Unit 1- Tutorial 4: Atomic Structure

1. Which is not a property of cathode rays?
    1) They are attracted to the (+) plate when an electric field is applied along their path.
    2) The e/m ratio of cathode rays from different gases is constant.
    3) There is an inclination towards the North Pole in a magnetic field.
    4) They move in a straight line.
    5) The nature of cathode rays does not depend on the gas inside the cathode ray tube or the material it is made of.

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2. Who showed that the charge/mass ratio of a cathode ray particle does not vary with the gas contained in the cathode ray tube?

    1) G.J. Stoney 2) Ernest Rutherford 3) J.J. Thomson
    4) R.A. Millikan 5) William Crookes

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3. Who among the following is the scientists who gave that name to the "electron"?

    1) William Crookes 2) Ernest Rutherford 3) G.J. Stoney
    4) Henri Becquerel 5) J.J. Thomson

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4. The scientist who named the basic unit of electricity as "electron" is,

   1) J.J. Thomson 2) Rutherford 3) Stoney

   4) R.A. Millikan 5) Michael Faraday

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5. Who observed in the study of cathode rays that the nature of cathode rays does not change regardless of the material the cathode is made of or the gas in the tube?

   1) G.J. Stoney 2) J.J. Thomson 3) William Crookes

   4) Ernest Rutherford 5) R.A. Millikan

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6. Which of the following statements is true?

   1) In an electric field, cathode rays are deflected perpendicular to the field.
   2) A cathode ray is a beam of particles with both mass and kinetic energy.
   3) The nature of the cathode rays does not vary with the gas in the discharge tube but with the material used for the cathode.

4) Cathode rays are not deflected in a magnetic field.

5) The e/m ratio of cathode rays from different gases is different from each other.

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7. Which of the following statement is **true** about cathode rays?

1) Attracted towards the North Pole in a magnetic field.

2) Attracted towards the South Pole in a magnetic field.

3) Contains He nuclei.

4) Moves in a straight line.

5) Able to perform work while traveling.

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8. The term "electron" was first introduced by,

1) J.J. Thomson 2) Moseley 3) Rutherford

4) Stoney 5) Faraday

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9. The two scientists who discovered the radioactivity caused by the nuclei of certain elements and the generation of positive rays in the cathode ray tube were respectively,

    1) Robert Millikan and Eugen Goldstein
    2) J.J. Thomson and Henri Becquerel
    3) Henri Becquerel and Eugen Goldstein
    4) Ernest Rutherford and J.J. Thomson
    5) Eugen Goldstein and Henri Becquerel

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10. Consider statements I and II below.

    I. Presenting the "golf ball model" as an atomic model.
    II. Providing experimental proof of the existence of positive charges in matter.

    The scientists who presented the facts mentioned in these I and II statements respectively are,

    1) J.J. Thomson and Eugen Goldstein
    2) Ernest Rutherford and John Dalton
    3) John Dalton and Eugen Goldstein
    4) John Dalton and James Chadwick
    5) Eugen Goldstein and Ernest Rutherford

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11. Who of the following scientists showed that the charge/mass ration of a positive ray particle varies with the gas contained in the cathode ray tube?

1) E. Goldstein 2) Ernest Rutherford 3) J.J. Thomson
4) R.A. Millikan 5) G.J. Stoney

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12. The mass of a proton is given by,

1) 10^{-22} g 2) 10^{-25} g 3) 10^{-13} g 4) 10^{-8} g 5) 10^{-24} g

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13. Which of the following statements about alpha (α) rays, beta (β) rays, and gamma (γ) rays is **false**?

1) γ rays are not accelerated in an electric field.
2) α particles are positively charged.
3) α rays show more acceleration than β rays in an electric field.
4) Ernest Rutherford discovered that radioactive elements release α, β, and γ rays.
5) γ rays are a type of high energy radiation.

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14. Who first represented a model of the nucleus of the atom?

1) Niels Bohr 2) G.J. Stoney 3) R.A. Millikan

4) Ernest Rutherford 5) J.J. Thomson

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15. Consider the following hypotheses/discoveries related to atomic structure.

I. Like the planets orbiting around the sun, the atomic nucleus is surrounded by electrons orbiting around it.

II. The number of positive charges in the nucleus increases one electron unit at a time.

The two scientists who made the hypotheses/discoveries mentioned in I and II respectively,

1) Eugen Goldstein and J.J. Thomson

2) Niels Henrik David Bohr and Henry Gwyn Jeffreys Moseley

3) Niels Henrik David Bohr and J.J. Thomson

4) J.J. Thomson and Eugen Goldstein

5) James Chadwick and Henry Gwyn Jeffreys Moseley

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16. The neutron was discovered by,

1) J.J. Thomson 2) James Chadwick 3) Ernest Rutherford

4) William Aston 5) Eugen Goldstein

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17. The electron was discovered by,

1) J.J. Thomson 2) James Chadwick 3) Ernest Rutherford

4) Eugen Goldstein 5) John Dalton

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18. The proton was discovered by,

1) J.J. Thomson 2) Ernest Rutherford 3) James Chadwick

4) Henry Moseley 5) Henri Becquerel

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19. Consider the following findings related to atomic structure.

I. Conducting experiments to find isotopes

II. Determination of e/m ratio of an electron.

III. Discovery of the nucleus of the atom.

The scientists who contributed to the discoveries mentioned in I, II, and III respectively,

1) Henri Becquerel, J.J. Thomson, Geiger

2) J.J. Thomson, John Dalton, Ernest Rutherford

3) William Aston, J.J. Thomson, Henri Becquerel

4) William Aston, J.J. Thomson, Ernest Rutherford

5) Eugen Goldstein, J.J. Thomson, Geiger

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20. Consider statements I and II below.

I. Introducing the name "electron" for the elementary particle of electricity.

II. Finding the electron's charge to be 1.602×10^{-19} C.

The scientists who presented the facts mentioned in these I and II statements respectively are,

1) John Dalton and J.J. Thomson

2) G.J. Stoney and R.A. Millikan

3) G.J. Stoney and William Crookes

4) R.A. Millikan and G.J. Stoney

5) J.J. Thomson and James Chadwick

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21. Which of the following sets of numbers represents the number of protons, neutrons and electrons in the $^{18}_{8}O_2^{2-}$ ion?

1) 8, 10, 10 2) 10, 20, 14 3) 16, 20, 18

4) 8, 10, 6 5) 16, 14, 20

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22. The number of electrons and neutrons in the triple positive ion of $^{52}_{24}Cr$ respectively are,

1) 24 and 28 2) 21 and 28 3) 27 and 28

4) 28 and 21 5) 21 and 25

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23. The number of electrons, neutrons, and protons in $^{81}_{35}A^{-}$ion respectively are,

1) 36, 18, 35 2) 37, 45, 36 3) 46, 35, 47 4) 34, 46, 35 5) 36, 46, 35

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* Follow the instructions given below for question number 24 to 31.

(1)	(2)	(3)	(4)	(5)
Only (a) and (b) are correct.	Only (b) and (c) are correct.	Only (c) and (d) are correct.	Only (d) and (a) are correct.	**Any other** number or combination of responses is correct.

24. Cathode ray particles are,

a) negatively charged.

b) attracted to the N-pole of a magnet.

c) attracted to the negative electrode in an external electric field.

d) move along a straight path.

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25. Which of the following is **true** about the factors on which the charge/mass ratio of cathode rays depends?

a) It does not depend on the metal the cathode is made of.

b) Does not depend on the gas in the discharge tube.

c) Depends on the potential gap applied across the discharge tube.

d) Depends on the pressure in the discharge pipe.

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26. Which of the following is **false** about α and β rays?

a) The penetrating power of β rays are lesser than α rays.

b) The path of both α and β rays changes in an electric field.

c) The ionizing power of β rays are lesser than α rays.

d) The trajectory of α and β rays cannot be changed by applying a magnetic field.

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27. Which of the following statement/s are **false**?

a) The first nuclear model of the atom was proposed by Thomson.

b) The e/m value of positive rays does not change according to the gas on the cathode ray tube.

c) A type of particle which is similar to He particles is used for gold leaf testing.

d) Electrons behave as waves and particles at the same time.

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28. Which of the following statement/s are **true**?

a) Canal rays are formed by the gas in the Crooks tube.

b) In Rutherford's gold leaf experiment, incoming α rays hit the gold nucleus and bounces back in the direction it came from.

c) Hund's law states that no two electrons in an atom can have the same set of quantum numbers.

d) Neutron is the subatomic particle that stabilizes the nucleus of an atom.

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29. The atomic mass of ^{12}C is,

a) $\frac{12}{6.022\times10^{23}}$ g b) 12 u c) $\frac{12}{6.022\times10^{23}} \times \frac{1}{12}$ g d) $\frac{6.022\times10^{23}}{12}$ g

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30. A mole of Na atoms has a mass of 23 g mol^{-1}. The true statement/s regarding the relative atomic mass of Na is/are, (N_A = Avogadro constant)

a) $\frac{Mass\ of\ a\ Na\ atom}{Mass\ of\ a\ 12C\ atom} \times 12 = 23$

b) $\frac{Mass\ of\ a\ Na\ atom}{1\ Da} = 23$

c) $\frac{Mass\ of\ a\ Na\ atom}{\frac{12g}{N_A} \times \frac{1}{12}} = 23$

d) $\frac{Mass\ of\ 1\ mol\ of\ Na\ atoms}{N_A} = 23$

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31. Which of the following statement/s is correct about the $^{214}_{90}Th^{2-}$ ion?

a) It has 88 electrons.

b) It has 124 neutrons.

c) It has 90 protons.

d) The total number of electrons, protons, and neutrons is 214.

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* Follow the instructions given below for question number 32 to 35.

	First statement	Second statement
1	True	True, and correctly explains the first statement
2	True	True, but does **not** explain the first statement correctly
3	True	False
4	False	True
5	False	False

	First statement	Second statement
32	A proton is heavier than a neutron.	Each ion has at least one electron.
33	A gas is ionized more by β rays than by α rays.	The speed of β rays is higher than the speed of α rays.
34	${}_1^1H, {}_1^2H, {}_1^3H$ are isotopic atoms of Hydrogen.	A change in the number of protons and number of electrons in the nucleus of different atoms of the same elements is isotopes.
35	Isotopes of the same element have the same atomic number and different mass numbers.	Isotopes have the same physical and chemical properties.

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Structured Essay

36. Complete the blanks in the following passage using the most appropriate term/s.

Around 1864, scientists (1) ……, ……. and (2) ……. studied the nature of the electron. A beam of light was (3) ……. from the cathode to the (4) ……. and they are named as (5) ……..

37. J.J. Thomson conducted several experiments to test the properties of the cathode rays.

I) State 3 properties of cathode rays as revealed by those tests.

II) Describe one of the above properties with a sketch of a cathode ray tube (observations and conclusions should be given).

38. Fill in the blanks.

The ratio between (1) ……. and (2) ……. of cathode ray particles was determined by (3) ……. in 1847. In the early 20th century, it was discovered that the value of (4) ……. for the electron was (5) ……. from the (6) ……. done by (7) ……. Therefore, the mass is equal to (8) ……. g. It is about (9) ……. times the mass of the (10) ……. atom.

39. Fill in the blanks.

The phenomenon of radioactivity was discovered in 1897 by (1) ……. The Uranium salt releases some type of (2) ……. that could penetrate material and this led to his discovery. Later, the (3) ……. Couple discovered that other elements such as (4) ……. and (5) ……. emitted similar (6) ……. Those three types of rays were named as (7) ……., (8) ……., and (9) …….

40. Fill in the blanks.

In 1911, the structure of the atom was studied by the (1) ……. done by (2) ……. It was evident from the above experiment that (3) ……. occurs when a beam of (4) ……. particles is diffracted to a (5) ……. foil. The truth of Rutherford's (6) ……. model of the atom was confirmed by the quantitative experiments done by (7) ……. Accordingly, this small area where all the (8) ……. particles in the atom are concentrated was named as (9) …….

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Essay

41. 2 isotopes of Cl are found in a Cl gas sample as $^{35}_{17}Cl$ and $^{37}_{17}Cl$. If the mean relative atomic mass of Cl is 35.5, calculate the relative abundances of each isotope.

42. Naturally occurring carbon is a mixture of two isotopes as $^{12}_{6}C$ and $^{13}_{6}C$. Find the percentage of $^{12}_{6}C$ and $^{13}_{6}C$ isotopes contained in a sample of carbon of relative atomic mass 12.0112. The relative isotopic mass of $^{13}_{6}C$ is 13.0034.

43. Neon gas is a mixture of 3 isotopes with mass numbers of 20, 21, 22. Their percentages are 90.51%, 0.27%, and 9.22% respectively. Find the relative atomic of Ne.

44. If the relative atomic mass of Cl is 35.454 in a mixture of two naturally occurring isotopes of ^{35}Cl and ^{37}Cl, find the number of ^{35}Cl atoms in a sample of 1000 Cl atoms.

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