

Round 21

1. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these is not characteristic of an r-selecting species?

- W) Small physical size
- X) Short life span
- Y) Parental care
- Z) Variable and unpredictable mortality

Toss Up Answer: Y

Bonus: Short Answer

For each of the following, state whether it is an r-strategist or k-strategist: Oyster, Garden weeds, Desert flowers, Humans

Bonus Answer: Oyster: r-strategist; Garden weeds: r-strategist; Desert flowers: r-strategist; Humans: k-strategist

2. CHEMISTRY

Writer: Elias Milborn

Toss Up: Short Answer

What is the IUPAC name for $\text{SnCl}_2 \cdot 6\text{H}_2\text{O}$?

Bonus Answer: Tin (II) Chloride Hexahydrate

Bonus: Multiple Choice

Which of the following elements has the valence electron configuration of $3s^2 3p^3$?

- W) Phosphorous
- X) Oxygen
- Y) Bromine
- Z) Nitrogen

Bonus Answer: W

3. MATHEMATICS

Writer: William Xiang

Toss Up: Short Answer

Find the first derivative of $10x^3 + 3x^2 + 3$ in the simplest form.

Bonus Answer: $30x^2 + 6x$

Bonus: Short Answer

How many points of inflection does the graph $x^3 + 5$ have?

Bonus Answer: 1

4. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following is a weak electrolyte?

- W) ammonia
- X) dilute sulfuric acid
- Y) 1 Molar sulfuric acid
- Z) dilute perchloric acid

Toss Up Answer: W

Bonus: Short Answer

What is the most common name for the conformation for the ring structure of cyclohexane adopts to reach a strain-free value?

Bonus Answer: Chair

5. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Nitrifying bacteria convert

W) Atmospheric Nitrogen to Ammonia

X) Ammonia to Nitrite

Y) Nitrite to Nitrate

Z) Nitrate to Nitrite

Toss Up Answer: X

Bonus: Short Answer

What is the shape of the curve of a population growing in ideal conditions?

Bonus Answer: J-curve

6. CHEMISTRY

Writer: Shantanu Jha

Toss Up: Multiple Choice

Which quantum number describes the specific orbital of an electron within a subshell?

W) Spin Projection

X) Magnetic

Y) Principal

Z) Azimuthal

Toss Up Answer: X

Bonus: Short Answer

What scientist disproved the caloric theory, which stated that an invisible gas transferred heat between objects?

Bonus Answer: James Prescott Joule (accept: James Joule)

7. MATHEMATICS

Writer: William Xiang

Toss Up: Short Answer

Find the integral of $2x^3 + 2$ with respect to x in simplest terms.

Bonus Answer: $(x^4)/2 + 2x$

Bonus: Multiple Choice

Which of the following is a conic section?

W) Cylinder

X) Triangle

Y) Hyperbola

Z) Asymptote

Bonus Answer: Y

8. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Short Answer

What is the net ionic reaction for the reaction between silver nitrate and potassium chloride?

Bonus Answer: $\text{Ag}^+ + \text{Cl}^- \rightarrow \text{AgCl}$

Bonus: Short Answer

Which of the following compounds are insoluble in water: potassium nitrate, barium chromate, nickel(II) hydroxide, and magnesium chloride?

Bonus Answer: Barium chromate and nickel(II) hydroxide

9. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Two trailers, X with mass 500kg and Y with mass 2000kg, are being pulled at the same speed. Find the ratio of the kinetic energy of Y to that of X in simplest terms.

Bonus Answer: 4:1 (or 4 to 1)

Bonus: Multiple Choice

Given a potential energy function $U(x)$, the corresponding force F is in the positive x direction if:

W) U is positive

X) U is negative

Y) U is an increasing function of x

Z) U is a decreasing function of x

Bonus Answer: Z

10. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which of the following has the lowest specific heat?

W) Copper

X) Granite

Y) Marble

Z) Dry air

Toss Up Answer: W

Bonus: Short Answer

Order the following rock particles from the biggest to the smallest: 1. Sand 2. Silt 3. Pebbles 4. Clay

Bonus Answer: 3, 1, 2, 4

11. MATHEMATICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Solve the following equation for x :

$$x^2 - 20x + 19 = 0$$

W) 9, 10

X) 10 and 9

Y) 21 and 19

Z) 19 and 1

Toss Up Answer: Z

Bonus: Short Answer

Convert log base 4 of 53 into a base 10 expression:

Bonus Answer: $\log 53 / \log 4$

12. PHYSICS

Writer: Nicholas Adit

Toss Up: Short Answer

A baseball is thrown straight upward. What is the acceleration at the highest point?

Bonus Answer: 0

Bonus: Multiple Choice

A rock is dropped off a cliff and strikes the ground with an impact velocity of 30 m/s. How high was the cliff?

W) 15 m

X) 30 m

Y) 45 m

Z) 60 m

Bonus Answer: Y

13. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Bottom-heavy age structure diagrams are characteristic of populations in:

W) Developed countries

X) Developing countries

Y) Stable populations

Z) Populations with high numbers of elderly

Toss Up Answer: X

Bonus: Short Answer

What is the expression for doubling time of a population given that it grows at constant annual rate of $r\%$?

Bonus Answer: $70/r$

14. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

How many elements are diatomic?

W) 5

X) 6

Y) 7

Z) 8

Toss Up Answer: Y

Bonus: Short Answer

Which elements are liquid at room temperature?

Bonus Answer: Mercury, Bromine

15. BIOLOGY

Writer: Siam Muquit

Toss Up: Short Answer

What does the Shannon Index quantify?

Bonus Answer: Biodiversity of a community (accept similar responses)

Bonus: Short Answer

What would be the Simpson's Index value for a population with infinite biodiversity?

Bonus Answer: 0

16. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

If all of the forces acting on an object balance so that the net force is zero, then

W) The object must be at rest

X) The object speed will decrease

Y) The object direction can change but its speed cannot

Z) None of the above

Toss Up Answer: Z

Bonus: Short Answer

A person who weighs 800 N steps onto a scale that is on the floor of an elevator car. If the elevator accelerates upward at a rate of 5 m/s², what will the scale read ($G = 10 \text{ m/s}^2$)?

Bonus Answer: 1200 N

17. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What are two general types of soils that have developed in the United States?

Bonus Answer: pedocals and pedalfers

Bonus: Short Answer

What are the two most prominent elements dissolved in seawater?

Bonus Answer: Chlorine and Sodium

18. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these is not a viral disease?

W) Dutch elm disease

X) Yellow fever

Y) Mumps

Z) Rubella

Toss Up Answer: W

Bonus: Short Answer

In which viral reproductive cycle is the viral DNA incorporated into the host DNA?

Bonus Answer: Lysogenic

19. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What is the name of Uranus' smallest moon, which is best known for the idea that it was shattered in a collision billions of years ago and reformed?

Bonus Answer: Miranda

Bonus: Short Answer

Which two moons in the solar system are bigger than the smallest planet?

Bonus Answer: Ganymede and Titan

20. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A force F of strength 20 N acts on an object of mass 3 kg as it moves a distance of 4 m. If F is perpendicular to the 4 m displacement, the work it does is equal to

- W) 0 J
- X) 60 J
- Y) 80 J
- Z) 600 J

Toss Up Answer: W

Bonus: Short Answer

Under the influence of a force, an object of mass 4 kg accelerates from 3 m/s to 6 m/s in 8 s. How much work was done on the object during this time?

Bonus Answer: 54 J

21. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of the following is thought to have undergone secondary endosymbiosis?

- W) Ciliate
- X) Dinoflagellates
- Y) Diatoms
- Z) Algae

Toss Up Answer: Z

Bonus: Short Answer

From what specific class of bacteria are mitochondria thought to originate from?

Bonus Answer: Alpha proteobacteria

22. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

An object of mass 2 kg has a linear momentum of magnitude 6 kg • m/s. What is this object's kinetic energy?

- W) 3 J
- X) 6 J
- Y) 9 J
- Z) 12 J

Toss Up Answer: Y

Bonus: Short Answer

Two objects, one of mass 3 kg and moving with a speed of 2 m/s and the other of mass 5 kg and speed 2 m/s, move toward each other and collide head-on. If the collision is perfectly inelastic, find the speed of the objects after the collision.

Bonus Answer: 0.5 m/s

=====

23. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

ATP is directly produced from glycolysis by which of the following?

W) respiration

X) oxidative phosphorylation

Y) substrate level phosphorylation

Z) pyruvate oxidation

Toss Up Answer: Y

=====

Bonus: Short Answer

What enzyme is responsible for converting fructose6-phosphate to fructose 1,6-biphosphate in the energy investment phase of glycolysis?

Bonus Answer: phosphofructokinase

=====

24. PHYSICS

Writer: Shanjeed Ali

Toss Up: Short Answer

How many orbitals are there in the third electron shell?

Bonus Answer: 9

=====

Bonus: Short Answer

Who discovered the neutron?

Bonus Answer: James Chadwick

=====

25. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following is not an electron carrier involved cellular respiration?

W) NADH

X) FADH₂

Y) NADPH

Z) NAD⁺

Toss Up Answer: Y

=====

Bonus: Multiple Choice

For each turn of the Krebs cycle, how many electron carriers are produced?

W) 3 FADH₂ and 1 NADH

X) 6 NADH and 2 FADH₂

Y) 3 NAD⁺ and 1 FAD

Z) 3 NADH and 1 FADH₂

Bonus Answer: Z

=====