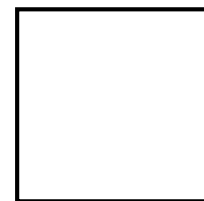


FAMILY NAME _____
please print

FIRST NAME _____
please print

SIGNATURE _____

ID NUMBER _____



1st letter of
your **last**
name

THE UNIVERSITY OF BRITISH COLUMBIA

CHEMISTRY 233

(ORGANIC CHEMISTRY)

Section 921 – Dr. Jay Wickenden

Midterm 1 – May 26th 2014

Time: 1 hour

**This examination consists of 6 double-sided pages. Ensure that you have a complete examination.
Write and bubble in your student ID and name on the Scantron form.**

- a) CANDIDATES SHOULD BE PREPARED TO PRODUCE, UPON REQUEST, THEIR LIBRARY/AMS CARD
- b) READ AND OBSERVE THE FOLLOWING ADDITIONAL RULES:
No candidate shall be permitted to enter the examination room after the expiration of 10 minutes, or to leave during the first 10 minutes of the examination.
Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.

WARNING

Candidates guilty of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action:

- Making use of any books, papers or memoranda, calculators, computers, audio or visual cassette players or other memory aid devices, other than those authorized by the examiners.
- Speaking or communication with other candidates.
- Purposely exposing written papers to the view of other candidates. The plea of accident or forgetfulness shall not be received.

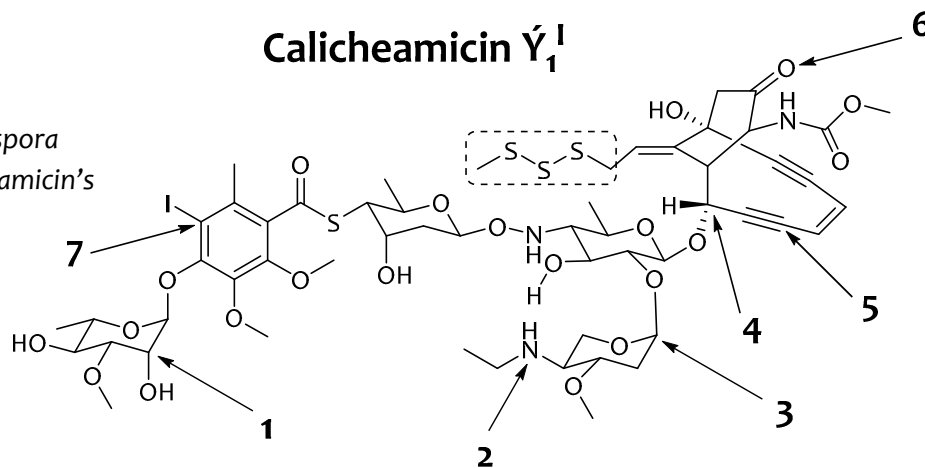
SMOKING IS NOT PERMITTED DURING EXAMINATIONS

Molecular models may be used during this examination

Part	Q's	Marks	Grader
1. Multiple Choice	1 - 28	/27 See Connect	
2. Open Ended	Page 6	/8	
	Page 7	/8	
	Page 8	/4	
	Page 9	/5	
Total Part 2		/25	
Total (Part 1 + Part 2)		/52	

Part 1: Multiple Choice. Questions 1 - 28 must be answered on the Scantron form by shading the appropriate circle with blue or black pen or pencil. Although responses on your Scantron sheet will be used to calculate your midterm grade, you can ensure that you receive all earned credit by indicating your answers on **both** the Scantron sheet and this examination paper. Note that **more than one letter could** be entered as an answer to a multiple choice question. In the case of a discrepancy between your examination paper and your Scantron, the Scantron shall be graded as the intended answer. While most correct answers are worth 1 point each, some may be worth less than 1 point.

Questions 1 - 8. Calicheamicin γ_1^I is a member of a family of naturally occurring compounds which were isolated from the bacteria *Micromonospora echinospora* SSP. The family of Calicheamicin's have led to the development of new, cancer fighting drugs. Take note that specific atoms/sites have been labelled 1 - 7.



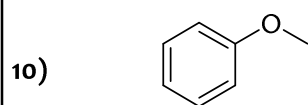
- 1) What is the name of the functional group in which carbon 1 is incorporated?
 (A) ether (B) acetal (C) hemiacetal (D) ketal (E) hemiketal (F) 2° alcohol (G) carboxylic ester
- 2) What is the hybridization of the nitrogen labelled 2?
 (A) sp (B) sp² (C) sp³ (D) sp³d² (E) σ (sigma) (F) π (pi) (G) s (H) p
- 3) What is the name of the functional group in which carbon 3 is incorporated?
 (A) ether (B) acetal (C) hemiacetal (D) ketal (E) hemiketal (F) 2° alcohol (G) carboxylic ester
- 4) What is the stereochemical configuration of the carbon atom labelled 4?
 (A) R (B) S (C) E (D) Z (E) cis (F) trans (G) α (alpha) (H) β (beta)
- 5) What is the hybridization of the carbon atom labelled 5?
 (A) sp (B) sp² (C) sp³ (D) sp³d² (E) σ (sigma) (F) π (pi) (G) s (H) p
- 6) What is the hybridization of the oxygen atom labelled 6?
 (A) sp (B) sp² (C) sp³ (D) sp³d² (E) σ (sigma) (F) π (pi) (G) s (H) p
- 7) What is the total number of lone pairs of electrons in the trisulfide (three consecutive sulfur atoms) located in the dashed box?
 (A) 8 (B) 6 (C) 12 (D) 16 (E) 5 (F) 9 (G) 10 (H) 28
- 8) What is the name of the functional group in which carbon 7 is incorporated?
 (A) alkene (B) alkyne (C) alkyl iodide (D) benzene (E) iodene (F) arene

For **questions 9 - 12**, consider that you have two solvents, heptane and water, available to dissolve each of the following compounds. Predict the superior solvent to accomplish this task in each question.

9) Methyl propoanoate

(A) heptane

(B) H₂O



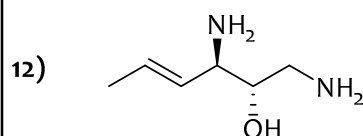
(A) heptane

(B) H₂O

11) (R)-2-bromopentane

(A) heptane

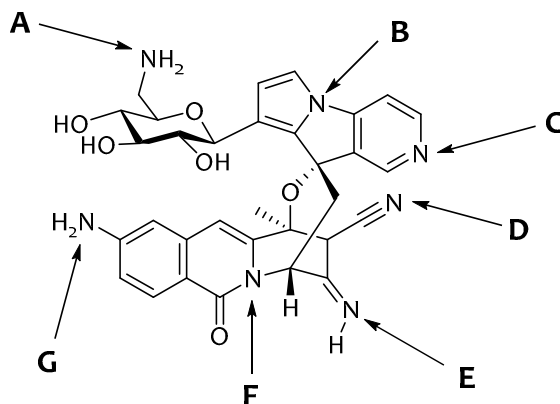
(B) H₂O



(A) heptane

(B) H₂O

Consider the structure below when answering **questions 13 - 15**. Take note that the nitrogen atoms in this structure have been labelled (A – G). Incorrect answers will be subtracted from correct answers to a minimum grade of zero for this section.



13) Which nitrogen(s) (A – G) is/are the most basic?

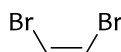
14) Which nitrogen(s) (A – G) have a lone pair in a sp² hybridized orbital?

15) Which nitrogen(s) (A – G) is/are the least basic?

16) Which of the following compounds (A - F) would have a dipole moment (μ) greater than zero? Incorrect answers will be subtracted from correct answers to a minimum grade of zero for this section



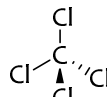
A



B



C



D

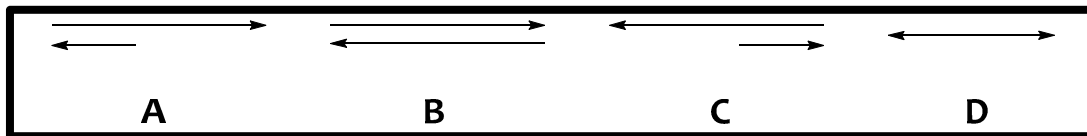


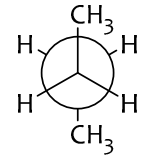
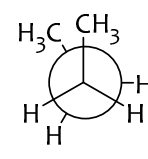
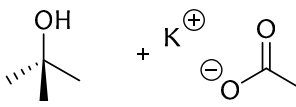
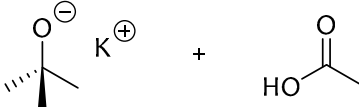
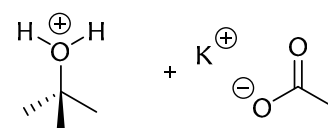
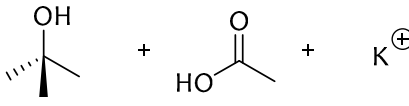
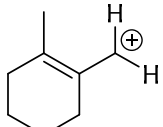
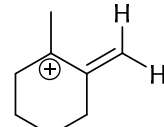
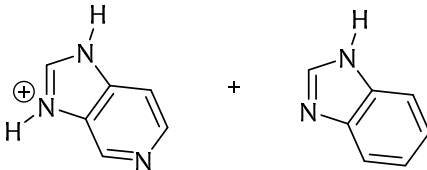
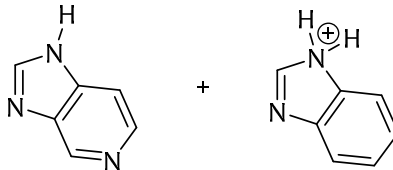
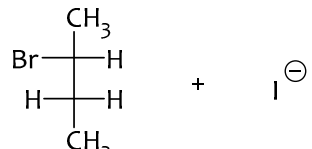
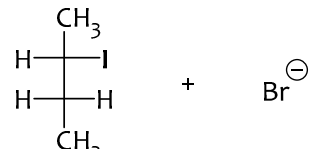
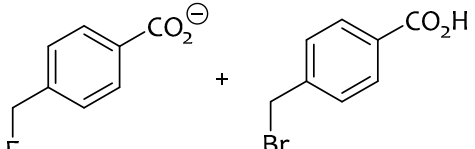
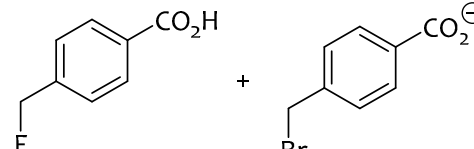
E



F

For **questions 17 - 23**, select the letter (**A**, **B**, **C** or **D**) that corresponds to the arrow that **best** describes the relationship between 'reactants' and 'products'.



- 17)  answer on scantron 
- 18)  answer on scantron 
- 19)  answer on scantron 
- 20)  answer on scantron 
- 21)  answer on scantron 
- 22)  answer on scantron 
- 23)  answer on scantron 

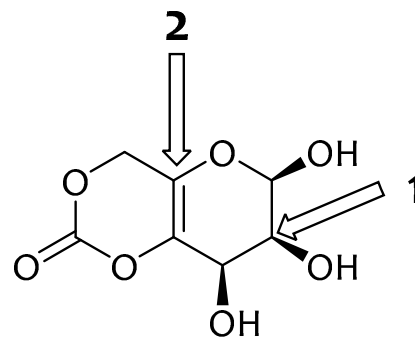
Consider the structure to the right when answering **questions 24 – 25**.

24) What is the stereochemical configuration of the carbon labelled 1?

- (A) R (B) S (C) E (D) Z (E) meso (F) Carbon is not asymmetric

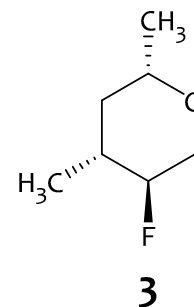
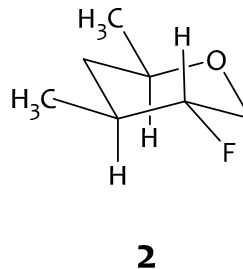
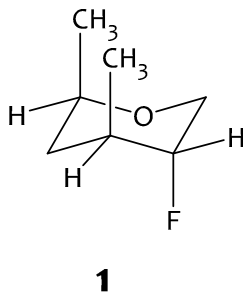
25) What is the stereochemical configuration of the alkene in which the carbon labelled 2 is incorporated?

- (A) R (B) S (C) E (D) Z (E) meso (F) Not a stereoisomer



For **questions 26 - 27**, select the letter (A – E) which **best** describes the relationship between the noted compounds.

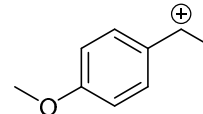
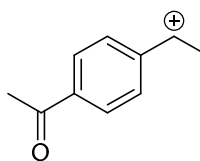
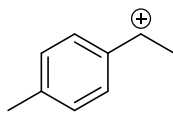
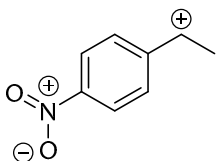
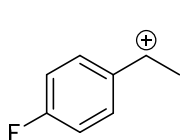
- (A) Conformers
 (B) Constitutional Isomers
 (C) Diastereomers
 (D) Enantiomers
 (E) Identical (not conformers)



26) What is the relationship between compounds 1 and 2?

27) What is the relationship between compounds 2 and 3?

28) Which of the carbocations (A – E) is/are considered the MOST stable?



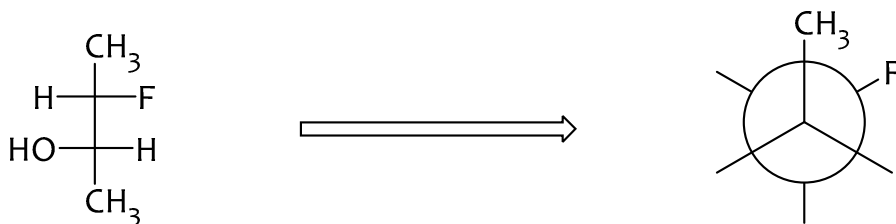
This is the end of the multiple choice portion of this examination!!

Be sure you have correctly “bubbled-in” your name and student number (I.D. number).

Part 2: Short Answer Questions. Write your answers in the designated space. Please note that in some cases it may be better for you to work out your answer on practice paper and copy a neat version to the examination paper.

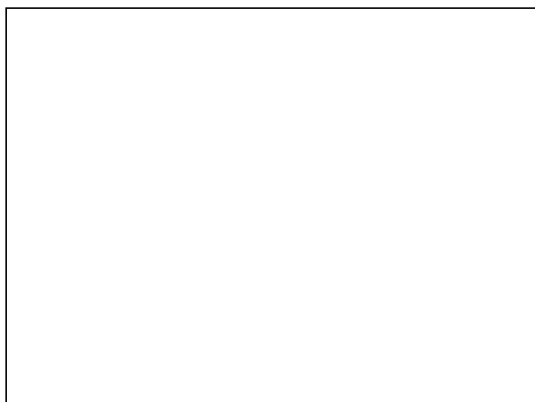
****Messy and/or incoherent answers that are difficult to read or interpret may receive reduced or zero credit****

Question 29 (2 marks). Using the supplied template, provide a Newman projection of the following compound.

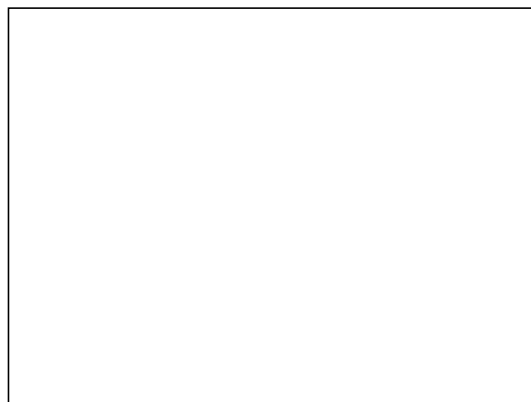


Complete this template using
the structure to the left

Question 30 (6 marks). Provide line-bond structures with all lone pairs and formal charges clearly shown.



Hydride ion (H^-)

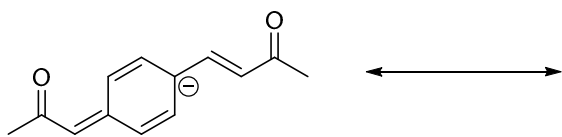


Conjugate acid of methanol



Aromatic compound with a
nitrogen and oxygen atom
in the ring

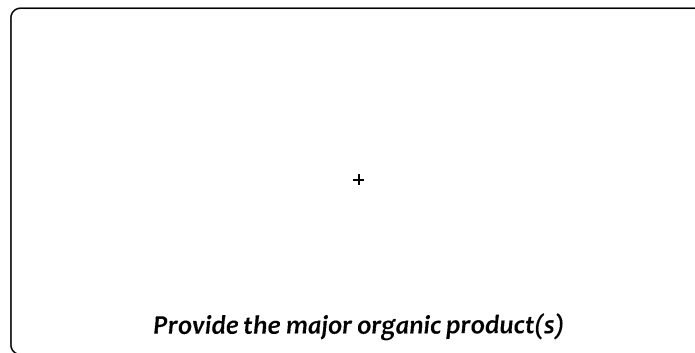
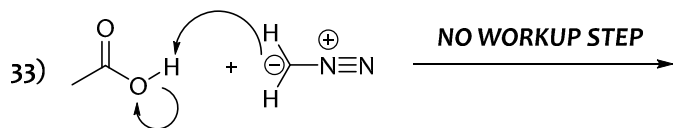
Question 31 (2 marks). Using the provided space, draw the single most contributing resonance structure of the compound below to the resonance hybrid.



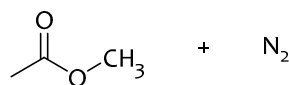
Single greatest contributor to the resonance hybrid

Question 32 (3 marks). Octanoic acid can act as a detergent. Using pictures and **BRIEF** descriptions explain how octanoic acid can solubilize (dissolve) hydrophobic substances.

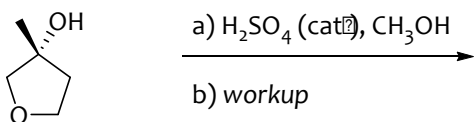
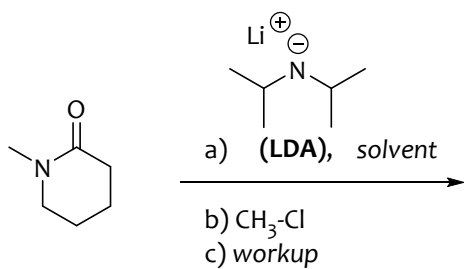
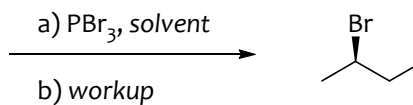
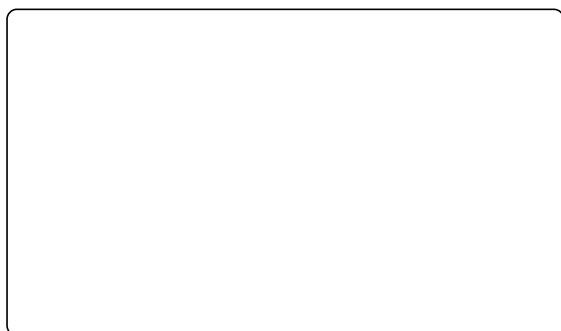
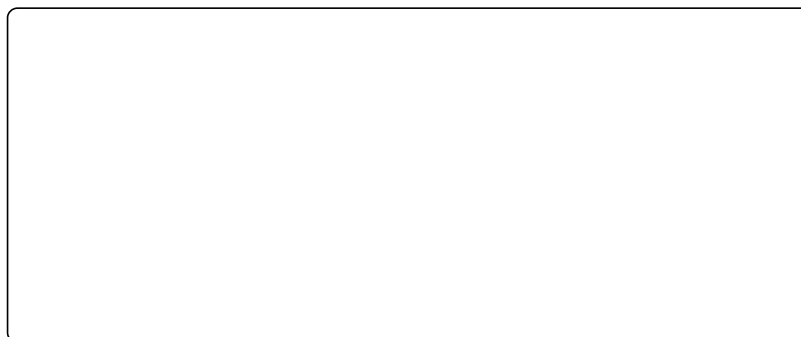
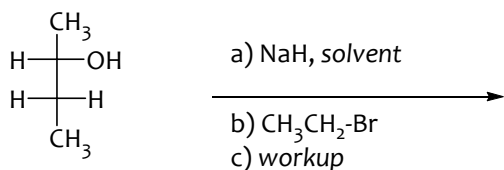
Diazomethane is a powerful method for the formation of methyl esters. For **question 33 - 34**, provide the required information. Note that **question 34** is written beside the arrow below (3 marks).



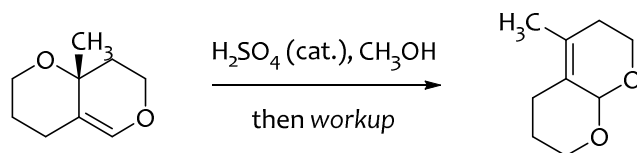
Question 34
On your compounds above, provide the arrows that would be required to produce the products below.



Question 35 (4 marks). Predict the major organic product(s) for each of the following transformations. Include stereoisomers if appropriate. You do not need to include by-products or a mechanistic rationale for these reactions.



Question 36 (5 marks). Using arrows to represent electron movement, draw a mechanistic rationale for the following transformation.



This is the end of the examination!!

This page is for rough work and will not be graded.

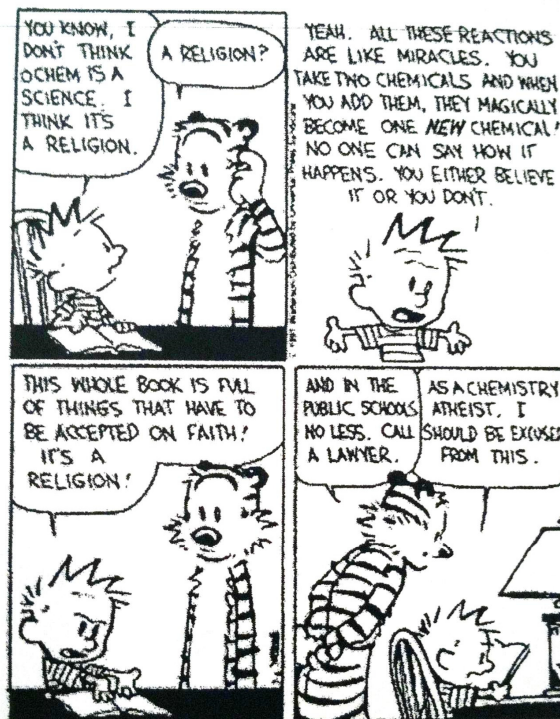
Periodic Table of the Elements

hydrogen 1 H 1.0079																				helium 2 He 4.0026					
lithium 3 Li 6.941	beryllium 4 Be 9.0122																			boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305																			aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80								
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29								
cesium 55 Cs 132.91	barium 56 Ba 137.33	lanthanum 57 La 138.91	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]								
francium 87 Fr [223]	radium 88 Ra [226]	actinides 89-102 * *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]							
			lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	unnilium 110 Uun [271]	ununium 111 Uuu [272]	unbibium 112 Uub [277]		ununquadium 114 Uuq [289]											

* Lanthanide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendeleevium 101 Md [258]	nobelium 102 No [259]

** Actinide series



This page is for rough work and will not be graded.