABC with integer side lengths, $AB = 7$, $BC = 14$, and $AC < 9$. Find AC.

Bonus Answer: 8 (Triangle Inequality)

3. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A bullet travels through the air, it slows down due to air resistance. How does the bullet's momentum change as a result?

Bonus Answer: The bullet's momentum decreases as its speed decreases.

Bonus: Short Answer

How can a small force produce a large change in momentum ?

Bonus Answer: A small force can produce a large change in momentum if the force acts on an object for a long period of time.

4. EARTH and SPACE

Writer: Banpreet Singh

Toss Up: Short Answer

Maritime air masses form over

Bonus Answer: water

Bonus: Short Answer

The biosphere may be broken up into about a dozen broad groupings of plants and animals that spread across the Earth at characteristic latitudes and altitudes. These groupings are called

Bonus Answer: biomes

5. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

If 8 moles dig 8 holes in 8 years, how many holes can 4 moles dig in 1461 days?

W) 1

X) 2

Y) 4

Z) 8

Toss Up Answer: X

Bonus: Short Answer

If 9 moles dig 24 holes in 10 days, how many holes can 3 moles dig in 5 days?

Bonus Answer: 4

6. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What is the electron configuration of $Mg(2+)$?

Bonus Answer: $1s^2 2s^2 2p^6$

Bonus: Short Answer

What is the electron configuration of $Cu(2+)$?

Bonus Answer: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$

7. BIOLOGY

Writer: Kerwin Chen

Toss Up: Short Answer

What are the names of the two bones in your forearm?

Bonus Answer: radius and ulna

Bonus: Short Answer

How many carpal bones does a person have in each arm?

Bonus Answer: 8

8. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

What is the smallest even triangular number?

Bonus Answer: 6

Bonus: Multiple Choice

If p and q are inversely proportional, and $p = 7$ when $q = 24$, then find p when $q = 12$.

W) 3.5

X) 7

Y) 12

Z) 14

Bonus Answer: Z

9. PHYSICS

Writer: Mohammed Jamil

Toss Up: Multiple Choice

A loaded freight car A with a mass of 14,000 kg moves at a constant velocity of 15 m/s on a horizontal railroad track and collides with an empty car B with a mass of 6,000 kg moving at 5 m/s. After the collision the cars stick to each other and moves like one object. What is the velocity of two cars after the collision?

- W) 6 m/s
- X) 8 m/s
- Y) 10 m/s
- Z) 12 m/s

Toss Up Answer: Z

Bonus: Multiple Choice

When two objects collide elastically the momentum is conserved. Which of the following is true about the kinetic energy during the collision?

- W) The kinetic energy is lost
- X) The kinetic energy is gained
- Y) The kinetic energy is conserved
- Z) The kinetic energy completely transforms into thermal energy

Bonus Answer: Y

10. BIOLOGY

Writer: Kerwin Chen

Toss Up: Short Answer

The vision of a person with myopia can be corrected with which type of lens?

Bonus Answer: diverging, concave

Bonus: Short Answer

What is the name of the surgical procedure in which cuts are made around the cornea to allow for the correction of myopia?

Bonus Answer: Radial keratotomy

11. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

Which of the following is a process used to produce an alternating current in an electric generator?

- W) a loop of wire is spun in a magnetic field
- X) a loop of wire is pushed in the direction of a magnetic field
- Y) a loop of wire is pushed perpendicular to a magnetic field
- Z) a magnet is pushed towards a wire

Toss Up Answer: W

Bonus: Short Answer

What is the SI unit for magnetic flux?

Bonus Answer: weber

12. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

Which of the following is a triangular number?

- W) 2
- X) 6
- Y) 9
- Z) 11

Toss Up Answer: X

Bonus: Short Answer

What is the greatest common factor of 456 and 460?

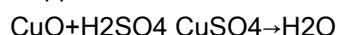
Bonus Answer: 4

13. CHEMISTRY

Writer: Mohammed Jamil

Toss Up: Short Answer

Copper sulfate can be made by warming copper oxide with sulfuric acid. The equation for the reaction is:



Calculate the maximum mass of copper oxide which can react with 9.8 g of sulfuric acid in this reaction.

(Relative atomic masses: H=1, O=16, Cu=64)

Bonus Answer: 8g

Bonus: Short Answer

It takes 83ml of a 0.45M NaOH solution to neutralize 235mL of an HCl solution. What is the concentration of the HCl solution ?

Bonus Answer: 0.16 M

14. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

What is the driving force present in a supernova explosion?

- W) electromagnetic force
- X) strong nuclear force
- Y) gravitational force
- Z) weak nuclear force

Toss Up Answer: Y

Bonus: Short Answer

What gas is the Mars atmosphere primarily made up of?

Bonus Answer: Carbon dioxide

15. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

An object slides across a horizontal surface and eventually comes to a stop. What is true of the object?

- W) its kinetic energy was converted to thermal energy
- X) the energy related to the motion of the object was destroyed
- Y) the kinetic energy of the object stayed constant
- Z) the potential energy of the object increased

Toss Up Answer: W

Bonus: Short Answer

What unit is defined as the energy needed to raise the temperature of a gram of liquid water by 1 degree Celsius?

Bonus Answer: calorie

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16. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

To the nearest day, how long is the sidereal period of the moon?

Bonus Answer: 27 days

Bonus: Short Answer

The only supernova explosion in modern times visible in the sky to the naked eye became visible in which year?

Bonus Answer: 1987

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17. BIOLOGY

Writer: Nten Nylam

Toss Up: Multiple Choice

From where do autotrophs obtain their carbon, nutrients, and minerals?

- W) From the sun
- X) From human activities
- Y) The inorganic environment
- Z) From the atmosphere

Toss Up Answer: Y

Bonus: Short Answer

What is the name of the parasite that causes malaria?

Bonus Answer: Plasmodium parasites (also accept plasmodium)

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18. CHEMISTRY

Writer: Brian Lim

Toss Up: Short Answer

What is the term for the conditions at which a substance begins to behave as a supercritical fluid?

Bonus Answer: critical point

Bonus: Multiple Choice

For a sample of a liquid, what is true about the relationship between temperature and vapor pressure?

- W) the relationship depends on the substance
- X) vapor pressure increases with temperature
- Y) vapor pressure decreases with temperature
- Z) vapor pressure is unaffected by changes in temperature

Bonus Answer: X

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19. BIOLOGY

Writer: Nten Nylam

Toss Up: Multiple Choice

All of the following processes involve hydrogen bonding except

- W) DNA replication
- X) Protein folding
- Y) Formation of ice crystals

Z) Binding of an enzyme and substrate

Toss Up Answer: Z

Bonus: Multiple Choice

Which of these is not an example of eukaryotic post-transcriptional modification?

- W) The 3' end of the growing strand is cleaved
- X) After splicing, exons are rejoined to make a final mRNA transcript
- Y) Exons, non-coding regions, are removed via splicing
- Z) A poly-A tail is added to the 5' end

Bonus Answer: Y

20. CHEMISTRY

Writer: Nten Nylam

Toss Up: Short Answer

Boyle's Law describes the relationship between what qualities of a gas/container?

Bonus Answer: Pressure and volume (accept in any order)

Bonus: Short Answer

What are acids with more than 2 ionizable hydrogens called?

Bonus Answer: polyprotic acids

21. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

Some birds, such as pigeons and doves secrete "milk" that they feed to their children. From which of the following organs does it come from?

- W) Crop
- X) Gizzard
- Y) Mammary Gland
- Z) Stomach

Toss Up Answer: W

Bonus: Short Answer

What is the common name for Columba livia?

Bonus Answer: Feral/City/Street pigeon

22. CHEMISTRY

Writer: Brian Lim

Toss Up: Multiple Choice

Iron is in which category of elements?

- W) alkali metals
- X) alkaline metals
- Y) transition metals
- Z) metalloids

Toss Up Answer: Y

Bonus: Short Answer

What is the term for the temperature and pressure at which a substance exists at three phases at once in thermal

equilibrium?

Bonus Answer: triple point

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23. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

What is the name of the first livestock virus eradicated by a vaccine?

- W) Smallpox
- X) Polio
- Y) Rinderpest
- Z) Mumps

Toss Up Answer: Y

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Bonus: Short Answer

By mass, what element makes up most of the human body?

Bonus Answer: Oxygen

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24. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

The chemical EDTA is routinely used in many experiments. For example, EDTA is used in electrophoresis buffer solutions. Which of the following statements is not true?

- W) EDTA has a strong binding affinity for divalent and some trivalent cations.
- X) EDTA is a catalyst for polymer formation and essential for protein and nucleic acid polymerization.
- Y) EDTA is a chelator.
- Z) EDTA is used to help denature proteins and weaken cell membranes.

Toss Up Answer: X

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Bonus: Multiple Choice

Which of the following statements is not true?

- W) Insects, birds, and many reptiles excrete nitrogenous waste in the form of urea.
- X) Neurons have evolved to speed the communication between distant cells in multi-cellular organisms.
- Y) Synapses are specialized connections between neurons to facilitate the formation of complex neuronal networks.
- Z) The regulatory proteins tropomyosin and troponin control the contraction of contractile filaments, actin and myosin.

Bonus Answer: W

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25. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

When the temperature increases, which of the following statements is not true?

- W) Dissolved oxygen decreases at higher temperatures and higher salinity.
- X) Many corals die when the temperature exceeds 86°F.
- Y) Metabolic reactions are less likely to achieve their activation energy.
- Z) The amount of carbon dioxide that can be absorbed by the ocean decreases.

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following carbohydrates contain α -1, 4-linkages?

W) amylose

X) Cellulose

Y) Deoxyarabinose

Z) Glucose

Bonus Answer: W
