

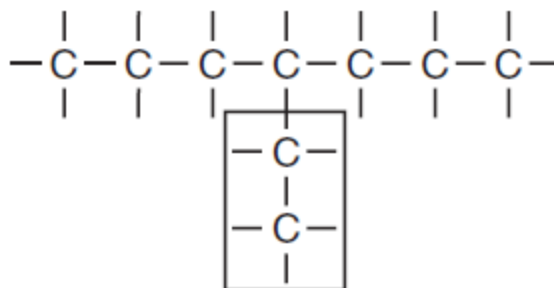
Organic/Nuclear Chemistry After School Regents Review Practice

- Which formula represents an alkane?
A) C_2H_2 B) C_2H_4 C) C_3H_4 D) C_3H_8
- Which condensed structural formula represents an unsaturated compound?
A) $CH_3CHCHCH_3$ B) $CH_3CH_2CH_3$
C) CH_3CH_3 D) CH_4
- Which formula represents an organic compound?
A) CaH_2 B) C_4H_8 C) H_2O_2 D) P_2O_5
- A hydrocarbon molecule has seven carbon atoms in a straight chain. There is a double bond between the third carbon atom and the fourth carbon atom in the chain. The IUPAC name for this hydrocarbon is
A) 3-heptyne B) 4-heptyne
C) 3-heptene D) 4-heptene
- What is the number of electrons shared in the multiple carbon-carbon bond in one molecule of 1-pentyne?
A) 6 B) 2 C) 3 D) 8
- Which compound is classified as a hydrocarbon?
A) butanal B) butyne
C) 2-butanol D) 2-butanone
- Butanal, butanone, and diethyl ether have different properties because the molecules of each compound differ in their
A) numbers of carbon atoms
B) numbers of oxygen atoms
C) types of functional groups
D) types of radioactive isotopes
- Which element is present in all organic compounds?
A) nitrogen B) oxygen
C) carbon D) sulfur
- Which compounds are isomers of each other?
A) methanol and methanal
B) propanoic acid and pentanoic acid
C) 1-propanol and 2-propanol
D) 1-chloropropane and 2-bromopropane

- Which compound yields H^+ ions as the only positive ions in an aqueous solution?

- A) KOH B) $NaOH$
C) CH_3OH D) CH_3COOH

- Given the formula for an organic compound:

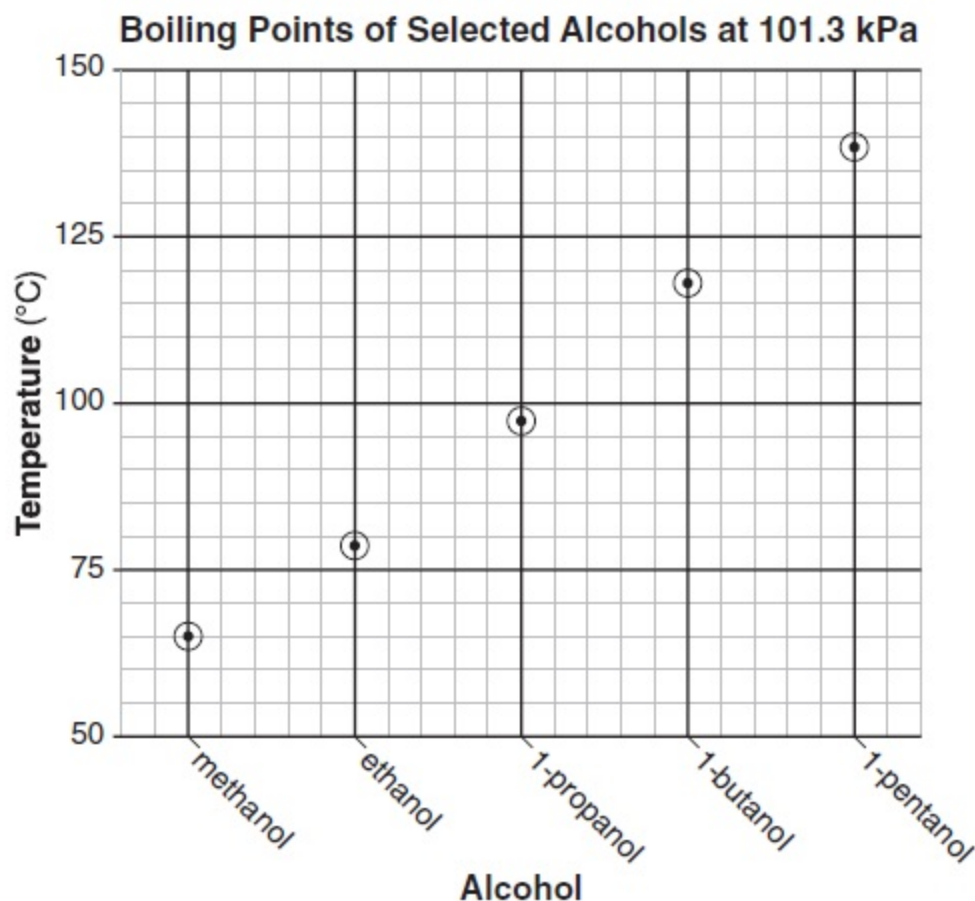


What is the name given to the group in the box?

- A) butyl B) ethyl
C) methyl D) propyl

Organic/Nuclear Chemistry After School Regents Review Practice

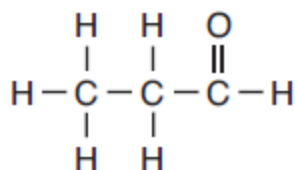
Base your answers to questions 12 and 13 on the graph below and on your knowledge of chemistry.



12. What can be concluded from this graph?
- A) At 101.3 kPa, water has a higher boiling point than 1-butanol.
 - B) At 101.3 kPa, water has a lower boiling point than ethanol.
 - C) The greater the number of carbon atoms per alcohol molecule, the lower the boiling point of the alcohol.
 - D) The greater the number of carbon atoms per alcohol molecule, the higher the boiling point of the alcohol.
13. What is represented by the number "1" in the IUPAC name for three of these alcohols?
- A) the number of isomers for each alcohol
 - B) the number of $\equiv\text{OH}$ groups for each carbon atom in each alcohol molecule
 - C) the location of an $-\text{OH}$ group on one end of the carbon chain in each alcohol molecule
 - D) the location of an $\equiv\text{OH}$ group in the middle of the carbon chain in each alcohol molecule

Organic/Nuclear Chemistry After School Regents Review Practice

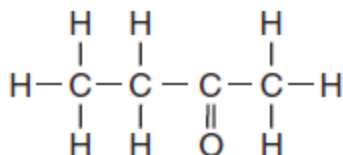
14. Given the formula:



What is the chemical name of this compound?

- A) propane B) propanal
 C) propanol D) propanone

15. Given the formula for a compound:



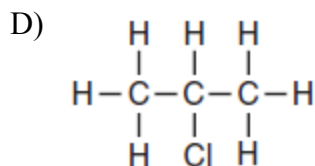
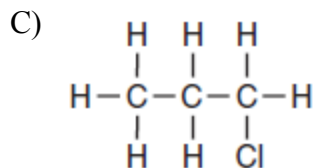
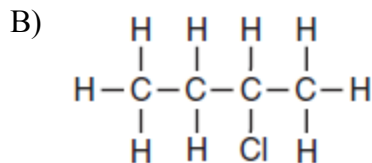
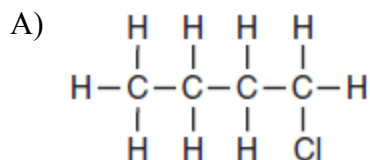
A chemical name for this compound is

- A) butanal B) butanol
 C) butanone D) butanoic acid

16. Which atom is bonded to the carbon atom in the functional group of a ketone?

- A) fluorine B) hydrogen
 C) nitrogen D) oxygen

17. Which formula represents a molecule of 2-chlorobutane?



18. Ethanoic acid and 1-butanol can react to produce water and a compound classified as an

- A) aldehyde B) amide
 C) ester D) ether

19. Which class of organic compounds contains nitrogen?

- A) aldehyde B) alcohol
 C) amine D) ether

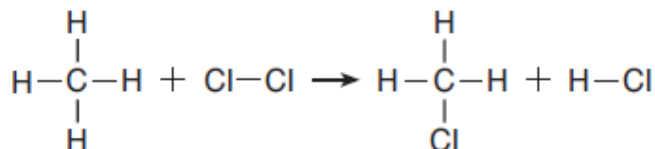
20. Which compound is classified as an ether?

- A) CH_3CHO B) CH_3OCH_3
 C) CH_3COCH_3 D) $\text{CH}_3\text{COOCH}_3$

21. Which formula represents the product of the addition reaction between ethene and chlorine, Cl_2 ?

- A)
$$\begin{array}{c}
 \text{Cl} \quad \text{Cl} \\
 | \quad | \\
 \text{Cl}-\text{C}-\text{C}-\text{Cl} \\
 | \quad | \\
 \text{H} \quad \text{H}
 \end{array}$$
 B)
$$\begin{array}{c}
 \text{Cl} \quad \text{Cl} \\
 | \quad | \\
 \text{H}-\text{C}-\text{C}-\text{H} \\
 | \quad | \\
 \text{H} \quad \text{H}
 \end{array}$$
- C)
$$\begin{array}{c}
 \text{Cl} \quad \text{Cl} \\
 | \quad | \\
 \text{H}-\text{C}=\text{C}-\text{H} \\
 | \quad | \\
 \text{H} \quad \text{H}
 \end{array}$$
 D)
$$\begin{array}{c}
 \text{Cl} \quad \text{H} \\
 | \quad | \\
 \text{H}-\text{C}-\text{C}-\text{H} \\
 | \quad | \\
 \text{H} \quad \text{H}
 \end{array}$$

22. Given the equation representing a reaction:



What type of reaction is represented by this equation?

- A) addition B) esterification
 C) polymerization D) substitution

23. Two types of organic reactions are

- A) deposition and saponification
 B) deposition and transmutation
 C) polymerization and saponification
 D) polymerization and transmutation

24. A reaction between an alcohol and an organic acid is classified as

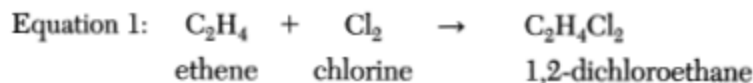
- A) esterification B) fermentation
 C) saponification D) substitution

Organic/Nuclear Chemistry After School Regents Review Practice

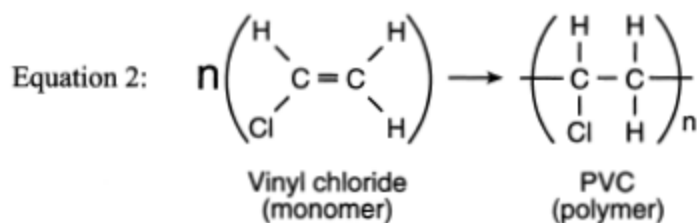
25. What are the two main products of a fermentation reaction?
- A) ethanol and carbon dioxide
 - B) ethanol and water
 - C) sugar and carbon dioxide
 - D) sugar and water
26. When hydrocarbons burn completely in an excess of oxygen, the products are
- A) carbon monoxide and water
 - B) carbon dioxide and water
 - C) carbon monoxide and carbon dioxide
 - D) carbon dioxide and carbon
27. Which reaction results in the production of soap?
- A) esterification
 - B) fermentation
 - C) polymerization
 - D) saponification

Base your answers to questions **28** through **30** on the information below and on your knowledge of chemistry.

Polyvinyl chloride (PVC) is a polymer used to make drain pipes, flooring, electric wire insulation, and some plastic bottles. Making PVC requires several reactions. The first step is represented by the equation below.



The 1,2-dichloroethane is converted to vinyl chloride. To produce PVC, the vinyl chloride monomer is polymerized, as represented by the equation below.



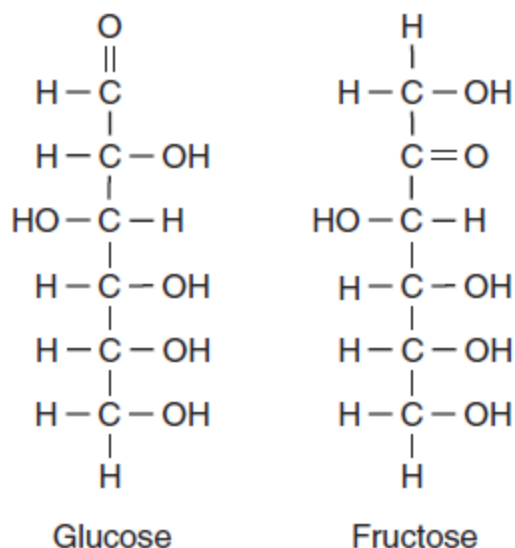
Note: n and n represent the same large number in the equation.

28. State the number of electrons shared between the carbon atoms in a molecule of vinyl chloride.
29. Draw a structural formula for the product of equation 1.
30. Explain, in terms of chemical bonds, why the hydrocarbon in equation 1 is unsaturated.
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Organic/Nuclear Chemistry After School Regents Review Practice

Base your answers to questions 31 and 32 on the information below and on your knowledge of chemistry.

Table sugar, sucrose, is a combination of two simple sugars, glucose and fructose. The formulas below represent these simple sugars.



31. Explain, in terms of atoms and molecular structure, why glucose and fructose are isomers of each other.
32. Identify the functional group that appears more than once in the fructose molecule.
-
33. A sample of which radioisotope emits particles having the greatest mass?
A) ^{137}Cs B) ^{53}Fe C) ^{220}Fr D) ^3H
34. Which list of nuclear emissions is arranged in order from the greatest penetrating power to the least penetrating power?
A) alpha particle, beta particle, gamma ray
B) alpha particle, gamma ray, beta particle
C) gamma ray, alpha particle, beta particle
D) gamma ray, beta particle, alpha particle
35. An unstable nucleus spontaneously releases a positron. This is an example of
A) radioactive decay
B) nuclear fusion
C) chemical decomposition
D) thermal conductivity
36. Which balanced equation represents a spontaneous radioactive decay?
A) $^{14}\text{C} + \text{Ca}_3(\text{PO}_4)_2 \rightarrow 3\text{CaC}_2 + 2\text{P} + 8\text{CO}$
B) $^{14}_7\text{N} + {}^1_0\text{n} \rightarrow {}^{14}_6\text{C} + {}^1_1\text{P}$
C) $\text{H}_2\text{CO}_3 \rightarrow \text{H}_2\text{O} + \text{CO}_2$
D) $^{14}_6\text{C} \rightarrow {}^{14}_7\text{N} + {}^0_{-1}\text{e}$
37. Positrons and beta particles have
A) the same charge and the same mass
B) the same charge and different masses
C) different charges and the same mass
D) different charges and different masses
38. When an atom of the unstable isotope Na-24 decays, it becomes an atom of Mg-24 because the Na-24 atom spontaneously releases
A) an alpha particle B) a beta particle
C) a neutron D) a positron

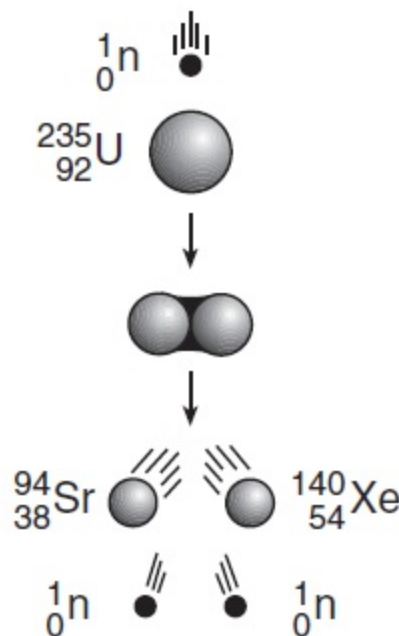
Organic/Nuclear Chemistry After School Regents Review Practice

39. Which statement describes the relative masses of two different particles?
- A) A neutron has less mass than a positron.
 B) A beta particle has less mass than a neutron.
 C) An alpha particle has less mass than a positron.
 D) An alpha particle has less mass than a beta particle.
40. What is the mass of an original 5.60-gram sample of iron-53 that remains unchanged after 25.53 minutes?
- A) 0.35 g B) 0.70 g
 C) 1.40 g D) 2.80 g
41. Which radioisotope has the fastest rate of decay?
- A) ^{14}C B) ^{37}Ca C) ^{53}Fe D) ^{42}K
42. Which phrase describes the decay modes and the half-lives of K-37 and K-42?
- A) the same decay mode but different half-lives
 B) the same decay mode and the same half-life
 C) different decay modes and different half-lives
 D) different decay modes but the same half-life
43. A radioactive isotope has a half-life of 2.5 years. Which fraction of the original mass remains unchanged after 10. years?
- A) 1/2 B) 1/4 C) 1/8 D) 1/16
44. Compared to the half-life and decay mode of the nuclide ^{90}Sr , the nuclide ^{226}Ra has
- A) a longer half-life and the same decay mode
 B) a longer half-life and a different decay mode
 C) a shorter half-life and the same decay mode
 D) a shorter half-life and a different decay mode
45. Given the equation representing a nuclear reaction:
 $^1_1\text{H} + X \rightarrow ^6_3\text{Li} + ^4_2\text{He}$
 The particle represented by X is
- A) ^9_4Li B) ^9_4Be C) $^{10}_5\text{Be}$ D) $^{10}_6\text{C}$
46. Given the balanced equation representing a reaction:
- $$^{27}_{13}\text{Al} + ^4_2\text{He} \rightarrow ^{30}_{15}\text{P} + ^1_0\text{n}$$

Which type of reaction is represented by this equation?

- A) combustion B) decomposition
 C) saponification D) transmutation

47. What occurs in both fusion and fission reactions?
- A) Small amounts of energy are converted into large amounts of matter.
 B) Small amounts of matter are converted into large amounts of energy.
 C) Heavy nuclei are split into lighter nuclei.
 D) Light nuclei are combined into heavier nuclei.
48. Which reaction releases the greatest amount of energy per mole of reactant?
- A) decomposition B) esterification
 C) fermentation D) fission
49. Given the diagram representing a reaction:



Which type of change is represented?

- A) fission B) fusion
 C) deposition D) evaporation
50. Which process converts mass into energy?
- A) distillation of ethanol
 B) filtration of a mixture
 C) fusion of hydrogen atoms
 D) ionization of cesium atoms

Organic/Nuclear Chemistry After School Regents Review Practice

51. Fission and fusion reactions both release energy.

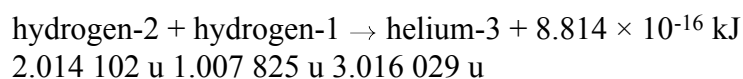
However, only fusion reactions

- A) require elements with large atomic numbers
- B) create radioactive products
- C) use radioactive reactants
- D) combine light nuclei

52. Which balanced equation represents nuclear fusion?

- A) ${}^3_1\text{H} \rightarrow {}^3_2\text{He} + {}^0_{-1}\text{e}$
- B) ${}^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + {}^4_2\text{He}$
- C) ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^4_2\text{He}$
- D) ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{90}_{38}\text{Sr} + {}^{143}_{54}\text{Xe} + 3{}^1_0\text{n}$

53. Given the equation representing a reaction where the masses are expressed in atomic mass units:



Which phrase describes this reaction?

- A) a chemical reaction and mass being converted to energy
- B) a chemical reaction and energy being converted to mass
- C) a nuclear reaction and mass being converted to energy
- D) a nuclear reaction and energy being converted to mass

54. Which radioisotope is used to determine the age of once-living organisms?

- A) carbon-14
- B) cobalt-60
- C) iodine-131
- D) uranium-238

55. Which radioisotope is used in dating geological formations?

- A) I-131
- B) U-238
- C) Ca-37
- D) Fr-220

56. Which radioisotope is used for diagnosing thyroid disorders?

- A) U-238
- B) Pb-206
- C) I-131
- D) Co-60

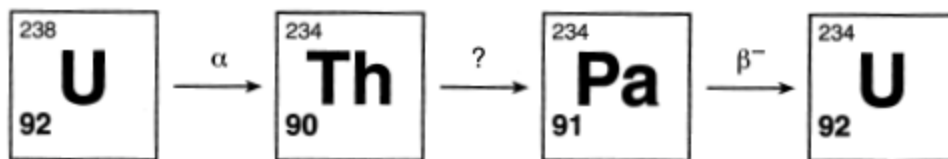
57. Which phrase describes a risk associated with producing energy in a nuclear power plant?

- A) depletion of atmospheric hydrogen (H_2)
 - B) depletion of atmospheric carbon dioxide (CO_2)
 - C) production of wastes needing long-term storage
 - D) production of wastes that cool surrounding water supplies
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Organic/Nuclear Chemistry After School Regents Review Practice

Base your answers to questions 58 through 60 on the information below and on your knowledge of chemistry.

The diagram below shows the first three steps in the uranium-238 radioactive decay series.

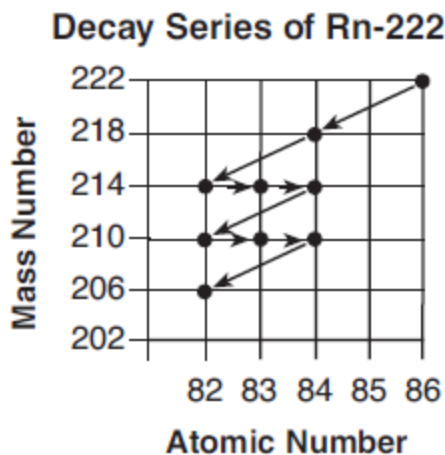


The decay mode for the first and third steps is shown above the arrows. The decay mode for the second step is not shown in the diagram. Thorium-234 has a half-life of 24.10 days.

58. Determine the total time that must elapse until only $\frac{1}{16}$ of an original sample of Th-234 remains unchanged.
59. Identify the decay mode particle emitted from the Th-234.
60. Explain, in terms of neutrons and protons, why U-238 and U-234 are different isotopes of uranium.

Base your answers to questions 61 through 64 on the information below and on your knowledge of chemistry.

The isotope Rn-222 is produced by the decay of uranium in Earth's crust. Some of this isotope leaks into basements of homes in areas where the ground is more porous. An atom of Rn-222 decays to an atom of Pb-206 through a series of steps as shown on the graph below.

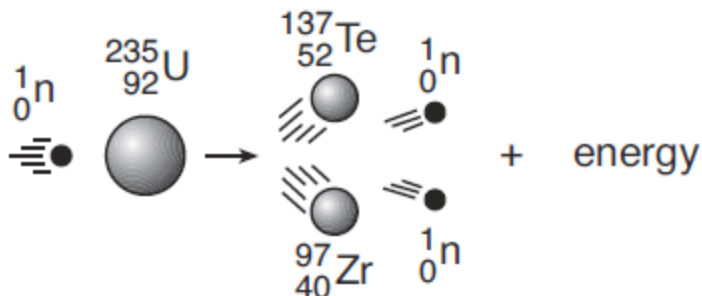


61. Explain, in terms of elements, why the decay of Bi-210 is considered a transmutation.
62. Determine the fraction of an original sample of Rn-222 that remains unchanged after 7.646 days.
63. Complete the nuclear equation *in your answer booklet* for the decay of Po-218 by writing a notation for the missing product.
64. Determine the number of neutrons in an atom of Pb-214.
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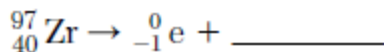
Organic/Nuclear Chemistry After School Regents Review Practice

Base your answers to questions 65 and 66 on the information below and on your knowledge of chemistry.

Nuclear fission reactions can produce different radioisotopes. One of these radioisotopes is Te-137, which has a half-life of 2.5 seconds. The diagram below represents one of the many nuclear fission reactions.



65. Complete the nuclear equation below for the beta decay of Zr-97, by writing an isotopic notation for the missing product.



66. State evidence that this nuclear reaction represents transmutation.
-

Base your answers to questions 67 through 69 on the information below and on your knowledge of chemistry.

In 1896, Antoine H. Becquerel discovered that a uranium compound could expose a photographic plate wrapped in heavy paper in the absence of light. It was shown that the uranium compound was spontaneously releasing particles and high-energy radiation. Further tests showed the emissions from the uranium that exposed the photographic plate were *not* deflected by charged plates.

67. Determine the number of neutrons in an atom of U-233.
68. Complete the nuclear equation below for the alpha decay of U-238.



69. Identify the highly penetrating radioactive emission that exposed the photographic plates.
-