Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which is heaviest? 1) _____
A) water molecule
B) hydrogen atom
C) oxygen atom
D) proton
E) electron

Answer: A
Explanation: A)
B)
C)
D)
E)

2) Evidence that things are made of atoms comes from 2) _____
A) the way that laser beams pass through air.
B) the fact that objects accelerate as they fall.
C) the fact that we can cut solid objects into smaller and smaller pieces.
D) Brownian motion.
E) superconductivity.

Answer: D
Explanation: A)
B)
C)
D)
E)

3) Is there any method by which we can detect individual atoms in the laboratory? 3) _____
A) Yes, by using microscopes based on X-rays rather than on light.
B) Yes, by using very high power microscopes based on visible light of very short wavelength.
C) No, because atoms are purely mathematical abstractions and not real physical objects.
D) No, because atoms are smaller than any physical wavelengths.
E) Yes, by using microscopes based on the "matter waves" made by material particles such as electrons.

Answer: E
Explanation: A)
B)
C)
D)
E)

4) According to the philosophy of Democritus, 4) _____
A) smells and other "sense impressions" are "real"--that is, they really exist.
B) atoms are real.
C) both A and B are true.
D) the things you imagine, in your mind, are real.
E) nothing really exists.

Answer: B
Explanation: A)
B)
C)
D)
E)

5) How many atoms are in the alcohol molecule C_2H_5OH? 5) _____
A) 11
B) 9
C) 3
D) 4
E) insufficient information is given

Answer: B
Explanation: A)
B)
C)
D)
E)

6) The number of atoms in the sulfuric acid molecule, H_2SO_4, is 6) _____
A) 3.
B) 7.
C) 4.
D) 6.
E) cannot be determined from the given information

Answer: B
Explanation: A)
B)
C)
D)
E)

7) An odor, such as the odor of bread, is due to 7) _____
A) individual atoms that detach from the source and diffuse individually through the air.
B) an electromagnetic wave emitted by the source [the bread].
C) molecules that detach from the source and diffuse through the air.
D) a pressure wave, similar to a sound wave, emitted by the violets.
E) cosmic vibrations emanating from the Great Pumpkin.

Answer: C
Explanation: A)
B)
C)
D)
E)

8) The U.S. national debt is about $6 trillion. Expressed in powers of ten, this is 8) _____

A) $\$6 \times 10^6$. B) $\$6 \times 10^{12}$. C) $\$6 \times 10^{15}$. D) $\$6 \times 10^{10}$. E) $\$6 \times 10^9$.

Answer: B

Explanation: A)
B)
C)
D)
E)

9) Chemically, clean [nonpolluted] air is 9) _____

A) a compound.
B) an element.
C) a liquid.
D) a mixture of different compounds.
E) an isotope.

Answer: D

Explanation: A)
B)
C)
D)
E)

10) The chemical formula that represents the burning of wood or paper is 10) _____

A) $H_2 + O \Rightarrow H_2O$.
B) $C + H_2O \Rightarrow CH_2O$.
C) $CO_2 \Rightarrow C+O_2$.
D) $C + O \Rightarrow CO$.
E) $C + O_2 \Rightarrow CO_2$.

Answer: E

Explanation: A)
B)
C)
D)
E)

11) Air is composed mainly of 11) _____

A) O_2.
B) N_2 and O_3.
C) CO_2 and O_3.
D) CO_2 and O_2.
E) N_2 and O_2.

Answer: E

Explanation: A)
B)
C)
D)
E)

12) The Greek model of the atom should be classified as 12) _____
A) an experimental fact.
B) a useful theory.
C) an observation.
D) a tentative hypothesis.
E) a useless falsehood.

Answer: B
Explanation: A)
B)
C)
D)
E)

13) A block of granite is actually mostly empty space because the atoms making up the granite are 13) _____
A) not as close together as they could be.
B) held together by electrical forces.
C) in perpetual motion.
D) themselves mostly empty space.
E) made of cotton candy.

Answer: D
Explanation: A)
B)
C)
D)
E)

14) Which is smallest? 14) _____
A) the solar system
B) the distance to other nearby stars
C) the Milky Way galaxy
D) the sun
E) the ripples in the cosmic background radiation

Answer: D
Explanation: A)
B)
C)
D)
E)

15) According to the philosophy of Democritus, 15) _____
A) the color red is not "real" but is instead just humans' "conjecture" or imagination.
B) atoms are not "real" but are instead just humans' "conjecture" or imagination.
C) Both of the above.
D) Neither of the above.
E) the moon is really a giant frog.

Answer: A
Explanation: A)
B)
C)
D)
E)

16) Suppose that Democritus were alive today, and that he saw a bright red fire truck. He would say that 16) _____

A) the color of the fire truck, and the atoms of which it is made, are equally real.
B) the color of the fire truck is more real than the atoms of which the truck is made.
C) the color of the fire truck is less real than the atoms of which it is made.
D) neither the color, nor the truck, nor the atoms are real.

Answer: C
Explanation: A)
B)
C)
D)

17) Suppose that a particular chemical substance A is "pure" [contains no "impurities"], and that it can be chemically decomposed into two other pure materials B and C. What conclusion can be draw from this? 17) _____

A) A must be a chemical compound.
B) B and C must be chemical compounds.
C) B and C must be elements.
D) A must be an element.
E) Nonsense--it is impossible to decompose a pure substance into two other materials.

Answer: A
Explanation: A)
B)
C)
D)
E)

18) At the microscopic level, the difference between liquids and solids is that 18) _____

A) the liquid's atoms move throughout the liquid, while the solid's atoms remain near their original locations.
B) in a liquid, the individual atoms are larger.
C) there is much more distance [at least 10 times more] between neighboring atoms in a liquid than between neighboring atoms in a solid.
D) both answers A and B are correct.
E) both answers B and C are correct.

Answer: A
Explanation: A)
B)
C)
D)
E)

19) An individual sulfur atom has twice the weight of an individual oxygen atom. What is the weight ratio of sulfur and oxygen in the formation of sulfur dioxide? 19) _____

A) 1 part sulfur to 2 parts oxygen
B) 4 parts sulfur to 1 part oxygen
C) 2 parts sulfur to 1 part oxygen
D) 1 part sulfur to 1 part oxygen
E) 1 part sulfur to 4 parts oxygen

Answer: D
Explanation: A)
B)
C)
D)
E)

20) The idea that everything is made of small particles is 20) _____

A) a useful idea that is known for certain to be true.
B) still only a tentative speculation made by many scientists.
C) a useful theory, but not known for certain.
D) false and no longer used by scientists.
E) not yet widely accepted.

Answer: C
Explanation: A)
B)
C)
D)
E)

21) According to the planetary model, an atom is 21) _____

A) a single tiny object, not made of parts.
B) made of protons, electrons, and ions.
C) impossible to visualize [or picture].
D) made of protons, electrons, and neutrons.
E) made of protons and electrons.

Answer: D
Explanation: A)
B)
C)
D)
E)

22) At the microscopic level, the difference between gases and solids is that 22) _____
A) there is much more distance (at least 10 times more) between neighboring atoms in a gas than between neighboring atoms in a solid.
B) the gas's atoms move throughout the gas, while the solid's atoms remain near their original locations.
C) in a gas, the individual atoms are larger.
D) both answers A and B are correct.
E) both answers B and C are correct.

Answer: D
Explanation: A)
B)
C)
D)
E)

23) Historically, the earliest atomic model to explain electrical phenomena was 23) _____
A) the planetary model.
B) the Hollywood model.
C) the quantum model.
D) the Greek model.
E) Galileo's model.

Answer: A
Explanation: A)
B)
C)
D)
E)

24) The "father" of atomic materialism was 24) _____
A) Newton.
B) Ptolemy.
C) Plato.
D) Democritus.
E) Kepler.

Answer: D
Explanation: A)
B)
C)
D)
E)

25) Why is it so difficult to remove the lid from a vacuum-sealed jar? 25) _____

A) The vacuum inside the jar pulls inward on the lid, holding it firmly to the jar.
B) The air pressure inside the jar pushes upward on the lid more strongly than the air pressure outside pushes downward on the lid.
C) The higher pressure inside the jar pulls inward on the lid, holding it firmly to the jar.
D) The vacuum inside the jar pushes outward on the lid, holding it firmly to the jar.
E) The air pressure outside the jar pushes downward on the lid more strongly than the air pressure inside pushes upward on the lid.

Answer: E
Explanation: A)
B)
C)
D)
E)

26) The length of your arm is closest to 26) _____

A) one meter.
B) one kilometer.
C) two meters.
D) 10 centimeters.
E) 100 meters.

Answer: A
Explanation: A)
B)
C)
D)
E)

27) According to the atomic materialist philosophy, certain things are regarded as "real" and other things as merely "imaginary." Which of the following is [or are] regarded by this philosophy as real? 27) _____

A) atoms
B) directly observable phenomena such as color and warmth
C) human emotions
D) Both answers A and B are correct.
E) None of the above are regarded as real by the atomic materialist philosophy.

Answer: A
Explanation: A)
B)
C)
D)
E)

28) At the microscopic level, the difference between gases and liquids is that 28) _____
A) in a gas, the individual atoms are larger.
B) there is much more distance [at least 10 times more] between neighboring atoms in a gas than between neighboring atoms in a liquid.
C) the gas's atoms move throughout the gas, while the liquid's atoms remain near their original locations.
D) both answers A and B are correct.
E) both answers B and C are correct.

Answer: B
Explanation: A)
B)
C)
D)
E)

29) Today, the idea that everything is made of atoms should be classified as 29) _____
A) a fact.
B) a certainty.
C) Both of the above.
D) a theory.
E) a hypothesis.

Answer: D
Explanation: A)
B)
C)
D)
E)

30) Chemically, clean [non-polluted] air is 30) _____
A) a mixture. B) a compound. C) an isotope. D) an element.

Answer: A
Explanation: A)
B)
C)
D)

31) Democritus said that, although we imagine many things, "in reality, there are only atoms and the void." This idea could best be classified as 31) _____
A) stoicism.
B) witticism.
C) idealism.
D) rationalism.
E) materialism.

Answer: E
Explanation: A)
B)
C)
D)
E)

32) A "megawatt" is 32) _____
A) 1000 watts.
B) 1,000,000 watts.
C) 100 watts.
D) 1,000,000,000 watts.
E) None of the above.

Answer: B
Explanation: A)
B)
C)
D)
E)

33) Which one of the following reactions is the most similar chemically to combustion? 33) _____
A) fusion in stars
B) respiration in animals
C) vaporization in the atmosphere
D) photosynthesis in plants
E) fission in nuclear reactors

Answer: B
Explanation: A)
B)
C)
D)
E)

34) What is the similarity between burning and respiration? 34) _____
A) Both reactions involve the combination of carbon with oxygen.
B) Both reactions consume glucose.
C) Both reactions create oxygen.
D) Both reactions consume energy.
E) Actually there is no similarity between them.

Answer: A
Explanation: A)
B)
C)
D)
E)

35) The number of atoms in the sulfuric acid molecule, H_2SO_4, is 35) _____
A) 7. B) 4. C) 6. D) 3.

Answer: A
Explanation: A)
B)
C)
D)

36) The diameter of an atomic nucleus is about a hundredth of a trillionth of a meter. In powers of 10, this is 36) _____

A) 10^{-17} m. B) 10^{-10} m. C) 10^{-15} m. D) 10^{-11} m. E) 10^{-14} m.

Answer: E

Explanation: A)
B)
C)
D)
E)

37) Suppose that a particular chemical substance is "pure" [contains no "impurities"], and that it is not possible to decompose this substance by chemical means. What can we conclude from this? 37) _____

A) The substance must be a chemical compound.
B) The substance must be an element.
C) The substance must be one of the ideal, or perfect, gases.
D) The substance must be incapable of entering into chemical reactions of any kind.
E) None of the above.

Answer: B

Explanation: A)
B)
C)
D)
E)

38) An individual oxygen atom has 16 times the weight of an individual hydrogen atom. What is the weight ratio of oxygen to hydrogen in water? 38) _____

A) 1 part oxygen to 2 parts hydrogen
B) 1 part oxygen to 16 parts hydrogen
C) 16 parts oxygen to 1 part hydrogen
D) 8 parts oxygen to 1 part hydrogen
E) 1 part oxygen to 8 parts hydrogen

Answer: D

Explanation: A)
B)
C)
D)
E)

39) The number of atoms in the glucose molecule, $C_6H_{12}O_6$, is 39) _____

A) 4.
B) 3.
C) 48.
D) 24.
E) cannot be determined from the given information.

Answer: D

Explanation: A)
B)
C)
D)
E)

40) Roughly how many different chemical compounds are there? 40) _____

A) 100
B) 4
C) many more than 500
D) 500
E) 20

Answer: C
Explanation: A)
B)
C)
D)
E)

41) The distance to the sun is about 150 million km. Expressed in powers of ten, this is 41) _____

A) 1.5×10^{6} km.
B) 1.5×10^{-8} km.
C) 1.5×10^{8} km.
D) 1.5×10^{-6} km.
E) None of the above.

Answer: C
Explanation: A)
B)
C)
D)
E)

42) Evidence that things are made of atoms comes from 42) _____

A) from the observation that, when chemicals combine to form new chemicals, they do so in simple ratios by weight.
B) the observation that we can smell things such as bread from a distance.
C) Both of the above answers.
D) Brownian motion.
E) All of the above answers.

Answer: E
Explanation: A)
B)
C)
D)
E)

43) It is 39 trillion miles to the nearest star beyond the sun. Expressed in powers of ten, this is 43) _____

A) 3.9×10^{10}. B) 3.9×10^{9}. C) 3.9×10^{13}. D) 3.9×10^{12}.

Answer: C
Explanation: A)
B)
C)
D)

44) In the photosynthesis reaction 44) _____

A) carbon combines with the ATP molecule.
B) CO_2 combines with H_2O.
C) oxygen combines with the ATP molecule.
D) oxygen combines with the carbon in glucose.
E) CO_2 combines with glucose.

Answer: B
Explanation: A)
B)
C)
D)
E)

45) Roughly how many different elements are there? 45) _____

A) many more than 1000
B) 4
C) 100
D) 1000
E) 20

Answer: C
Explanation: A)
B)
C)
D)
E)

46) Where does the chemical reaction known as "respiration" occur? 46) _____

A) in your nose
B) in the air while it is being held in your lungs
C) in living plants
D) at many points all over your body
E) in the lining of your lungs

Answer: D
Explanation: A)
B)
C)
D)
E)

47) The reverse of the photosynthesis reaction is 47) _____

A) the combustion reaction.
B) the respiration reaction.
C) the photolysis reaction.
D) the reduction reaction.
E) nonsense--the photosynthesis reaction is not reversible.

Answer: B
Explanation: A)
B)
C)
D)
E)

48) A feature of the quantum model of the atom that is not a feature of the Greek or planetary models is that 48) _____

A) the quantum model is only a theory, whereas the other two models are supported by factual evidence.
B) the quantum model of the atom cannot be visualized.
C) Both of the above.
D) the quantum model can explain electrical effects.
E) All of the above.

Answer: B
Explanation: A)
B)
C)
D)
E)

49) Comparing the size of a wavelength of light with the size of an atom, 49) _____

A) they are about the same size.
B) some lightwaves are larger than atoms, but others are smaller than atoms.
C) some atoms are are larger than a lightwave, but others are small than a lightwave.
D) atoms are much larger.
E) atoms are much smaller.

Answer: E
Explanation: A)
B)
C)
D)
E)

50) One piece of evidence that Democritus found for his idea that everything is made of atoms was 50) _____

A) the random, chaotic motions often found in liquids.
B) the twinkling of stars, due to our atmosphere.
C) Brownian motion.
D) the smell of bread and of other substances.
E) the fact that chemicals combine in definite proportions.

Answer: D
Explanation: A)
B)
C)
D)
E)

51) Which is lightest in weight? 51) _____

A) oxygen atom
B) hydrogen atom
C) proton
D) electron
E) water molecule

Answer: D
Explanation: A)
B)
C)
D)
E)

52) Chemically, helium is 52) _____

A) an isotope.
B) a compound.
C) a solid.
D) an element.
E) a mixture.

Answer: D
Explanation: A)
B)
C)
D)
E)

53) Which scientific theory or theories of the atom agrees with all of the atomic experiments performed to date? 53) _____

A) The Greek theory of the atom.
B) The planetary theory of the atom.
C) The quantum theory of the atom.
D) Both the planetary theory and the quantum theory of the atom.
E) None of the above theories agree with all of the atomic experiments performed to date.

Answer: C
Explanation: A)
B)
C)
D)
E)

54) In words, 3.5×10^{11} is 54) _____
(HINT: Write this number out before trying to answer the question.)
A) 350 billion.
B) 3.5 trillion.
C) 350 million.
D) 35 million.
E) 35 billion.

Answer: A
Explanation: A)
B)
C)
D)
E)

55) Why can't you directly observe, with the unaided eye, Brownian motion in easily visible objects such as floating bits of paper? 55) _____
A) Because bits of paper are so massive [or heavy] that they do not respond noticeably to atomic impacts.
B) Because paper cannot be electrically charged, so it cannot respond to Brownian forces by individual atoms.
C) Because atoms are so small that you can't see them with the unaided eye.
D) Because only living organisms such as bacteria exhibit Brownian motion.
E) Because only individual atoms and molecules exhibit Brownian motion.

Answer: A
Explanation: A)
B)
C)
D)
E)

56) One kilometer is closest to 56) _____
A) 0.001 meters.
B) 0.5 miles.
C) 500 feet.
D) 100 meters.
E) 2 miles.

Answer: B
Explanation: A)
B)
C)
D)
E)

57) The universe is only seconds old, a million trillion seconds in fact. In powers of 10, this number is 57) _____

A) 10^{15}.

B) 10^{17}.

C) 10^{19}.

D) 10^{21}.

E) None of the above.

Answer: E

Explanation: A)

B)

C)

D)

E)

58) The reverse of the respiration reaction is the reaction known as 58) _____

A) photo-synthesis.

B) exhaling.

C) combustion.

D) oxidation.

E) inhaling.

Answer: A

Explanation: A)

B)

C)

D)

E)

59) In the respiration reaction 59) _____

A) oxygen combines with such biological molecules as DNA.

B) CO_2 combines with H_2O.

C) CO_2 combines with the carbon in such biological molecules as glucose.

D) carbon combines with such biological molecules as DNA.

E) oxygen combines with the carbon in such biological molecules as glucose.

Answer: E

Explanation: A)

B)

C)

D)

E)

Answer Key
Testname: C2

1) A
2) D
3) E
4) B
5) B
6) B
7) C
8) B
9) D
10) E
11) E
12) B
13) D
14) D
15) A
16) C
17) A
18) A
19) D
20) C
21) D
22) D
23) A
24) D
25) E
26) A
27) A
28) B
29) D
30) A
31) E
32) B
33) B
34) A
35) A
36) E
37) B
38) D
39) D
40) C
41) C
42) E
43) C
44) B
45) C
46) D
47) B
48) B
49) E
50) D

Answer Key
Testname: C2

51) D
52) D
53) C
54) A
55) A
56) B
57) E
58) A
59) E