

Chemistry HP
Final Review

(1) Convert between standard form and scientific notation.

(a) $8\,900\,000 =$ _____
(b) $0.00056 =$ _____

(c) $4.5 \times 10^{-8} =$ _____
(d) $2.7 \times 10^4 =$ _____

(2) Convert between the units indicated.

(a) $35\text{ cm} =$ _____ m

(c) $0.068\text{ ms} =$ _____ μs

(b) $280\text{ mL} =$ _____ L

(d) $1400\text{ mg} =$ _____ kg

(3) Complete the following temperature conversions.

(a) _____ $^{\circ}\text{C} = 300\text{ F} =$ _____ K

(b) $-20\text{ }^{\circ}\text{C} =$ _____ F = _____ K

(4) Complete the following conversions.

(a) $8.25\text{ km} =$ _____ miles

(b) $6.5 \times 10^4\text{ cm}^2 =$ _____ in^2
= _____ m^2

(c) $12.5\text{ m/s} =$ _____ miles/hour

(5) Perform the following calculations. Give the answer with the correct number of significant figures.

(a) $9.409 + 2.0$
(b) 66.0×1.000

(c) $10.0 \div 5.0$
(d) $3.05 - 1.540$

(6) A gold block measures 1.50 cm by 1.00 cm by 0.900 cm.

- (a) What is the volume of the block?
(b) What is the density of gold?
(c) What is the mass of the block?

(7) A graduated cylinder contains 50 mL of water. When a small stone is placed in the graduated cylinder the water level rises to 70 mL. If the stone weighs 40 g, what is the density?

(8) Determine the number of protons, electrons, and neutrons in the following elements.

(a) Cr (b) Br^- (c) Sr^{2+}

(9) Draw a Bohr Diagram for the following elements. Include the number of protons, electrons, and neutrons.

(a) N (b) Ca

(10) Chromium has four isotopes: Chromium-50 (4.35%), Chromium-52 (83.79%), Chromium-53 (9.50%), and Chromium-54 (2.37%)

- (a) Determine the number of neutrons of each isotope.
(b) Determine the average atomic mass of Chromium.

(11) A radio wave has a wavelength of 5.01 m. Determine the frequency of the radio wave. What is the energy of the radio wave?

(12) UV radiation has a frequency of 5.0×10^{15} Hz. What is the wavelength of the UV radiation? What is the energy of the UV radiation?

(13) Write orbital notation for the following elements/ions.

(a) Si

(b) V

(c) S^{2-}

(14) Write electron configuration notation for the following elements/ions.

(a) Cl

(b) Ge

(c) Y^{3+}

(15) Write noble notation for the following elements/ions.

(a) Rb

(b) Sc

(c) I

(16) Determine the number of valance electrons in each of the following elements:

(a) S

(b) Ca

(c) Ar

(17) Complete the following table.

	(a) Na or P?	(b) Li or K?
Electron Configuration	Na: P:	Li: K:
Which element has a larger atomic radius? Explain.		
Which elements has a higher ionization energy? Explain.		
Which element has a higher electronegativity? Explain.		

(18) Which has a larger radius, the atom or the ion? Explain.

(a) P or P^{3-}

(b) Zr or Zr^{4+}

(19) For each molecule: 1. Draw the Lewis Structure 2. Draw the VSEPR diagram and classify the shape of the molecule

(a) F₂O

(e) PF₅

(b) PH₃

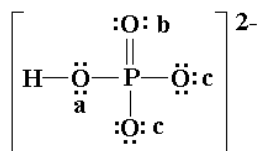
(f) CBr₄

(c) SF₆

(g) BF₃

(d) CS₂

(20) The Lewis structure for the polyatomic ion hydrogen phosphate, HPO₄²⁻, is shown below. Determine the total number of valence electrons for the ion. Calculate the formal charge on each atom.



(21) Classify the following substances as mixtures or pure substances. Classify whether each mixture is heterogeneous or homogeneous and whether each pure substance is a compound or element.

Substance	Classification
(a) a taco	
(b) salt	
(c) silver	
(d) chocolate milk	

(22) Name the following compounds

(a) LiCl _____

(b) MgCO₃ _____

(c) CuS _____

(d) NiCl₃ _____

(e) N₂O₅ _____

(f) H₂CO₂ _____

(g) FePO₄ _____

(h) CCl₄ _____

(i) HBr _____

(j) MnO₂ _____

(23) Write the chemical formula for the following compounds.

(a) sodium sulphide _____

(b) lithium carbonate _____

(c) chromium (III) oxide _____

(d) nitrogen dioxide _____

(e) iodic acid _____

(f) cobalt (II) chloride _____

(g) scandium borate _____

(h) sulphur hexafluoride _____

(i) hydroiodic acid _____

(j) lead (IV) sulphide _____

(24) Determine the molar mass of the following elements/compounds

(a) phosphorus

(b) chlorine

(c) calcium fluoride

(d) MgCO₃

(25) Complete the following mole conversions.

(a) $0.25 \text{ mol Al} = \underline{\hspace{2cm}} \text{ g Al}$

(b) $45 \text{ g NaCl} = \underline{\hspace{2cm}} \text{ mol NaCl}$

(c) $2.25 \times 10^{23} \text{ atoms Au} = \underline{\hspace{2cm}} \text{ mol Au}$

(d) $220 \text{ g magnesium chloride} = \underline{\hspace{2cm}} \text{ molecules magnesium chloride}$

(e) $5.0 \times 10^{24} \text{ molecules of potassium phosphate} = \underline{\hspace{2cm}} \text{ kg of potassium phosphate}$

(26) If there are 400 molecules of water, how many atoms are there of hydrogen and of oxygen?

(27) Calculate the percent composition of each element in the following compounds

(a) Na_2S

(b) silver nitrate

(28) Determine the empirical formula for the following compounds. Name each compound.

(a) 36.5% Na, 25.4 % S, 38.0% O

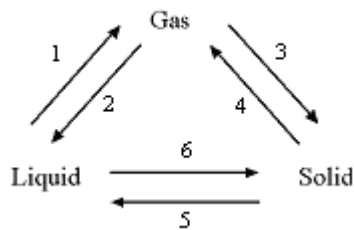
(b) 32.4% Na, 22.6 % S, 45.1% O

(29) A 10.0 g sample of powder was found to contain 1.36 g lithium, 2.36 g carbon, and the remainder was oxygen. The molecular weight of the compound is 101.898 g/mol. Determine the empirical and molecular formula. Name the molecular compound.

(30) (a) Compare the phases of matter.

State	Molecular Motion	Molecular Spacing	Spread to fill a container?	Compressible?
solid				
liquid				
gas				

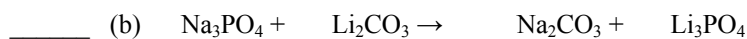
(b) Complete the following diagram by labelling the phase changes.



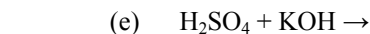
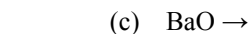
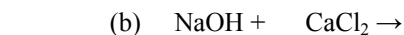
(31) Classify each of the following changes as chemical or physical. Explain.

Change	Classification	Explanation
(a) baking cookies		
(b) flattening a box		
(c) a popsicle is frozen		
(d) a banana turns brown over time		

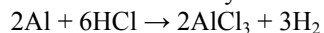
(32) Classify the reactions as Synthesis (S), Decomposition (D), Single Replacement (SR), Double Replacement (DR), Combustion (C), or Neutralization (N). Balance the chemical equations.



(33) Classify the reaction as Synthesis (S), Decomposition (D), Single Replacement (SR), Double Replacement (DR), Combustion (C), or Neutralization (N). Predict the products and balance the chemical equation.



(34) Aluminum reacts with hydrochloric acid according to the following balanced chemical equation:



- If 0.250 mol of Al reacts, determine the moles of H₂ produced.
- If 5.0 mol of AlCl₃ are produced, determine the moles of HCl reacting.
- If 50 g of Al react, what mass of HCl is required? What is the mass of each of the products?

(35) Ammonia (NH₃), is prepared by combining hydrogen and nitrogen.

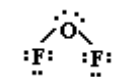
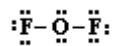
- Write a balanced chemical equation for the reaction.
- When 28 g of nitrogen are reacted, what mass of hydrogen is required?
- If the reaction yields 30 g of ammonia, what is the percent yield of the reaction?

(36) Titanium (IV) chloride reacts magnesium to form titanium and magnesium chloride according to the following balanced chemical equation: $\text{TiCl}_4 + 2\text{Mg} \rightarrow \text{Ti} + 2\text{MgCl}_2$

- If 120 g of titanium (IV) chloride are reacted with 60g of magnesium, which reactant is limiting and which is in excess.
- What is the mass of each of the products?
- What mass of the excess reactant is used in the reaction and what mass of the excess reactant remains after the reaction?
- If only 20 g of titanium is produced, what is the percent yield of the reaction? What mass of magnesium chloride will be produced?

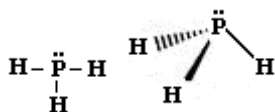
(19)

(a)



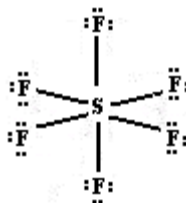
bent

(b)

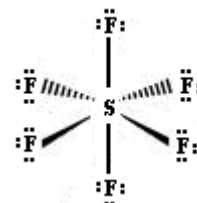


trigonal pyramidal

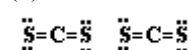
(c)



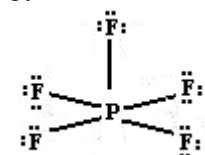
octahedral



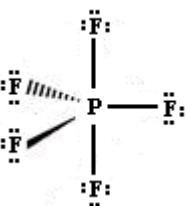
(d) linear



(e) bipyramidal

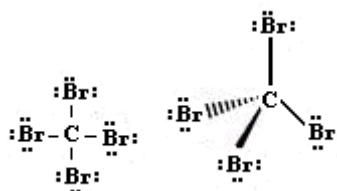


trigonal



(f)

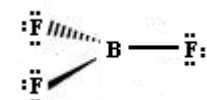
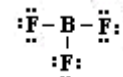
tetrahedral



(g)

trigonal

planar



(20) 32 electrons, FC P = 0, FC H = 0, FC Oa = 0, FC Ob = 0, FC Oc = -1

(21)

Substance	Classification
(a) a taco	mixture heterogeneous
(b) salt	pure substance compound
(c) silver	pure substance element
(d) chocolate milk	mixture homogeneous

(22) (a) lithium chloride (b) magnesium carbonate (c) copper (II) sulphide (d) nickel (III) chloride
 (e) dinitrogen pentoxide (f) carbonous acid (g) iron (III) phosphate (h) carbon tetrachloride
 (i) hydrobromic acid (j) manganese (IV) oxide

(23) (a) Na₂S (b) Li₂CO₃ (c) Cr₂O₃ (d) NO₂ (e) HIO₃ (f) CoCl₂
 (g) ScBO₃ (h) SF₆ (i) HI (j) PbS₂

(24) (a) 30.97 g/mol (b) 70.90 g/mol (c) 78.08 g/mol (d) 84.32 g/mol

(25) (a) 6.7 g (b) 0.77 mol (c) 0.374 mol (d) 1.39x10²⁴ molecules (e) 1.8 kg

(26) 800 atoms of hydrogen and 400 atoms of oxygen

(27) (a) 58.9 % Na 41.1% S (b) 63.5% Ag 8.2% N 28.3% O

(28) (a) Na₂SO₃, sodium sulphite (b) Na₂SO₄, sodium sulphate

(29) Li₂C₂O₄, lithium oxalate

(30) (a)

State	Molecular Motion	Molecular Spacing	Spread to fill a container?	Compressible?
solid	slow	little space	no	no
liquid	medium	medium	yes	no
gas	fast	far apart	yes	yes

(b) 1. boiling/evaporation 2. condensation 3. sublimation
 4. deposition 5. melting 6. freezing/solidification

(31)

Change	Classification	Explanation
(a) baking cookies	chemical	- new substances formed with new properties - colour change - non-reversible
(b) flattening a box	physical	- no new substances formed - change of shape - reversible
(c) a popsicle is frozen	physical	- no new substances formed - phase change (freezing) - reversible
(d) a banana turns brown over time	chemical	- new substances formed with new properties - colour change - non-reversible

(32) SR (a) CaCl₂ + 2Na → 2NaCl + Ca

DR (b) 2Na₃PO₄ + 3Li₂CO₃ → 3Na₂CO₃ + 2Li₃PO₄

SR (c) 2MgCl₂ + O₂ → 2MgO + 2Cl₂

N (d) Ba(OH)₂ + 2HBr → BaBr₂ + 2H₂O

S (e) 4Al + 3O₂ → 2Al₂O₃

(33) C (a) 2C₆H₆ + 15O₂ → 12CO₂ + 6H₂O

DR (b) 2NaOH + CaCl₂ → Ca(OH)₂ + 2NaCl

D (c) 2BaO → 2Ba + O₂

SR (d) 2SrBr₂ + O₂ → 2SrO + 2Br₂

N (e) H₂SO₄ + 2KOH → K₂SO₄ + 2H₂O

(34) (a) 0.375 mol H₂ produced (b) 15 mol HCl reacting (c) 2.0x10² g HCl, 2.5x10² g AlCl₃, 5.6 g H₂

(35) (a) 3H₂ + N₂ → 2NH₃ (b) 6.0 g H₂ (c) 88.1%

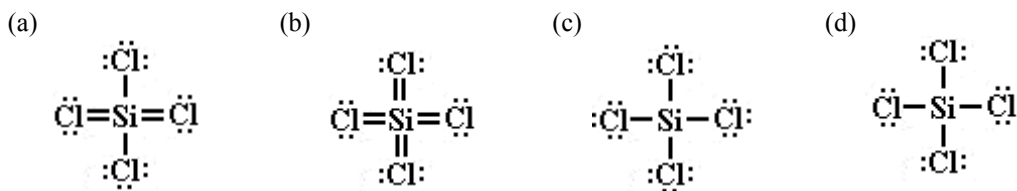
(36) (a) lim: TiCl₄ ex: Mg (b) 30 g Ti, 1.2x10² g MgCl₂

(c) used: 31 g, remaining: 29 g (d) 66.7%, 80 g MgCl₂

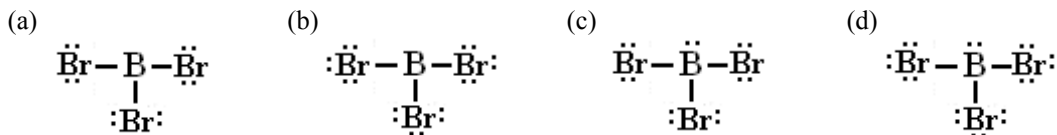
Chemistry Final Exam Practice Multiple Choice

- (1) Which of the following gives the number 4500000000 in scientific notation?
 (a) 4.5×10^9 (c) 45×10^{-9}
 (b) 45×10^9 (d) 4.5×10^{-9}
- (2) Which of the following gives the number 0.000043 in scientific notation?
 (a) 43×10^5 (c) 4.3×10^{-5}
 (b) 4.3×10^5 (d) 43×10^{-5}
- (3) How many meters are equivalent to 55 km?
 (a) 0.055 m (c) 550 m
 (b) 0.55 m (d) 55000 m
- (4) A ring weighs 180 g. When the ring is placed in a graduated cylinder containing 25 mL of water, the water level rises to 45 mL. Which of the following is the density of the ring?
 (a) 7.2 g/mL (c) 4.0 g/mL
 (b) 9.0 g/mL (d) 0.11 g/mL
- (5) How many neutrons does sodium-23 have?
 (a) 11 (c) 24
 (b) 12 (d) 34
- (6) How many electrons does a neutral silicon atom have?
 (a) 4 (c) 12
 (b) 6 (d) 14
- (7) How many electrons does a lithium ion (Li^+) ion have?
 (a) 1 (c) 3
 (b) 2 (d) 4
- (8) How many valence electrons does a nitrogen atom have?
 (a) 5 (c) 8
 (b) 7 (d) 10
- (9) Which of the following gives the orbital notation for the element manganese?
 (a) $\begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow \\ 1s & 2s & 2p & 3s & 3p & 4s & 3d \end{array}$
 (b) $\begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow & \uparrow\uparrow\uparrow\uparrow\uparrow \\ 1s & 2s & 2p & 3s & 3p & 4s & 3d \end{array}$
 (c) $\begin{array}{cccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow \\ 1s & 2s & 2p & 3s \end{array}$
 (d) $\begin{array}{ccccccc} \uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow\uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow & \uparrow\uparrow\uparrow \\ 1s & 2s & 2p & 3s & 3p & 3d & \end{array}$
- (10) Which of the following gives the electron configuration notation for the element arsenic?
 (a) $1s^2 2s^2 3s^2 4s^2 2p^6 3p^6 4p^6 3d^7$ (c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3$
 (b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6 5s^2 3p^5$ (d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$
- (11) Which of the following gives the noble gas notation for the element strontium?
 (a) $[\text{Kr}] 4s^2$ (b) $[\text{Kr}] 5s^2$ (c) $[\text{Ar}] 4s^2$ (d) $[\text{Ar}] 5s^2$
- (12) Which of the following gives the electron configuration notation for the sulphide ion (S^{2-})?
 (a) $1s^2 2s^2 2p^6 3s^2 3p^6$ (b) $1s^2 2s^2 2p^6 3s^2 3p^4$ (c) $1s^2 2s^2 2p^6 3s^2 3p^2$ (d) $1s^2 2s^2 2p^6 3s^2 3p^5$
- (13) Which of the following atoms has the largest atomic radius?
 (a) Li (b) Na (c) K (d) Rb
- (14) Which of the following atoms has the highest ionization energy?
 (a) Cl (b) S (c) P (d) Si

(15) Which of the following is the correct Lewis structure for the compound SiCl_4 ?



(16) Which of the following is the correct Lewis structure for BBr_3 ?



(17) What is the shape of the molecule OBr_2 ?

- (a) linear (b) bent (c) trigonal planar (d) trigonal pyramidal

(18) What is the shape of the molecule PCl_3 ?

- (a) trigonal pyramidal (b) trigonal planar (c) tetrahedral (d) trigonal bipyramidal

(19) Which of the following is the chemical formula for calcium oxide?

- (a) CaO (b) Ca_2O (c) Ca_2O_2 (d) Ca_2O_3

(20) Which of the following is the name of the compound K_2S ?

- (a) potassium sulphate (b) potassium sulphur (c) potassium sulphide (d) potassium (II) sulphide

(21) Which of the following is the chemical formula for copper (II) sulphate?

- (a) CuSO_4 (b) Cu_2SO_4 (c) Cu_2SO_3 (d) CuSO_3

(22) Which of the following is the chemical formula for aluminum nitrate?

- (a) AlNO_3 (b) AlNO_2 (c) $\text{Al}(\text{NO}_3)_3$ (d) $\text{Al}(\text{NO}_2)_3$

(23) Which of the following is the name of the compound N_2O ?

- (a) nitrogen oxide (b) dinitrogen oxide (c) nitrogen monoxide (d) dinitrogen monoxide

(24) Which of the following is the name of the compound HClO_3 ?

- (a) hydrochloric acid (b) chloric acid (c) chlorous acid (d) hydrogen chloride trioxide

(25) Which of the following is the molar mass of the compounds citric acid ($\text{C}_6\text{H}_8\text{O}_7$)?

- (a) 192.124 g/mol (b) 304.116 g/mol (c) 29.018 g/mol (d) 609.378 g/mol

(26) How many moles are there in 3.20×10^{23} atoms of zinc?

- (a) 0.532 mol (b) 0.516 mol (c) 1.94 mol (d) 1.88 mol

(27) How many moles are there in 45.0 g of NO_2 ?

- (a) 1.02 mol (b) 0.667 mol (c) 1.50 mol (d) 0.978 mol

(28) What is the mass of 7.45×10^{23} molecules of sodium oxide?

- (a) 59.5 g (b) 48.3 g (c) 76.7 g (d) 1.24 g

- (29) How many molecules are there in 160 g of glucose ($C_6H_{12}O_6$)?
 (a) 6.79×10^{23} molecules (c) 1.08×10^{26} molecules
 (b) 5.35×10^{23} molecules (d) 9.63×10^{25} molecules
- (30) How many atoms of each element are in 100 molecules of propane (C_3H_8)?
 (a) 100 atoms of carbon and 100 atoms of hydrogen (c) 800 atoms of carbon and 800 atoms of hydrogen
 (b) 300 atoms of carbon and 300 atoms of hydrogen (d) 300 atoms of carbon and 800 atoms of hydrogen
- (31) What is the percent composition of each element in the compound $KMnO_4$?
 (a) 15.5% K, 56.2% Mn, 28.3% O (c) 35.5% K, 49.9% Mn, 14.5% O
 (b) 24.7% K, 34.8% Mn, 40.5% O (d) 37.5% K, 40.2% Mn, 23.3% O
- (32) The reactants of a neutralization reaction are always which of the following?
 (a) carbon dioxide and water (c) a salt and water
 (b) a hydrocarbon an oxygen (d) an acid and a base
- (33) The products of a combustion reaction are always which of the following?
 (a) carbon dioxide and water (c) a salt and water
 (b) a hydrocarbon an oxygen (d) an acid and a base
- (34) The reaction $2NF_3 \rightarrow N_2 + 3F_2$ can be classified as which of the following types?
 (a) double replacement (c) synthesis
 (b) decomposition (d) single replacement
- (35) The reaction $Mg(NO_3)_2 + 2Na \rightarrow Mg + 2NaNO_3$ can be classified as which of the following types?
 (a) double replacement (c) single replacement
 (b) neutralization (d) combustion
- (36) Which set of coefficients would balance the following reaction?
 $\underline{\quad} Al(OH)_3 + \underline{\quad} H_2C_2O_4 \rightarrow \underline{\quad} Al_2(C_2O_4)_3 + \underline{\quad} H_2O$
 (a) 2, 3, 1, 3 (c) 1, 3, 1, 3
 (b) 2, 3, 1, 6 (d) 2, 3, 2, 3

Use the following information to answer questions 37 and 38.

Sodium and water react according to the following balanced chemical equation: $2Na + 2H_2O \rightarrow 2NaOH + H_2$

- (37) If 2.0 mol of H_2O are reacted, determine the moles of H_2 produced.
 (a) 1.0 mol (c) 3.0 mol
 (b) 2.0 mol (d) 4.0 mol
- (38) If 4.0 mol of $NaOH$ are produced, determine the moles of Na reacting
 (a) 1.0 mol (c) 3.0 mol
 (b) 2.0 mol (d) 4.0 mol

Use the following information to answer questions 39 and 40.

Iron (III) oxide reacts with carbon according the following balanced chemical equation: $2Fe_2O_3 + 3C \rightarrow Fe + 3CO_2$
 25.0 g of carbon is present in the reaction.

- (39) What mass of iron will be produced?
 (a) 155 g (c) 88.1 g
 (b) 77.5 g (d) 122 g
- (40) What mass of carbon dioxide will be produced?
 (a) 21.1 g (c) 91.6 g
 (b) 275 g (d) 30.5 g

Answers:

(1) a	(6) d	(11) b	(16) b	(21) a	(26) a	(31) b	(36) b
(2) c	(7) b	(12) a	(17) b	(22) c	(27) d	(32) d	(37) a
(3) d	(8) a	(13) d	(18) a	(23) d	(28) c	(33) a	(38) d
(4) b	(9) b	(14) a	(19) a	(24) b	(29) b	(34) b	(39) a
(5) b	(10) d	(15) c	(20) c	(25) a	(30) d	(35) c	(40) c