

The
June 2018
Chemistry
Regents Exam
PART 1
ANSWERS
IN BLUE

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The June 2018 Chemistry Regents Exam Answers Explained 1-50

1 Which statement describes the charge and location of an electron in an atom?

- (1) An electron has a positive charge and is located outside the nucleus. **Electrons are negative**
- (2) An electron has a positive charge and is located in the nucleus. **Electrons are negative**
- (3) **An electron has a negative charge and is located outside the nucleus. CORRECT**
- (4) An electron has a negative charge and is located in the nucleus. **In the nucleus are protons and neutrons**

2 Which statement explains why a xenon atom is electrically neutral?

- (1) The atom has fewer neutrons than electrons. **The neutron : electron ratio varies, these are not connected to each other**
- (2) The atom has more protons than electrons. **Neutral atoms have equal numbers of proton and electrons**
- (3) The atom has the same number of neutrons and electrons. **The neutron : electron ratio varies, these are not connected to each other**
- (4) **The atom has the same number of protons and electrons. CORRECT**

3 If two atoms are isotopes of the same element, the atoms must have

- (1) the same number of protons and the same number of neutrons **No, isotopes have different numbers of neutrons, that is the definition of an isotope. Chemically identical with different mass (diff # neutrons)**
- (2) **the same number of protons and a different number of neutrons CORRECT**
- (3) a different number of protons and the same number of neutrons **No, different numbers of protons makes them different types of atoms, not isotopes.**
- (4) a different number of protons and a different number of neutrons **No, different numbers of protons makes them different types of atoms, not isotopes.**

4 Which electrons in a calcium atom in the ground state have the greatest effect on the chemical properties of calcium?

- (1) the two electrons in the first shell **No, shielded electrons do not affect bonding**
- (2) **the two electrons in the fourth shell CORRECT, only the valence electrons get involved in bonding**
- (3) the eight electrons in the second shell **No, shielded electrons do not affect bonding**
- (4) the eight electrons in the third shell **No, shielded electrons do not affect bonding**

5 The weighted average of the atomic masses of the naturally occurring isotopes of an element is the

- (1) **atomic mass of the element CORRECT**
- (2) atomic number of the element **No, atomic number is the number of protons only**
- (3) mass number of each isotope **No, all isotopes have different mass (diff # neutrons)**
- (4) formula mass of each isotope **No, this is like molar mass**

6 Which element is classified as a metalloid?

- (1) Cr metal
- (2) Cs metal
- (3) Sc metal
- (4) **Si CORRECT**

7 Which statement describes a chemical property of iron?

- (1) Iron oxidizes. CORRECT (2) Iron is a solid at STP. (physical property)
(3) Iron melts. (physical) (4) Iron is attracted to a magnet. (physical)

8 Graphite and diamond are two forms of the same element in the solid phase that differ in their

- (1) atomic numbers no, both 6 for carbon
(2) crystal structures CORRECT Chemically identical, different structures
(3) electronegativities both on table S
(4) empirical formulas (these are stupid, but the empirical formula would just be "C" for carbon)

9 Which ion has the largest radius? (LOOK UP ON TABLE S)

- (1) Br (117 pm) (2) Cl (100. pm) (3) F (60. pm) (4) I (136 pm)

10 Carbon monoxide and carbon dioxide have (these are different compounds, with different formulas)

- (1) the same chemical properties and the same physical properties
(2) the same chemical properties and different physical properties
(3) different chemical properties and the same physical properties
(4) different chemical properties and different physical properties

11 Based on Table S, which group on the Periodic Table has the element with the highest electronegativity? (LOOK IT UP, it's Fluorine, a 4.0 EN value in group 17)

- (1) Group 1 (2) Group 2 (3) Group 17 (4) Group 18

12 What is represented by the chemical formula $\text{PbCl}_{2(s)}$? (It has a formula, it's a pure substance, it's a compound, it's an ionic compound, it makes formula units, it might be soluble in water, check table F (it's not))

- (1) a substance
(2) a solution (not soluble)
(3) a homogeneous mixture (mixtures do not have formulas, they are "rough")
(4) a heterogeneous mixture (mixtures do not have formulas)

13 What is the vapor pressure of propanone at 50.°C? (LOOK IT UP)

- (1) 37 kPa (2) 50. kPa (3) 83 kPa (4) 101 kPa

14 Which statement describes the charge distribution and the polarity of a CH_4 molecule?

- (1) The charge distribution is symmetrical and the molecule is nonpolar.
This molecule has radial symmetry, the bonds are polar, but balance each other out.
(2) The charge distribution is asymmetrical and the molecule is nonpolar.
(3) The charge distribution is symmetrical and the molecule is polar.
(4) The charge distribution is asymmetrical and the molecule is polar.

15 In a laboratory investigation, a student separates colored compounds obtained from a mixture of crushed spinach leaves and water by using paper chromatography. The colored compounds separate because of differences in

- (1) molecular polarity They dissolve into water and are “carried” through the paper, like the color markers you used in October
- (2) malleability This pertains to being pounded flat, like metals
- (3) boiling point No boiling in paper chromatography
- (4) electrical conductivity No electricity either

16 Which phrase describes the motion and attractive forces of ideal gas particles?

- (1) random straight-line motion and no attractive forces
- (2) random straight-line motion and strong attractive forces IDEAL gases have no attraction, they’re perfect
- (3) random curved-line motion and no attractive forces No gases can “curve”
- (4) random curved-line motion and strong attractive forces See #2 and #3 here

17 At which temperature will $\text{Hg}_{(l)}$ and $\text{Hg}_{(s)}$ reach equilibrium in a closed system at 1.0 atmosphere?

Liquid to Solid is melting point (or freezing point), look it up on table S)

- (1) 234 K
- (2) 273 K This is FP for water
- (3) 373 K This is BP for water
- (4) 630. K this is the boiling point for mercury, but we need liquid to solid

18 A molecule of any organic compound has at least one

- (1) ionic bond
- (2) double bond
- (3) oxygen atom
- (4) carbon atom (the definition of organic chem starts with the word carbon)

19 A chemical reaction occurs when reactant particles

- (1) are separated by great distances - no reactions without collisions
- (2) have no attractive forces between them - if they repelled, they couldn’t collide, they couldn’t react
- (3) collide with proper energy and proper orientation
- (4) convert chemical energy into nuclear energy - nuclear energy means NOT CHEMISTRY

20 Systems in nature tend to undergo changes toward

- (1) lower energy and lower entropy - this means one big solid of mass, things will break down
- (2) lower energy and higher entropy CORRECT
- (3) higher energy and lower entropy - this means things will get hot, but energy dissipates (gets colder)
- (4) higher energy and higher entropy - this is wrong both ways

21 Which formula can represent an alkyne?

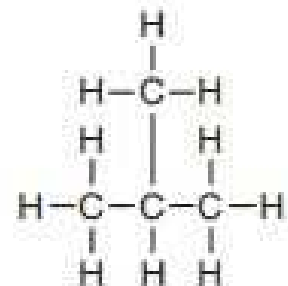
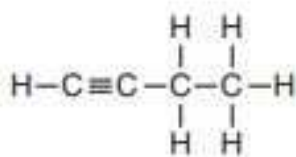
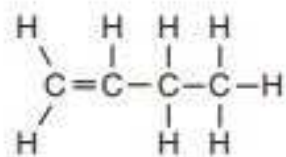
(has one TRIPLE BOND, follows the $\text{C}_n\text{H}_{2n-2}$ general formula)

- (1) C_2H_4 (this is ethene)
- (2) C_2H_6 (this is ethane)
- (3) C_3H_4 (this is propyne)
- (4) C_3H_6 (this is propane)

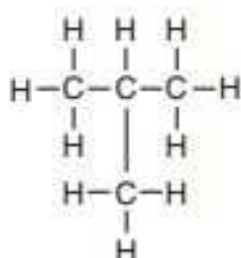
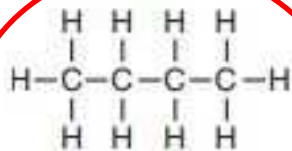
22 Given the formula representing a compound:

Formula is C_4H_{10}

Which formula represents an isomer of this compound?



#1 has a formula of C_4H_8 , 1-butene
#3 has a formula of C_4H_6 , 1-butyne
#4 has a formula of C_4H_{10} , it's just upside down from the original molecule, not an isomer.



23 Which energy conversion occurs in an operating voltaic cell?

- (1) chemical energy to electrical energy CORRECT (this is a battery)
- (2) chemical energy to nuclear energy No, voltaic cells make electricity, not nuclear power
- (3) electrical energy to chemical energy No, this is an electrolytic cell, electroplating
- (4) electrical energy to nuclear energy No, no nuclear energy here, it's a battery

24 Which process requires energy to decompose a substance?

- (1) electrolysis (we used electricity to break down water in the Hoffmann Apparatus)
- (2) neutralization (acid-base, no energy required)
- (3) sublimation (no breakdown, just a phase change)
- (4) synthesis (this is the opposite of decomposition)

25 The concentration of which ion is increased when LiOH is dissolved in water?

- (1) hydroxide ion The more OH^{-1} ions, the stronger the base
- (2) hydrogen ion more of these means more acidic
- (3) hydronium ion these are stupid, except on the Regents, but more of these means more acidic
- (4) halide ion This is like chloride, or bromide, has nothing to do with LiOH, no halides in it

26 Which equation represents neutralization? (LOOK for acid plus base makes salt and water)

- (1) $6Li_{(s)} + N_{2(g)} \rightarrow 2Li_3N_{(s)}$ (this is synthesis)
- (2) $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$ (this is synthesis also)
- (3) $2KOH_{(aq)} + H_2SO_{4(aq)} \rightarrow K_2SO_{4(aq)} + 2H_2O_{(l)}$ (TRICKY, it's base plus acid, but still correct)
- (4) $Pb(NO_3)_{2(aq)} + K_2CrO_{4(aq)} \rightarrow 2KNO_{3(aq)} + PbCrO_{4(s)}$ (this is double replacement)

27 The stability of an isotope is related to its ratio of

(BY DEFINITION, nuclei must have a stable Neutron:Proton ratio, to be in the band of stability)

- (1) neutrons to positrons (2) neutrons to protons (3) electrons to positrons (4) electrons to protons

28 Which particle has the least mass? (LOOK IT UP ON TABLE O)

- (1) alpha particle (mass of 4 amu) (2) beta particle (mass of 0)
(3) neutron (mass of 1 amu) (4) proton (mass of 1 amu)

29 The energy released during a nuclear reaction is a result of

- (1) breaking chemical bonds - chemical bonds make for kilojoules, not nuclear explosions
(2) forming chemical bonds - chemical bonds make for kilojoules, not nuclear explosions
(3) mass being converted to energy - Remember Einstein's equation: $e = mc^2$ mass becomes energy
(4) energy being converted to mass - this is the reverse of true

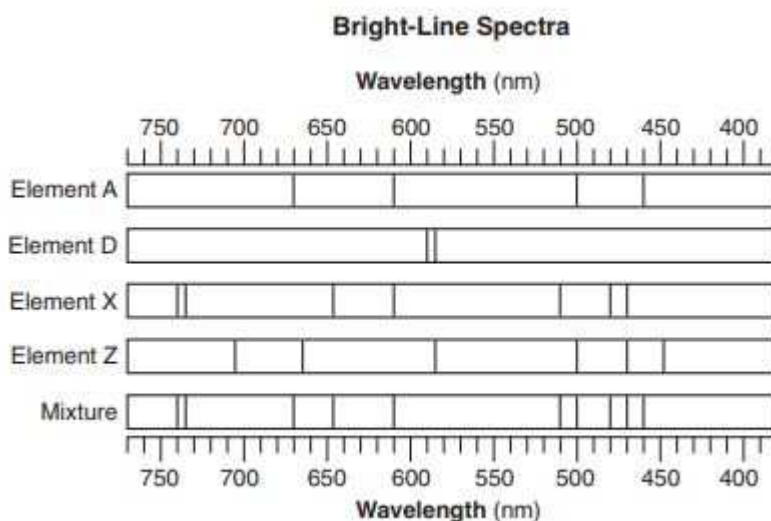
30 The use of uranium-238 to determine the age of a geological formation is a beneficial use of

- (1) nuclear fusion (this is a reaction (boom), not helpful for dating)
(2) nuclear fission (this is a different reaction (boom), also not helpful for dating)
(3) radioactive isomers these have different numbers of neutrons (so what)
(4) radioactive isotopes (specific isotopes have specific half lives, which can be measured for dating purposes)

Base your answers to questions 31 and 32 on your knowledge of chemistry and the bright-line spectra produced by 4 elements and the spectrum of a mixture of elements represented in the diagram below.

31 Which elements are present in this mixture? (LOOK AT THE LINES)

- (1) D and A (2) D and Z
(3) X and A (4) X and Z
D is NOT in the mixture
Z is not in the mixture



32 Each line in the spectra represents the energy

- (1) absorbed as an atom loses an electron
(2) absorbed as an atom gains an electron
(3) released as an electron moves from a lower energy state to a higher energy state
(4) released as an electron moves from a higher energy state to a lower energy state

Atoms and their electrons get excited by absorbing energy, SPECTRA is that energy this is released

33 The table below shows the number of protons, neutrons, and electrons in four ions.

Four Ions	Number of protons	Number of neutrons	Number of electrons
A	8	10	10
E	9	10	10
G	11	12	10
J	12	12	10

Which ion has a charge of 2- ? (count the protons and electrons, get 2 more electrons than protons)

- (1) A (2) E (3) G (4) J

34 What is the approximate mass of an atom that contains 26 protons, 26 electrons and 19 neutrons?

In HS, protons and neutrons = 1 AMU each, electrons have no mass. COUNT. $26 p^+$ plus $19 n^0 =$

- (1) 26 u (2) 45 u (3) 52 u (4) 71 u

The “u” is on table D, at the bottom, it stands for atomic mass units or AMU

35 Which electron configuration represents a potassium atom in an excited state? (K has 19 electrons)

- (1) 2-7-6 = 15 X wrong (2) 2-8-5 = 15 X wrong
 (3) 2-8-8-1 = 19 GROUND STATE (4) 2-8-7-2 = 19 but NOT ground state, these are excited

36 What is the total number of neutrons in an atom of K-42?

Here, total mass is 42 AMU, and K has 19 protons, so $42 - 19 =$ the answer

- (1) 19 (that’s 19 p+ or 19 electrons too) (2) 20 (wild guess) (3) 23 (4) 42 (total mass in amu)

37 Given the equation representing a reaction: $2C + 3H_2 \rightarrow C_2H_6$

What is the number of moles of C that must completely react to produce 2.0 moles of C_2H_6 ?

$$\text{MR} \quad \frac{C}{C_2H_6} \quad \frac{2}{1} = \frac{X}{2.0} \quad X = 4.0$$

- (1) 1.0 mol (2) 2.0 mol (3) 3.0 mol (4) 4.0 mol

38 Given the equation representing a reaction: $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$

Which type of chemical reaction is represented by the equation?

Here the Mg replaces the H+1 ions in solution, bumping them out as hydrogen gas.

- (1) synthesis (2) decomposition (3) single replacement (4) double replacement

39 The table below lists properties of selected elements at room temperature.

Properties of Selected Elements at Room Temperature			
Element	Density g/cm ³	Malleability	Conductivity
Sodium	0.97	yes	good
Gold	19.3	yes	good
iodine	4.933	no	poor
tungsten	19.3	yes	good

Based on this table,

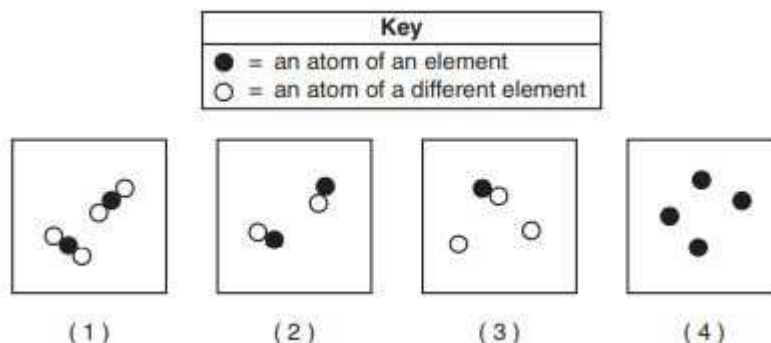
Which statement describes how two of these elements can be differentiated from each other?

Find properties that are DIFFERENT.

- (1) Gold can be differentiated from tungsten based on density. **Not true, both have same density**
 (2) Gold can be differentiated from sodium based on malleability. **No, both are malleable**
 (3) Sodium can be differentiated from tungsten based on conductivity. **No, both conduct**
 (4) Sodium can be differentiated from iodine based on malleability. **Yes, iodine is brittle, sodium is malleable.**

40 Which particle diagram represents a mixture?

- (1) is a compound, like CO_{2(g)} X
 (2) is a compound, like HCl_(g) X
 (3) has 2 substances, ex: He_(g) +& CO_(g) YES
 (4) is atomic, like Ne_(g) or Ar_(g)



41 An atom of which element reacts with an atom of hydrogen to form a bond with the greatest degree of polarity? This is ELECTRONEGATIVITY DIFFERENCE, the greater the difference, the greater the polarity. LOOK UP ON TABLE S: Hydrogen has EN Value of 2.2

- (1) carbon (2.6 no) (2) fluorine (4.0 yes) (3) nitrogen (3.0 no) (4) oxygen (3.4 no)

42 What is the concentration of an aqueous solution that contains 1.5 moles of NaCl in 500. milliliters of this solution?

Use the MOLARITY FORMULA, back page of reference table.

$$M = \frac{\text{Number of Moles}}{\text{Liters of Solution}} = \frac{1.5 \text{ Moles}}{.500 \text{ Liters}} = 3.0 \text{ M}$$

- (1) 0.30 M (2) 0.75 M (3) 3.0 M (4) 7.5 M

43. Data for Four Gases			
GAS SAMPLE	Temperature (K)	Pressure (atm)	Volume (L)
I	600.	2.0	5.0
II	300.	1.0	10.0
III	600.	3.0	5.0
IV	300.	1.0	10.0

43. Which two gas samples contain the same number of molecules?

(this is Avogadro's Hypothesis question, Equal volumes of different gases, at the same temp and pressure have the same number of moles, and the same number of particles. No math.)

It has to be either I & III or II & IV. One and three have different pressure conditions, so it's 2 and 4.

- (1) I and II (2) I and III (3) II and III (4) II and IV

44 Based on Table I, (get out table I now, LOOK - the hint is from the title: 101.3 kPa and 298 K)

What is the ΔH value for the production of 1.00 mole of $\text{NO}_{2(g)}$ from its elements at 101.3 kPa and 298 K?

On table I, NO_2 gas forms 2 moles at once, so be careful with the math. The ΔH is +66.4 kJ, but here it's just one mole, so HALF of that

- (1) +33.2 kJ (2) -33.2 kJ (3) +132.8 kJ (4) -132.8 kJ

45 Which equation represents an addition reaction? (this is organic, where you ADD either H_2 or a halogen INTO an unsaturated hydrocarbon like an alkene or alkyne, there's ONE product for these reactions).

- (1) $\text{C}_3\text{H}_8 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_7\text{Cl} + \text{HCl}$ (this is SUBSTITUTION of one halogen into a SATURATED alkane)
 (2) $\text{C}_3\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_6\text{Cl}_2$ (this is it, yes)
 (3) $\text{CaCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{CaCO}_3 + 2\text{NaCl}$ (this is double replacement and not organic either)
 (4) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ (this is synthesis AKA combination, but not organic either)

46 Given the balanced equation representing a reaction: $\text{Ni}_{(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{NiCl}_{2(aq)} + \text{H}_{2(g)}$

In this reaction, each Ni atom

Here the Ni atom becomes the Ni^{+2} ion by losing 2 electrons

- (1) loses 1 electron (2) loses 2 electrons (3) gains 1 electron (4) gains 2 electrons

47 Which equation represents a reduction half reaction?

(Think LEO goes GER! The GAIN of ELECTRONS is Reduction)

- (1) $\text{Fe} \rightarrow \text{Fe}^{3+} + 3\text{e}^-$ (NO: here iron loses 3 electrons to become the Fe^{+3} ion)
 (2) $\text{Fe} + 3\text{e}^- \rightarrow \text{Fe}^{3+}$ (NO: it seems like iron is gaining 3 electrons, but that would mean becoming Fe^{-3} !)
 (3) $\text{Fe}^{3+} \rightarrow \text{Fe} + 3\text{e}^-$ (NO: the Fe^{+3} cation can't become a neutral atom by lose ANOTHER 3 electrons)
 (4) $\text{Fe}^{3+} + 3\text{e}^- \rightarrow \text{Fe}$ (YES: the Fe^{+3} ion gains 3 electrons to become a neutral iron atom again)

48 Given the balanced ionic equation representing a reaction: $\text{Cu}_{(s)} + 2\text{Ag}^+_{(aq)} \rightarrow \text{Cu}^{2+}_{(aq)} + 2\text{Ag}_{(s)}$

During this reaction, electrons are transferred from the copper atoms to the silver cations.

The copper ends up as Cu^{+2} and the silver cations end up as neutral atoms again.

(1) $\text{Cu}_{(s)}$ to $\text{Ag}^+_{(aq)}$

(2) $\text{Cu}^{2+}_{(aq)}$ to $\text{Ag}_{(s)}$

(3) $\text{Ag}_{(s)}$ to $\text{Cu}^{2+}_{(aq)}$

(4) $\text{Ag}^+_{(aq)}$ to $\text{Cu}_{(s)}$

49 Which metal reacts spontaneously with Sr^{2+} ions?

Look at table J, which of these four is HIGHER on table J, and therefore reactive enough to bump the Sr^{+2} cations out of solution? LOOK)

(1) $\text{Ca}_{(s)}$ (LOWER)

(2) $\text{Co}_{(s)}$ (LOWER)

(3) $\text{Cs}_{(s)}$ (HIGHER)

(4) $\text{Cu}_{(s)}$ (LOWER)

50 Given the balanced equation representing a reaction: $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$

The water molecule acts as a base because it

This is that STUPID alternate theory that explains why ammonia is a base (NH_3 accepts the H^+ , so it's a base. To make that happen, water donates the H^+ , which makes water the acid. How dumb! This is the total reverse, the hardest alternate theory acid base question of them all) A base accepts that H^+

(1) donates an H^+

(3) donates an OH^-

(2) accepts an H^+

(4) accepts an OH^-
