Chemistry A: Form TR2-20A Name _____

REVIEW Date _____ Period _____

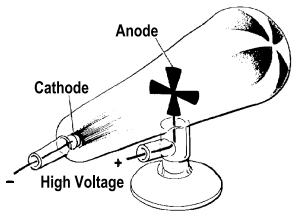
Test Review № 2

Skills

- Understand the Law of Conservation Matter, Law of Constant Composition (also known as Law of Definite Proportions) and Law of Multiple Proportions
- Understand the postulates of Dalton's Atomic Theory
- Be able to explain J.J. Thomson's experiment, his results and his conclusions
- Be able to explain J.J. Thomson's Plum Pudding Model
- Be able to explain Rutherford's Gold Foil Experiment, results and conclusions
- Contrast J.J. Thomson's Plum Pudding Model with Rutherford's nuclear model
- Describe Bohr's model of the atom and how it explains the line spectra emitted by elements.
- What is the Heisenberg Uncertainty Principle and how does it affect Bohr's model
- Describe Schrödinger's model (the quantum mechanical model) of the atom

Dalton's Atomic Theory. Dalton proposed atomic theory in 1803 to explain his observations about the relative masses of elements in a compound. Dalton's Postulates say: [1] Matter is made of small particles called atoms; [2] Atoms are indestructible. They cannot be created or destroyed during chemical or physical changes; [3] Atoms of an element are identical. They have the same mass; [4] Atoms of different elements have different masses; [5] Compounds are formed by combining atoms of different elements. The Dalton model of the atom is a solid, indivisible sphere.

Thomson's Model. Thomson showed that the beam of light in a Crookes tube was actually composed of negatively charged particles he called electrons. In order to account for the negatively charged particles in neutral matter, he assumed the rest of the atom was positively charged. Thomson's model of the atom was a positively charged cloud with the negative electrons scattered evenly throughout.



Rutherford's Model. Ernest Rutherford performed the alpha scattering experiment in 1911. He probed the inside of the atom by aiming small, positively charged particles called alpha particles at gold foil. Only 1 in 8,000 alpha particles bounced straight back or were deflected greatly. The rest went straight through the gold foil Based on these observations, Rutherford suggested that the atom is mostly empty space with a small, positively charged center and negatively charged electrons revolving around the outside like planets around the sun.

The Bohr Model. Bohr developed a model of the atom with circular pathways for the electron. These pathways were at fixed distances from the nucleus. Electrons could be found only in these circular pathways. If an electron absorbed enough energy, it could jump up to another level, but it could never be found between levels. Inevitably, the electron lost energy and fell back down to a previous level, giving off the extra energy as a specific frequency of light. Bohr had a complex equation into which he could substitute simple numbers, integers such as 1, 2, or 3, and the equation predicted the frequencies of the light. These mystery numbers represented the energy levels of the electrons. Bohr's evidence for his model was the bright line spectra formed when electrons fell from the excited state back to the ground state.

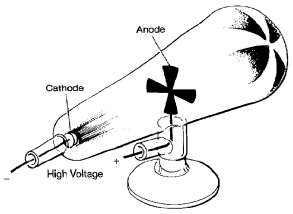
Wave Mechanical Model. The Bohr model successfully explained the bright line spectra for hydrogen, but could not explain the spectra of atoms with more electrons. The wave mechanical model solved the problem. Thinking of the electron as a standing wave also helps to explain why the electron's energy is quantized. The wave mechanical model describes the location of electrons a their most probable location rather than as orbits with fixed radii. The regions where elections are most probably found are called orbitals. An orbital can hold, at most, two electrons.

Answer the questions below by circling the number of the correct response

1. An 18 kg sample of water is decomposed by electrolysis, releasing 16 kg of oxygen. How much hydrogen was released? (1) 34 kg (2) 2 kg (3) 16 kg (4) 1.125 kg

2. If 46 g of X combines with 16 g of Y to form Z, how much Z is formed? (1) 30 g (2) 2.9 g (3) 724 g (4) 62 g

3. When William Crookes passed current through a cathode (negative electrode) in a glass vacuum tube, the tube glowed casting a shadow of the anode at the opposite end as shown in the diagram at the right. This showed Crookes that the source of the light was the (1) anode, (2) cathode, (3) protons, (4) neutrons.



4. Modern atomic theory is based on the work of (1) Kepler, (2) Aristotle, (3) Dalton, (4) Leeuwenhoek.

5. The law of conservation of mass follows from the concept that (1) atoms are indivisible during chemical reactions. (2) atoms of different elements have different properties. (3) matter is composed of atoms. (4) atoms can be destroyed in chemical reactions.

6. In water, H_2O, the ratio of the masses of oxygen to hydrogen is 8:1. What is the ratio of the masses of oxygen to hydrogen in hydrogen peroxide, H_2O_2? (1) 1:1 (2) 8:1 (3) 16:1 (4) 32:1

7. According to Dalton's atomic theory, atoms (1) are destroyed in chemical reactions. (2) can be divided. (3) of each element are identical in size, mass, and other properties. (4) of different elements cannot combine.

8. Which of the following is NOT part of Dalton's atomic theory? (1) Atoms cannot be divided, created, or destroyed. (2) The number of protons in an atom is its atomic number. (3) In chemical reactions, atoms are combined, separated, or rearranged. (4) All matter is composed of extremely small particles called atoms.

9. According to Dalton's atomic theory, atoms (1) of different elements combine in simple whole-number ratios to form compounds. (2) can be divided into protons, neutrons, and electrons. (3) of all elements are identical in size and mass. (4) can be destroyed in chemical reactions.

10. Dalton's atomic theory helped to explain the law of conservation of mass because it stated that atoms (1) could not combine. (2) could not be created or destroyed. (3) all had the same mass. (4) were invisible.

11. Which concept in Dalton's atomic theory has been modified? (1) All matter is composed of atoms. (2) Atoms of different elements have different properties and masses. (3) Atoms can combine in chemical reactions. (4) Atoms cannot be divided

12. Dalton's model of the atom was (1) a solid sphere, (2) a positive cloud with scattered electrons, (3) the "solar system" model, (4) based on electrons moving in fixed circular pathways around the nucleus

13. Who made the discovery that cathode rays were actually negatively charged particles called electrons? (1) Thomson, (2) Bohr, (3) Rutherford, (4) Dalton

14. In early experiments on electricity and matter, an electrical current was passed through a glass tube containing (1) water. (2) gas under high pressure. (3) liquid oxygen. (4) gas under low pressure.

15. In a glass tube, electrical current passes from the negative electrode, called the -?- to the other electrode. (1) cathode (2) anode (3) electron (4) millikan

16. The rays produced in a cathode tube in early experiments were (1) unaffected by a magnetic field. (2) deflected away from a negative plate. (3) found to carry a positive charge. (4) striking the cathode.

17. The behavior of cathode rays produced in a glass tube containing gas at low pressure led scientists to conclude that the rays (1) were not composed of matter. (2) were composed of positively charged particles. (3) were composed of negatively charged particles. (4) were composed of uncharged particles.

18. Experiments with cathode rays led to the discovery of the (1) proton. (2) nucleus. (3) neutron. (4) electron.

19. After measuring the ratio of the charge of a cathode-ray particle to its mass, Thomson concluded that the particles (1) had no mass. (2) had a very small mass. (3) had a very large mass. (4) carried a positive charge.

20. Whose model of the atom could be represented by a solid, indivisible sphere with a characteristic mass? (1) Dalton (2) Thomson (3) Rutherford (4) Bohr

21. Whose model of the atom could be represented by a positively charged cloud with electrons distributed through it? (1) Dalton (2) Thomson (3) Rutherford (4) Bohr

22. The nucleus of the atom was discovered by (1) Thomson, (2) Bohr, (3) Rutherford, (4) Dalton

23. In Rutherford's experiments, most of the alpha particles aimed at gold foil (1) bounced back. (2) passed through the foil. (3) were absorbed by the foil. (4) combined with the foil.

24. Because most particles fired at metal foil passed straight through, Rutherford concluded that (1) atoms were mostly empty space. (2) atoms contained no charged particles. (3) electrons formed the nucleus. (4) atoms were indivisible.

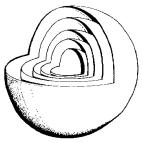
25. Because a few positively charged particles bounced back from the foil, Rutherford concluded that such particles were (1) striking electrons. (2) indivisible. (3) repelled by densely packed regions of positive charge. (4) magnetic.

26. Rutherford's experiments led to the discovery of the (1) electron. (2) nucleus. (3) cathode ray. (4) neutron.

27. Rutherford's experimental results led him to conclude that atoms contain massive central regions that have (1) a positive charge. (2) a negative charge. (3) no charge. (4) both protons and electrons.

28. Which of the following particles is negatively charged?
(1) electron (2) proton (3) neutron (4) cation

29. Whose model of the atom could be represented by the diagram to the right?
(1) Dalton
(2) Thomson
(3) Rutherford
(4) Bohr



30. Evidence that electrons exist in distinct energy levels outside the nucleus is provided by (1) cathode rays, (2) spectral lines, (3) atomic masses, (4) radioactivity.

31. When excited electrons return to the ground state, they lose excess energy in the form of (1) light, (2) gamma rays, (3) nuclear radiation, (4) sound.

32. The product of the frequency and the wavelength of a wave equals the (1) number of waves passing a point in a second, (2) speed of the wave, (3) distance between wave crests, (4) time for one full wave to pass.

33. Visible light, X rays, infrared radiation, and radio waves all have the same (1) energy. (2) wavelength. (3) speed. (4) frequency.

34. When the pink-colored light of glowing hydrogen gas passes through a prism, it is possible to see (1) all the colors of the rainbow. (2) only lavender-colored lines. (3) four lines of different colors. (4) black light.

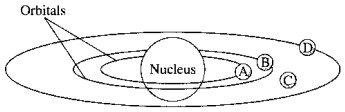
35. Bohr's theory helped explain why (1) electrons have negative charge. (2) most of the mass of the atom is in the nucleus. (3) excited hydrogen gas gives off certain colors of light. (4) atoms combine to form molecules.

36. Bohr's model of the atom works best in explaining (1) the spectra of the first ten elements. (2) only the spectrum of hydrogen. (3) only the spectra of atoms with electrons in an s orbital. (4) the entire visible spectra of atoms.

37. According to Bohr's theory, an excited atom would (1) collapse. (2) absorb photons. (3) remain stable. (4) radiate energy.

38. According to the Bohr model of the atom, the single electron of a hydrogen atom circles the nucleus (1) in specific, allowed orbits. (2) in one fixed orbit at all times. (3) at any of an infinite number of distances, depending on its energy. (4) counterclockwise.

39. According to Bohr, electrons cannot reside at which of the labeled points in the figure to the right? (1) point A
(2) point B (3) point C (4) point D



40. The characteristic bright-line spectrum of an element is produced when electrons (1) fall back to lower energy levels, (2) are gained by a neutral atom, (3) are emitted by the nucleus as beta particles, (4) move to higher energy levels

41. In Bohr's atomic theory, when an electron moves from one energy level to another energy level more distant from the nucleus (1) energy is emitted. (2) energy is absorbed. (3) no change in energy occurs. (4) light is emitted. (5) none of these

42. The modern model of the atom shows that electrons are (1) orbiting the nucleus in fixed paths, (2) found in regions called orbitals, (3) combined with neutrons in the nucleus, (4) located in a solid sphere covering the nucleus

43. A mine in Pennsylvania produces 200 kg of the compound, consisting of 140 kg of iron and 60 kg of oxygen. A small sample of the compound is obtained from Brazil, which consists of 70 kg of iron and 30 kg of oxygen. Which law associated with Dalton's Atomic Theory that supports this data

44. Which aspect of Thomson's model is still true? Which aspect of this model is false?

45. In the gold foil experiment, the alpha particles mainly traveled through the foil with only occasional reflection and deflection. This data lead to the nuclear model. If the results were reversed, where alpha particles mainly deflected and reflected and only an occasional alpha particle passed through, what would have been a logical deduction regarding the atomic model?

Answers

1. 2	11. 4	21. 2	31. 1	41. 2
2. 4	12. 1	22. 3	32. 2	42. 2
3. 2	13. 1	23. 2	33. 3	43. Law of Definite proportions
4. 3	14. 4	24. 1	34. 3	44. There are electrons, but rather than a cloud of positive charge there is a nucleus.
5. 1	15. 1	25. 3	35. 3	
6. 3	16. 2	26. 2	36. 2	45. In the gold foil experiment, the alpha particles mainly traveled through the foil with only occasional reflection and deflection. This data lead to the nuclear model. If the results were reversed, it would imply that the atom is mostly a positive solid instead of empty space with a small space for electrons close by.
7. 3	17. 3	27. 1	37. 4	
8. 2	18. 4	28. 1	38. 1	
9. 1	19. 2	29. 4	39. 3	
10. 2	20. 1	30. 2	40. 1	