Natural Science Discipline
Category 5 - Sample Questions

1. Which of the following structures is found in prokaryotic cells but not in eukaryotic cells?
   A. Cell wall
   B. Flagellum
   C. Nucleoid
   D. Ribosome

2. What is the function of the mitochondrion?
   A. It encloses the cell, separating its content from the surroundings.
   B. It is the largest organelle that serves as the control center of the cell.
   C. It is where most adenosine triphosphate molecules (ATP) are produced.
   D. It breaks down large molecules into smaller pieces and digests worn-out organelles.

3. Which of the following describes photophosphorylation?
   A. Production of NADPH from $NADP^+$
   B. Production of ATP using light energy
   C. Pumping of electrons back to the thylakoids
   D. Splitting of water into hydrogen and oxygen

4. Which of the following transformations happens during the production of ribulose 1,5-bisphosphate from ribulose 5-phosphate?
   A. ATP → ADP
   B. ADP → ATP
   C. $NADP^+$ → NADPH
   D. NADPH → $NADP^+$

5. During alcoholic fermentation, how many ATP molecules are produced from every glucose molecule?
   A. 1
   B. 2
   C. 3
   D. 4

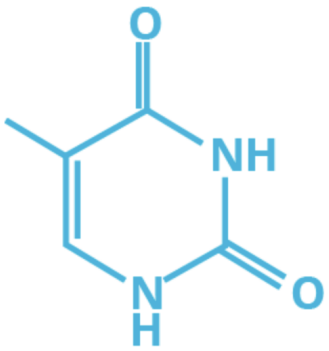
6. Which of the following statements are true about the actions of hormones that may affect behavior?

   (1) They promote certain behavior, such as displacement behavior.
   (2) They promote maturation of lymphocytes for immunity in infants.
   (3) They affect nerve cells and synapses in the central nervous system.
   (4) They affect nerve cells and synapses in the central nervous system.

   A. 1 and 2 only
   B. 1 and 3 only
   C. 2 and 3 only
   D. 2 and 4 only

7. In oxidative phosphorylation, what compound is formed when oxygen takes up protons?

8. A nucleic acid was found to contain a nitrogenous base having this structure.



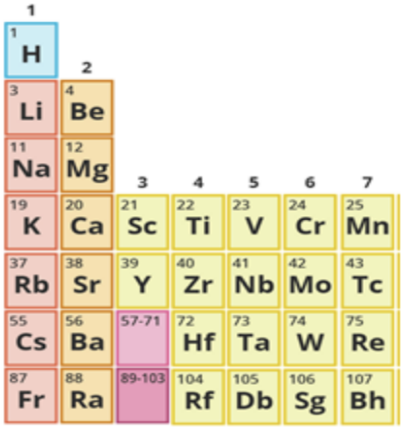
What is the identity of this nucleic acid?

9. Which of the following scientists explained that a radio wave called a pilot wave holds the electrons in the orbit?
   A. Niels Bohr
   B. Louis de Broglie
   C. Wolfgang Pauli
   D. Erwin Schrödinger

10. Which statement best describes orbitals?
   A. They are the space where the nucleus of an atom lies.
   B. They are the space where protons and electrons interact.
   C. They are regions of positive space where electrons are embedded in an atom.
   D. They are regions in space where there is a high probability of finding an electron.

11. According to collision theory, what should happen to the molecules of the reactants for a chemical reaction to occur?
   A. Colliding with one another
   B. Clustering with one another
   C. Reacting with one another
   D. Rearranging with one another

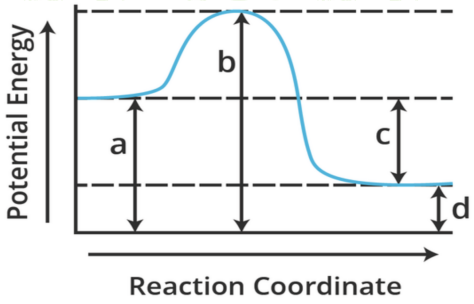
12. Refer to the illustration below.



Manganese (Mn) is a transition metal that belongs to group 7. How many valence electrons does it have?
   A. 1 to 5
   B. 2 to 7
   C. 3 to 6
   D. 7 to 10

13. Which of the following is a type of intermolecular forces present only in polar molecules?
A. Covalent bonding
B. Dipole-dipole
C. Ionic bonding
D. London dispersion

14. What does part B represent in the energy diagram given below?



A. Activation of energy
B. Energy of the reaction
C. Energy of the reactants
D. Energy of the products

15. Draw the Lewis structure of water. Then, indicate how many pairs of shared electrons does a water molecule have.

16. The reaction below shows a single displacement reaction between copper (II) oxide and magnesium to produce copper and magnesium oxide.

$$CuO + Mg \rightarrow Cu + MgO$$

How many moles of magnesium oxide is produced from 2 moles of magnesium?

17. According to Newton's law of universal gravitation, what are the factors that affect gravitational force?

(1) The mass of objects
(2) The distance between the objects
(3) The direction in which the objects move
(4) The speed of the movement of the objects

A. 1 and 2 only
B. 1 and 3 only
C. 2 and 4 only
D. 1, 2, and 3 only

18. An object thrown downward increases its speed as it falls. This acceleration is proportional to the gravitational force acting on the object. Which of the following laws is described by the given situation?
A. Law of Inertia
B. Law of Acceleration
C. Law of Interaction
D. Law of Universal Gravitation

19. Which of the following Kepler's laws explained the path traveled by the planets?
A. Law of Eclipses
B. Law of Harmonies
C. Law of Gravitation
D. Law of Equal Areas

20. Which of the following describes the law of conservation of momentum?
A. It states that the total momentum of an object is zero if there are no external forces acting on it.
B. It states that the total momentum of an object is zero if there are no external forces acting on it.
C. It states that the total momentum of an object does not change if there are no external forces acting on it.
D. It states that the total momentum of an object does not change regardless of the external forces acting on it.

21. A 98-N ball falls on a cliff. If the speed of the ball 5 m from the ground is 20 m/s, what is its total mechanical energy?
A. 622 J
B. 1245 J
C. 2490 J
D. 4980 J

22. Which of the following affects the speed of light?
A. Color
B. Frequency
C. Intensity
D. Medium

23. A 2-0 kg trolley is moving to the left at 6.0 m/s when it collided with the stationary 3.0-kg trolley. What is the total momentum of the trolleys before the collision?

24. How many seconds will it take for an electrically powered commercial jet model with a continuous 70 A to pull a total charge of 2.4×10^6 C?

25. Geothermal energy, a possible energy resource, is based on which phenomenon?
A. Heat energy from the Sun penetrates deep into Earth.
B. Human activity is the largest source of heat energy on Earth.
C. Earth's internal energy heats its surface more than the Sun does.
D. There are concentrations of heat in some places of Earth's crust.

26. More solar energy reaches the equatorial regions than the polar regions because the equatorial regions
A. Have days with more hours of light
B. Receive sun rays closest to vertical
C. Are covered by a greater area of land
D. Have more vegetation to absorb sunlight

27. Relative cooling rates of igneous intrusive rocks can be estimated by comparing which property of rock?
A. Chemical reactivity
B. Composition

C. Crystal sizes
D. Density

28. The picture below shows a rock formation with folded layers.

Which statement best explains how the rock layers folded?

A. The rock melted and flowed downhill.
B. The rock was deformed by a meteorite impact.
C. The rock was suddenly pulled apart during an earthquake.
D. The rock was slowly compressed due to tectonic plate movement.

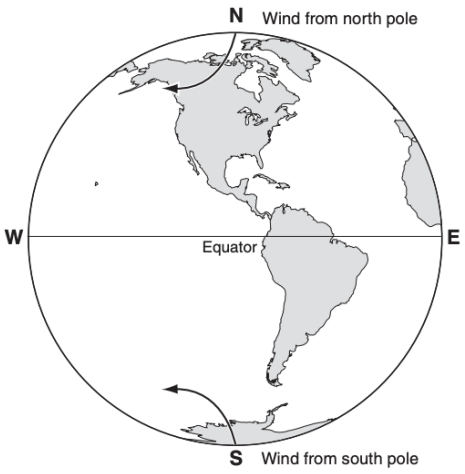
29. When a layer of cool air at the surface of Earth is found under a layer of warmer air above it, the result is known as

A. An upwelling
B. The Coriolis effect
C. The greenhouse effect
D. A temperature inversion

30. The primitive atmosphere of Earth was deficient in free oxygen. What process was primarily responsible for the development of the present percentage of free oxygen in the Earth's atmosphere?

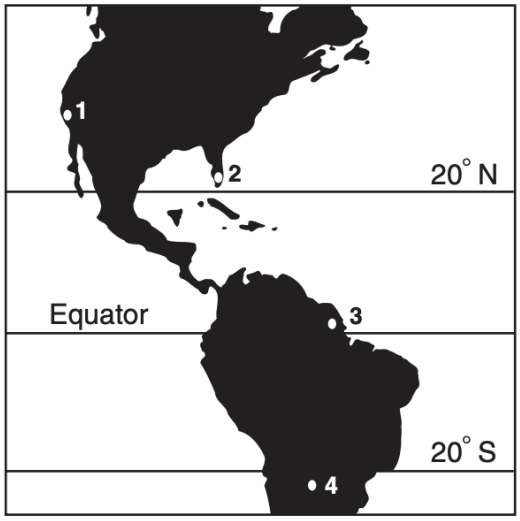
A. Outgassing
B. Photosynthesis
C. Volcanic eruptions
D. Oxidation of iron-based minerals

31. Look at the diagram below.



What causes the wind deflection from the north and south poles? What is this phenomenon called?

32. At which location on the map would a rain forest most likely be found?



Why?

33. Which of the following physicists theorized that electromagnetic field moves through space at a fixed speed?
A. Niels Bohr
B. Albert Einstein
C. James Clerk Maxwell
D. Max Planck

34. Astronomers have discovered vast differences in stars through their observations. One theory used to explain these differences is that
A. The distances between stars are vast.
B. Stars are at different points in their life cycles.
C. Earth's atmosphere distorts our view of the stars.
D. There is too much light pollution on Earth to study stars.

35. As part of the modern theory of the origins of the elements, it is hypothesized that before the formation of the stars, most of the matter in the universe consisted of what atoms?
A. Silicon and lithium
B. Nitrogen and carbon
C. Uranium and radium
D. Hydrogen and helium

36. Early telescopes showed stars as only points of light, while the planets appeared to be much larger. This provides evidence that stars
A. Travel in elliptical orbits like planets
B. Reflect much more light than planets
C. Be much farther from Earth than planets
D. Be more plentiful in our solar system than planets

37. The clouds that surround Venus are so thick that the planet actually absorbs less sunlight than the Earth. Nevertheless, Venus has a surface temperature of more than 400 °C.
Which of these best explains this high surface temperature?
A. The sulfuric acid in the clouds releases heat energy.
B. The strong winds in the atmosphere produce friction.
C. The thick clouds in the atmosphere prevent heat from escaping.
D. The bright surfaces of the clouds reflect sunlight back on the planet.

38. Which of the following factors is the main reason an astronaut's muscle mass and bone density decrease while in space?
A. Astronauts do not need to support body weight in space.
B. Astronauts are restricted to a confined living area in space.
C. It is not possible for astronauts to exercise vigorously in space.
D. It is difficult for astronauts to consume a balanced diet in space.

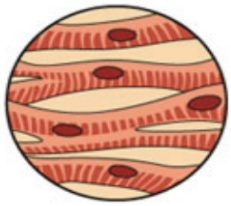
39. There are twins. One works for mission control of NASA and the other is an astronaut. The astronaut leaves Earth on a spaceship travelling at 0.95c. Upon returning, the astronaut has aged 10 years. How old is his brother on Earth?

40. A space probe manned by two astronauts returned to Earth after 10 years. How much time has elapsed as observed by the astronauts inside the space probe if they were travelling at 50% of the speed of light?

41. How many skeletal muscles does the human body have?
A. Equal to 600 muscles
B. Less than 600 muscles
C. More than 600 muscles
D. Cannot be determined

42. What dinosaur fossil was originally mistaken for a type of bison?
A. Archosaurs
B. Brachiosaurus
C. Triceratops
D. Velociraptors

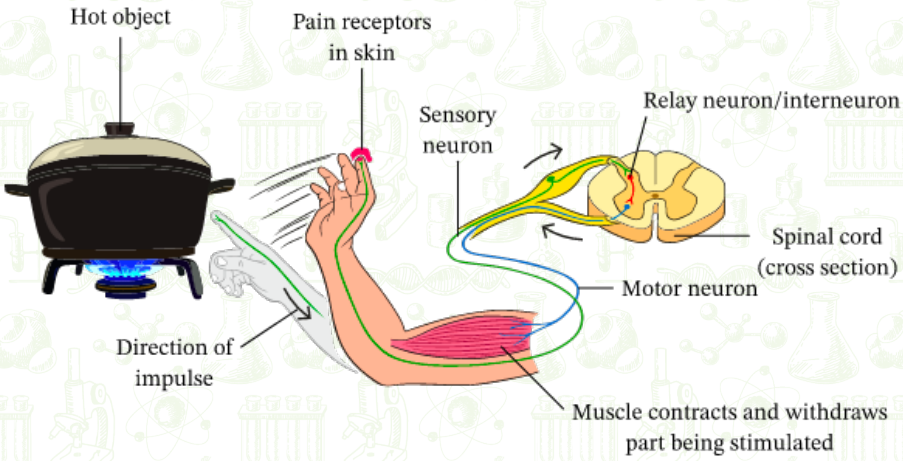
43. What type of muscle is shown in the image below?



A. Cardiac
B. Nervous
C. Skeletal
D. Smooth

44. What is the scientific word for fossilized dinosaur droppings?
A. Coprolite
B. Doodicus
C. Giganto stink
D. Streptococcus

45. Explain the reflex arc when someone accidentally touched a hot object.



46. How are dinosaurs named?

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ANSWER KEY

No	Answer	No	Answer	No	Answer	No	Answer
1	C	12	B	23	-12 kg-m/s	34	B
2	C	13	B	24	3.4 x 10^4 s	35	D
3	B	14	A	25	D	36	C
4	A	15		26	B	37	C
5	B	16	2 moles MgO	27	C	38	A
6	B	17	A	28	D	39	32 years old
7	Water	18	B	29	D	40	8.66 years
8	A DNA	19	A	30	B	41	C
9	B	20	C	31	The rotation of Earth on its axis causes the wind deflection from the north and south poles. This is known as the Coriolis effect.	42	C
10	D	21	C	32	Location 3. Most rainforests are found in tropical regions which are near the equator.	43	A
11	A	22	D	33	C	44	A
45	1. Receptor in the skin detects a stimulus (the change in temperature). 2. Sensory neuron sends electrical impulses to a relay neuron, which is located in the spinal cord of the CNS. Relay neurons connect sensory neurons to motor neurons. 3. Motor neuron sends electrical impulses to an effector. 4. Effector produces a response (muscle contracts to move hand away)						
46	Dinosaurs generally are named after a characteristic body feature, after the place where they were found, or after a person involved in the discovery. Usually, the name consists of two Greek or Latin words (or combinations); in order, these are the genus (plural, genera) and the species name.						