

4. COMPOSITION OF ATOM SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

Mutliple Choice Question Type :

1. The charge of an electron is $-1.6 \times 10^{-19}\text{C}$. The value of free charge on Li^+ will be

- A) $3.6 \times 10^{-19}\text{C}$ B) $1 \times 10^{-19}\text{C}$ C) $1.6 \times 10^{-19}\text{C}$ D) $2.6 \times 10^{-19}\text{C}$

Answer:C

Solution:A Li^+ ion has +1 elementary charge, same magnitude as an electron but positive

2. The charge of an electron is $4.8 \times 10^{-10}\text{esu}$. What is the value of charge in Cl^- ion?

- A) $4.8 \times 10^{-10}\text{esu}$ B) $9.6 \times 10^{-10}\text{esu}$ C) $1.44 \times 10^{-10}\text{esu}$ D) $2.4 \times 10^{-10}\text{esu}$

Answer:A

Solution:A Cl^- ion has -1 charge, i.e., same as electron.

3. The increasing order (lowest first) for the values of e/m (charge/mass) for

- A) e, p, n, α B) n, p, e, α C) n, p, α, e D) n, α, p, e

Answer:D

Solution:

Neutron (n): 0 (no charge).

Proton (p): $e/m = 9.58 \times 10^7 \text{C/kg}$.

Alpha (α): $e/m \sim 4.79 \times 10^7 \text{C/kg}$ (charge $+2e$, mass $\sim 4u$).

Electron (e): $e/m = 1.76 \times 10^{11} \text{C/kg}$ (highest).

4. The specific charge of an α -particle is :

- A) $38.4 \times 10^7 \text{Ckg}^{-1}$ B) $19.2 \times 10^7 \text{Ckg}^{-1}$ C) $2.4 \times 10^7 \text{Ckg}^{-1}$ D) $4.8 \times 10^7 \text{Ckg}^{-1}$

Answer:D

Solution: α -particle: Charge = $+2e$, mass $\sim 4u$.

$e/m = (2 \times 1.6 \times 10^{-19} \text{C}) / (4 \times 1.67 \times 10^{-27} \text{kg}) \sim 4.8 \times 10^7 \text{C/kg}$.

5. The constancy of e/m ratio for electron shows that

- A) Electrons mass is $1/1837$ th of the mass of proton
B) Electrons are universal particles of all matter
C) Electrons are produced in discharge tube only
D) None of these

Answer:B

Solution: e/m is constant for electrons, proving they are fundamental to all atoms.

6. The nature of anode rays depends upon

- A) Nature of gas filled in the discharge tube B) Nature of electrode
C) Nature of metal D) None of these

Answer:A

Solution:Depends on the gas filled in the discharge tube (not cathode material)

7. The e/m value of proton is

- A) Less than e/m value of electron B) Equal to e/m value of electron

C) Greater than e/m value of electron D) All the above.

Answer:A

Solution: Proton mass $\gg$ electron mass $\rightarrow e/m$ (proton) $\ll e/m$ (electron)

8. The charge to mass ratio of α -particle is approximately two the charge to mass ratio of proton is

A) Half B) Twice C) 4 times D) 6 times

Answer:A

Solution: α -particle: $+2e$, 4 amu $\rightarrow e/m = 0.5 \times$ proton's e/m

9. The increasing order of specific charge of electron (e), proton (p), alpha particle (α) and neutron (n) is

A) e, p, n, α B) n, p, e, α C) n, α , p, e D) n, p, α , e

Answer:C

Solution: $n (0) < \alpha (4.8 \times 10^7) < p (9.6 \times 10^7) < e (1.76 \times 10^{11})$.

10. The e/m ratio of cathode rays is x unit, when hydrogen is filled in the discharge tube. What will be its value when deuterium (D_2) is filled in it?

A) x unit B) $x/2$ unit C) $2x$ unit D) $x/4$ unit

Answer:A

Solution: e/m depends on electron properties, not the gas (deuterium or hydrogen).

11. For cathode rays the value of e/m which of the following statements is incorrect

A) Is independent of the nature of the cathode and the gas filled in the discharge tube

B) Is constant

C) Is -1.7588×10^8 coulombs/g

D) Is lowest when hydrogen gas is filled in discharge tube.

Answer:D

Solution: e/m is always constant for electrons, regardless of the gas.

12. The charge to mass ratio of α particle is approximately '2', the charge to mass ratio of proton

A) Twice B) Half C) Four times D) Six times

Answer:B

Solution: α -particle $e/m = 2$

Proton $e/m = 4$

So, α is half of proton's

JEE ADVANCED LEVEL QUESTIONS

Mutli Correct answer Type :

13. Which of the following relations are correct ?

A) e/m order : neutron $< \alpha$ -particle $< electron$

B) mass : neutron $< \alpha$ -particle $< electron$

C) Magnitude of charge : neutron $< electron = proton < \alpha$ -particle

D) mass of Hydrogen - atom = mass of electron

Answer:A,C

Solution: A) e/m order: neutron $< \alpha$ -particle $< electron$

Correct:

Neutron (n): $e/m = 0$ (no charge).

α -particle: $e/m \sim 4.8 \times 10^7 \text{ C/kg}$.

Electron (e): $e/m \sim 1.76 \times 10^{11} \text{ C/kg}$ (highest).

C) Magnitude of charge: neutron < electron = proton < α -particle

Correct:

Neutron: 0 charge.

Electron/proton: $\pm 1.6 \times 10^{-19} \text{ C}$.

α -particle: $+3.2 \times 10^{-19} \text{ C}$ ($2 \times$ proton charge).

14. Which of the following statement(s) is/are correct

A) e/m value of anode rays is depends on the nature of gas in discharge tube & is maximum when hydrogen gas is taken in discharge tube.

B) Neutrons are exist in all isotopes of every element

C) Neutron is discovered in the nuclear reaction of ${}_{52}^{141}\text{Te} \rightarrow {}_{52}^{140}\text{Te} + {}_0^1\text{n}$

D) Neutrons deflects in external magnetic field.

Answer: A, C

Solution: A) Anode rays are positive ions. Lighter ions like H^+ have highest e/m .

B) Protium (${}^1\text{H}$) has no neutron. So not all isotopes contain neutrons.

C) ${}_{52}^{141}\text{Te} \rightarrow {}_{52}^{140}\text{Te} + {}_0^1\text{n}$

Neutron was discovered by James Chadwick using this reaction.

D) Neutrons are neutral particles. So no deflection in electric or magnetic fields.

Comprehension Type :

Cathode rays consists of negatively charged material particles called electrons.

These electrons are fundamental sub atomic particles carrying negative charge and having mass $9.1 \times 10^{-31} \text{ kg}$. Discovered by J.J Thomson. Charge to mass (e/m) ratio of an electron is $1.76 \times 10^8 \text{ C/g}$. Charge to mass (e/m) ratio for an proton is $9.55 \times 10^4 \text{ C/g}$.

15. Particles in cathode rays have same charge to mass ratio as:

A) α -particles B) β -particles C) γ -rays D) Protons

Answer: B

Solution: β -particles are high-speed electrons, so they have the same e/m ratio as electrons (i.e., cathode ray particles)

16. The ratio of specific charge of a proton and that of an α -particle is:

A) 1 : 2 B) 1 : 1 C) 2 : 1 D) 1 : 4

Answer: C

Solution: Proton (p): $e/m = 9.55 \times 10^4 \text{ C/g}$.

α -particle: Charge = $+2e$, mass $\sim 4u \rightarrow e/m \sim 4.78 \times 10^4 \text{ C/g}$.

Ratio = $(9.55 \times 10^4) / (4.78 \times 10^4) \sim 2 : 1$.

17 Which of the following particles has maximum charge to mass ratio?

A) Electrons B) Protons C) α -particles D) Neutons

Answer: A

Solution: Electron (e): $e/m = 1.76 \times 10^8 \text{ C/g}$ (highest).

Matrix Matching Type :**18. Column-I Column-II**

- A) Electron is present in P) Helium nucleus
 B) Proton is present in Q) Hydrogen atom
 C) Neutron is present in R) Helium atom
 D) α -particle is present in S) Hydrogen nucleus

Answer:A-Q,R,B-P,Q,R,S,C-P,R,D-P

Solution:

- A) Electron is present in Q) Hydrogen atom,R) Helium atom
 B) Proton is present in P) Helium nucleus,Q) Hydrogen atom,R) Helium atom,S) Hydrogen nucleus
 C) Neutron is present in P) Helium nucleus,R) Helium atom
 D) α -particle is present in P) Helium nucleus

LEARNERS TASK**CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ'S)****Mutiple choice question type:**

1. Cathode rays were discovered by

- A) William Crookes B) G.J. Stoney C) Rutherford D) None of these

Answer:A

Solution:William Crookes discovered cathode rays using a discharge tube. He observed glowing rays traveling from cathode to anode.

2. Cathode rays are

- A) Protons B) Electrons C) Neutrons D) α -particles

Answer:B

Solution:Cathode rays are streams of fast-moving electrons emitted from the cathode in a discharge tube.

3. Anode rays were discovered by

- A) Goldstein B) G.J. Stoney C) Rutherford D) J.J. Thomson

Answer:A

Solution:Eugen Goldstein (1886) discovered anode rays (positively charged ions) in modified cathode-ray tubes.

4. Which of the following reactions led to the discovery of the neutron

- A) ${}_{61}^{141}\text{Np} + {}_{2}^{4}\text{He} \rightarrow {}_{62}^{143}\text{Sm} + {}_{0}^{1}\text{n}$
 B) ${}_{51}^{112}\text{Sb} + {}_{2}^{4}\text{He} \rightarrow {}_{52}^{114}\text{Te} + {}_{0}^{1}\text{n}$
 C) ${}_{41}^{94}\text{Be} + {}_{2}^{4}\text{He} \rightarrow {}_{42}^{96}\text{Si} + {}_{0}^{1}\text{n}$
 D) ${}_{42}^{84}\text{Be} + {}_{2}^{4}\text{He} \rightarrow {}_{44}^{88}\text{Ru} + {}_{0}^{1}\text{n}$

Answer:C

Solution:Neutrons are formed when Be-9 is bombarded with alpha particle



5. The discovery of neutron becomes very late because

- A) Neutrons are present in nucleus
 B) Neutrons are highly unstable particles
 C) Neutrons are chargeless
 D) Neutrons do not move

Answer:C

Solution: Neutrons have no charge, so they don't interact with electric/magnetic fields, making them harder to detect than protons or electrons.

6. Which of the following is correct for cathode rays in discharge tube

- A) Independent of the nature of the cathode
- B) Independent of the nature of the gas
- C) Deflection is observed in presence of electric and magnetic field
- D) All the above

Answer: D

Solution:

- A) Correct — Cathode rays (electrons) are the same regardless of cathode material.
- B) Correct — They are independent of the type of gas used.
- C) Correct — They do get deflected in electric and magnetic fields.

7. The specific charge for a cathode ray.

- A) Has the smallest value when the discharge tube is filled with H_2
- B) Is constant
- C) Varies with the atomic number of gas in the discharge tube
- D) Varies with the atomic number of an element forming the cathode ray

Answer: B

Solution: Cathode rays are electrons; their e/m ratio is always $1.76 \times 10^{11} \text{ C/kg}$, regardless of gas or cathode.

8. The specific charge for positive rays is much less than the specific charge for cathode rays. This is because:

- A) Positive rays are positively charged
- B) Charge on positive rays is less
- C) Positive rays comprise ionised atoms whose mass is much higher
- D) Experimental method for determination is wrong.

Answer: C

Solution: Positive rays (anode rays) consist of ions of gas atoms, which are much heavier than electrons.

9. Which is true to say about cathode rays?

- A) Their e/m ratio depends upon the nature of residual gas
- B) They are deflected by electrical and magnetic field
- C) Their e/m ratio is constant
- D) These are produced by ionization of molecules of the residual gas

Answer: B, C

Solution: Cathode rays are electrons (universal e/m).

Deflection proves they are charged particles.

JEE MAINS LEVEL QUESTIONS

Multiple choice question type :

1. Which is false to say about anode rays ?

- A) Their e/m ratio depends upon the nature of residual gas
- B) They are deflected by electrical and magnetic field
- C) Their e/m ratio is constant
- D) These are produced by ionization of molecules of the residual gas

Answer: C

Solution:

- A) Their e/m ratio depends upon the nature of residual gas — True (different gas

ions give different e/m).

B) They are deflected by electrical and magnetic field — True (positive ions deflect).

C) Their e/m ratio is constant — False (varies with ion mass/charge).

D) These are produced by ionization of molecules of the residual gas — True.

2. Nuclei tend to have more neutrons than protons at high mass numbers because

A) Neutrons are neutral particles

B) Neutrons have more mass than protons

C) More neutrons minimize the coulomb repulsion

D) Neutrons decrease the binding energy

Answer:C

Solution:In heavier nuclei, with a large number of protons, the electrostatic repulsion between the protons becomes significant. Adding more neutrons, which are neutral particles, helps to counteract this repulsive force by providing additional attractive nuclear forces, thus stabilizing the nucleus.

3. The specific charge for positive rays is much less than the specific charge for cathode rays. This is because

A) Positive rays are positively charged

B) Charge on positive rays is less

C) Positive rays comprise ionised atoms whose mass is much higher

D) Experimental method for determination is wrong

Answer:C

Solution:Positive rays comprise ionised atoms whose mass is much higher — Correct (ions vs. electrons).

4. Which of the following statements about the electron is incorrect?

A) It is a negatively charged particle.

B) The mass of electron is equal to the mass of neutron.

C) It is a basic constituent of all atoms.

D) It is a constituent of cathode rays.

Answer:B

Solution:A) It is a negatively charged particle. — True

B) The mass of electron is equal to the mass of neutron. — False (electron « neutron)

C) It is a basic constituent of all atoms. — True

D) It is a constituent of cathode rays. — True

5. Magnitude of deflection of cathode rays in discharge tube is more when

A) Magnitude of charge of the particle is more

B) Greater interaction with the electric or magnetic field

C) Less mass of the particle

D) All the above

Answer:D

Solution:All three increase deflection.

6. When the speed of the electron increases, the specific charge

A) Decreases B) Increases C) Remains same D) None

Answer:C

Solution: (e and m are constants in classical physics, so e/m doesn't change)

7. The nature of anode rays depends upon

- A) Nature of gas filled in the discharge tube B) Nature of electrode
C) Nature of metal D) None of these

Answer: A

Solution: Nature of gas filled in the discharge tube — Correct (different gases produce different positive ions)

8. The e/m value of proton is

- A) Less than e/m value of electron B) Equal to e/m value of electron
C) Greater than e/m value of electron D) All the above.

Answer: A

Solution: The e/m (charge-to-mass ratio) of a proton is much smaller than that of an electron because a proton is about 1836 times heavier than an electron but has the same charge magnitude.

9. The charge to mass ratio of α -particle is approximately two the charge to mass ratio of proton is

- A) Half B) Twice C) 4 times D) 6 times

Answer: A

Solution: An α -particle (He^{2+}) has twice the charge ($+2e$) and four times the mass ($4u$) of a proton ($+e, 1u$).

$$\frac{e}{m} \frac{21}{42} \quad \frac{e}{m} \frac{1}{1}$$

Thus, the charge-to-mass ratio of α -particle is half that of a proton.

10. The increasing order of specific charge of electron (e), proton (p), alpha particle (α) and neutron (n) is

- A) e, p, n, α B) n, p, e, α C) n, α , p, e D) n, p, α , e

Answer: C

Solution: Order: $n < \alpha < p < e$.

11. The e/m ratio of cathode rays is x unit, when hydrogen is filled in the discharge tube. What will be its value when deuterium (D_2) is filled in it?

- A) x unit B) x/2 unit C) 2x unit D) x/4 unit

Answer: A

Solution: Cathode rays consist of electrons, whose e/m ratio does not depend on the gas in the discharge tube.

Deuterium (D_2) is heavier than H_2 , but the cathode rays still consist of electrons. Hence, e/m remains x unit.

12. Which has highest specific charge?

- A) Na^+ (A = 23) B) Mg^{2+} (A = 24) C) Al^{3+} (A = 27) D) Si^{4+} (A = 28)

Answer: D

Solution:

$$\text{Specific Charge} = \frac{\text{Charge}}{\text{Mass}}$$

$$\text{Na}^+(23) = \frac{+1e}{23u}$$

$$\text{Mg}^{2+}(24) = \frac{+2ee}{24u}$$

$$\text{Al}^{3+}(27) = \frac{+3ee}{27u}$$

$$\text{Si}^{4+}(28) = \frac{+4ee}{28u}$$

13. When beryllium is bombarded with α -particles, extremely penetrating radiations are produced which can not be deflected by electrical or magnetic field. These are

A) Protons B) α -rays C) Neutrons D) X-rays

Answer:C

Solution: Neutrons are neutral, so they cannot be deflected by electric or magnetic fields.

14. The mass to charge ratio (m/e) for a univalent cation is 1.5×10^{-8} Kg/c. Find mass of the atom.

A) 2.4×10^{-19} g B) 2.4×10^{-27} g C) 2.4×10^{-24} g D) None of these

Answer:A

Solution:

$$\text{Given } \frac{m}{e} = 1.5 \times 10^{-8}$$

$$\text{Charge of univalent cation } = +e$$

$$\text{Mass } (m) = \left(\frac{m}{e} \right) \times (+e)$$

$$m = 1.5 \times 10^{-8} \times 1.6 \times 10^{-19}$$

JEE ADVANCED LEVEL QUESTIONS

Mutli Correct Answer Type :

15. For cathode rays the value of e/m

- A) Is independent of the nature of the cathode and the gas filled in the discharge tube
- B) Is constant
- C) Is -1.7588×10^8 coulombs/g
- D) Is lowest when hydrogen gas is filled in discharge tube.

Answer:A,B,C

Solution: Cathode rays consist of electrons, so their e/m ratio is a fundamental constant and does not depend on the cathode material or gas in the tube.

The accepted value of e/m for electrons is $-1.7588 \times 10^8 \text{ C/g}$ (negative sign indicates electron charge).

Option D is incorrect because e/m is the same regardless of the gas (including hydrogen).

16. Which of the following statement(s) is/are incorrect

A) The volume of a proton is $\approx 1.5 \times 10^{-38} \text{ cm}^3$

B) Neutron is a stable particle.

C) Neutron is a fundamental particle of all the atomic nucleus, except Deuterium.

D) Mass of proton and mass of hydrogen atom are equal.

Answer: C, D

Solution: A) The volume of a proton is $\approx 1.5 \times 10^{-38} \text{ cm}^3 \rightarrow$ Correct

Option B is correct: Neutrons are stable inside nuclei but decay when free (half-life ~ 14.7 minutes).

Option C is incorrect:

Neutrons are present in all nuclei except ordinary hydrogen (^1H , which has no neutrons).

Deuterium (^2H) does have a neutron, so the statement is wrong.

Option D is incorrect:

A hydrogen atom (^1H) consists of a proton + electron, so its mass is slightly less than a proton alone (due to binding energy).

Thus, the mass of a proton $\neq$ mass of a hydrogen atom.

Statement type :

A) Both Assertion & Reason are true and Reason is the correct explanation of Assertion.

B) Both Assertion & Reason are true and Reason is not the correct explanation of Assertion.

C) Assertion is true, Reason is false.

D) Assertion is false, Reason is true.

17. Assertion : Electrons are negatively charged .

Reason : The application of electric and magnetic field deflected the rays in the discharge tube towards the cathode.

Answer: C

Solution: Assertion: Electrons are negatively charged. $\rightarrow$ True

Reason: The application of electric and magnetic field deflected the rays in the discharge tube towards the cathode. $\rightarrow$ False, because cathode rays (electrons) actually deflect towards the anode (positive plate), not the cathode.

18. Assertion : Anode rays are deflected towards positive plate in an electrical field

Reason : Anode rays consist of Protons.

Answer: D

Solution: Assertion: Anode rays are deflected towards the positive plate in an electric field. $\rightarrow$ False, since anode rays are positive ions and deflect toward the negative plate.

Reason: Anode rays consist of protons. $\rightarrow$ True in that they are streams of positive

ions (not purely protons, but positive species).

Comprehension Type :

Comprehension - I

Electron, proton & neutron are said to be fundamental particles the charge of fundamental particles calculated by mullikan oil drop experiment.

19. An oil drop has -6.39×10^{-19} coulomb charge. The number of electrons in this oil drop is

A) 4 B) 3 C) 2 D) 1

Answer:A

Solution: The charge of one electron (e) = -1.6×10^{-19} C.

Given charge on oil drop = -6.39×10^{-19} C.

$$\text{Number of electrons} = \frac{\text{Total Charge}}{\text{Charge of electron}} = \frac{-6.39 \times 10^{-19}}{-1.6 \times 10^{-19}} \approx 4$$

20. The total number of fundamental particle in $^{17}_8\text{O}$

A) 8 B) 17 C) 16 D) 25

Answer:D

Solution: Atomic number (Z) = 8 $\rightarrow$ 8 protons.

Mass number (A) = 17 $\rightarrow$ Neutrons = $17 - 8 = 9$.

Electrons in a neutral atom = 8.

Total fundamental particles = Protons + Neutrons + Electrons = $8 + 9 + 8 = 25$.

21. The isotope doesnot consists of neutron

A) ^2_1H B) ^1_1H C) ^4_2He D) None of these.

Answer:B

Solution: B) ^1_1H (Protium):

1 proton, 0 neutrons, 1 electron.

Only hydrogen-1 lacks neutrons

Integer Type :

22. The total charge present on 1 mole of phosphide ions is ____ Faraday

Answer:1

Solution: Phosphide ion (P^{3-}) carries 3 extra electrons.

Charge per mole of P^{3-} = $3 \times$ Faraday's constant (F).

Since $1 \text{ F} = 96,485 \text{ C/mol}$ (charge of 1 mole of electrons),

Total charge = 3F

23. Number of neutrons in heavy water molecule is _____

Answer:10

Solution: Heavy water (D_2O) consists of:

2 Deuterium (D) atoms: Each has 1 neutron (total = 2 neutrons).

1 Oxygen (O) atom: $^{16}_8\text{O}$ has 8 neutrons.

Total neutrons = 2 (from D) + 8 (from O) = 10.

24. Mass of 1 mole of protons is approximately equal to ____ grams

Answer:1

Solution: Mass of one proton $\sim 1.0073\text{u} \sim 1.0073\text{g/mol}$

So 1 mole of protons $\sim 1\text{g}$

25. The no. of electrons in 8 gm of O^{2-} ion is $x \times 10^{24}$ then x is _____

Answer: 3

Solution: Moles of O^{2-} in 8 g = $\frac{8}{16} = 0.5\text{mol}$

Each O^{2-} ion has 10 electrons (8 + 2 extra).

Total electrons = $0.5\text{mol} \times 10 \times 6.022 \times 10^{23} = 3.011 \times 10^{24}$.

26. How many grams of nitrogen (N^{14}) contains same number of neutrons as 6 gm of C^{12}

Answer: 6

Solution: N^{14} : 14 grams $\rightarrow$ 7 neutrons

C^{12} : 12 grams $\rightarrow$ 6 neutrons

C^{12} : 6 grams $\rightarrow$ 3 neutrons

For N:

14 grams $\rightarrow$ 7 neutrons

X grams $\rightarrow$ 3 neutrons

cross multiply

$7X = 14(3)$

$X = 14(3)/7 = 6\text{grams}$

Matrix Matching Type :

27. Column-I

Column-II

A) Electron

P) Negative charge

B) proton

Q) positive charge

C) Neutron

R) 1.6×10^{-19} coulomb

D) positron

S) chargeless

Answer: A-P, B-Q, R, C-S, D-Q, R

Solution:

A) Electron

P) Negative charge

B) proton

Q) positive charge, R) 1.6×10^{-19} coulomb

C) Neutron

S) chargeless

D) positron

Q) positive charge, R) 1.6×10^{-19} coulomb

KEY

			TEACHING TASK						
1	2	3	4	5	6	7	8	9	10
C	A	D	D	B	A	A	A	C	A
11	12	13	14	15	16	17	18		
D	B	A,C	A,C	B	C	A	A-Q,R,B-P,Q,R,S,C-P,R,D-P		
			LEARNERS TASK						
			CUQ'S						
1	2	3	4	5	6	7	8	9	
A	B	A	C	C	D	B	C	B,C	
			JEE MAINS&ADVANCED LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
C	C	C	B	D	C	A	A	A	C
11	12	13	14	15	16	17	18	19	20
A	D	C	A	A,B,C	C,D	C	D	A	D
21	22	23	24	25	26	27			
B	1	10	1	3	6	A-P,B-Q,R,C-S,D-Q,R			