

Chem H90 The Idiom and Practice of Science Midterm Exam October 31, 2005

This is an open book, open note exam. You do not need a calculator or a computer. If your answer does not fit in the space provided, you have said too much! Do not spend too much time on any single problem; there are 29 questions and they vary in degree of difficulty. Do the most difficult ones last. The test contains 100 points. A periodic table is attached at the end of the exam for your convenience.

1. (2 points) The periodic table is arranged in the order of increasing what?

+2 number of things... protons, yeah, those...

2. We took the divide and conquer approach to categorizing the 109 elements of the periodic table. Show your understanding of this method by answering the following questions about the table shown below:

1 H 1.008	2 He 4.003																
3 Li 6.94	4 Be 9.01	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 18.99	10 Ne 20.18										
11 Na 22.99	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95										
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.01	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (97.91)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30
55 Cs 132.91	56 Ba 137.34	57-71 Ln	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po (209)	85 At (209)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89-103 An	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (267)	108 Hs (269)	109 Mt (268)	110 Ds (271)	111 Nh (272)	112 Fl (285)	113 Nh (288)	114 Nh (289)	115 Nh (291)	116 Nh (293)	117 Nh (294)	118 Nh (296)

*a) (2 points) Line "a" separates what two types of elements?

+2 metals & non-metals

*b) (6 points) Name three special things about elements above line b.

- 6
1. they don't have that orbit above p
 2. they only have one full s-orbital
 3. they commonly occur in nature.

*c) (2 points) What is the general name of the elements in box c?

+2 transition metals

(d) (2 points) What is special about the elements beyond line d?

0 they're man-made, just like Frankenstein, since it's hellacious and all.

3. (3 points) In the tour of Kevin's research lab, why were the glove boxes needed?

0

So you don't get stuff on your hands, duh.

4. (2 points) Which element has an electronegativity value that is not similar to its congeners?

0

Iron, cuz it rocks

5. (2 points) To what elements does the duet rule apply?

0

Oxygen, Fluorine, Chlorine, Hydrogen

6. (3 points) Which has more intermolecular attractive force, a polar or non-polar molecule?

+3

polar

7. (a) (3 points) Why are models always flawed?

3

because the way things actually work on a molecular level is very different from how we perceive them to work, like electron shells, the electrons are really all over the place, they just happen to show up where we say dot.

(b) (3 points) If models are always flawed, why do we use them?

3

Cuz we can't understand stuff and things without them, so even a flawed one helps

8. (2 points) What is r in the following equation? $E = (q_1)(q_2)/r$

+2

the radius of a sphere centered at q_1 with an outermost point on a S^2 plane with q_2 . Just kidding, the distance from q_1 to q_2 , their centers.

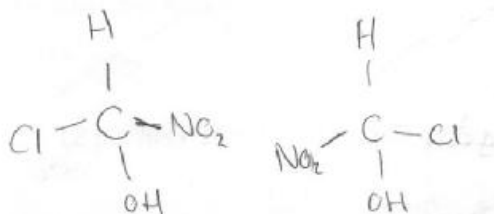
9. (3 points) Why does neon have no electronegativity?

0

Oh, that's easy. It's a noble gas, so it thinks it's all better than the commoner elements, stupid noble. It's all like, "No, I don't want your electrons," and, "No, you can't have any of my electrons and trash."

11

10 (4 points) Draw two optical isomers.



11. (3 points) Give an example in which the forces of Coulomb's law are outweighed by a much stronger force.

+3

The nucleus of an atom. There's a force in there that puns electromagnetivity all day long and back again.

12. (3 points) Which model for exposure to a harmful substance, e.g. radiation or lead or smoke, offers the most protection, the linear model or the threshold model?

0

the threshold model, obviously, since thresholds keep out vapours, which are kind like radiation

13. (3 points) ABS is an acronym for polymers made of acrylonitrile ($\text{H}_2\text{C}=\text{CHCN}$), butadiene ($\text{H}_2\text{C}=\text{CHCH}=\text{CH}_2$), and styrene ($\text{H}_2\text{C}=\text{CHC}_6\text{H}_5$). Why are some products made of ABS instead of pure materials like polymeric acrylonitrile, polymeric butadiene, or polymeric styrene.

0

cuz they're more stable that way, due to the forces, you know

14. (3 points) Which has larger London dispersion forces He or Kr?

+3

Kr, cuz it's bigger.

10

15. (2 points) In a crystalline salt, how many lattice atoms or ions are around an octahedral hole?

uh... 6.

16. (2 points) In iron metal, how many nearest neighbors does each lattice any have?

any here? that's just silly. 6, then again, it is like a sea... of electrons

17. (3 points) The nylon made in class was made by condensation polymerization whereas polyethylene is made by addition polymerization. What is the basic difference between condensation polymerization and addition polymerization?

In condensation all the elements are cooled off to form the stuff at a more stable, lower temp. In addition you need to apply an outside source of energy to make things come together. Kinda like giant robots.

18. (3 points) What are the two main types of chemical reactions?

Endothermic, and exothermic, just like animals.

19. (5 points) How does the composition of an alpha particle relate to the abundance of carbon and oxygen in the universe.

It has a free radical, and since it's all radical and free, it likes to tear things up and find nice, stable places to chill, and since oxygen has a free electron and carbon does that whole sp-hybridization thing, they're good places to go, you know?

20. (2 points) What is the greatest single source of radiation exposure to our bodies.

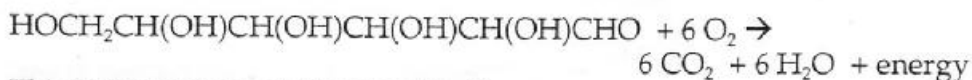
the sun

21. (3 points) Why is a banana radioactive?

cuz it has unstable isotopes of stuff in it, like us.

0

22. (3 points) Glucose has the formula $\text{HOCH}_2\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CHO}$. Hopefully, right now glucose is being consumed in your brain to give you the energy to complete these questions. The reaction is



This is the reverse of what reaction?

x3 Well, this is the burning of a fully-substituted hydrocarbon, so the reverse would be the formation of glucose

*23. (2 points) What law or equation was used to rationalize why the hydrogen molecule was more stable than two hydrogen atoms?

x2 Coulomb's law, since they have like, very large charges, so they shouldn't be very far apart

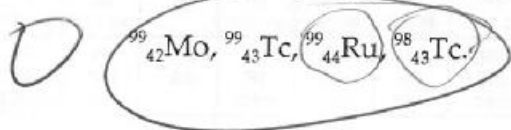
24. (3 points) Why are salts brittle and metals malleable?

0 cuz salts have a lattice that doesn't shift, but metals are composed of the same thing, so molecular rearrangement is easy.

25. (4 points) Give two reasons why a tetrahedral geometry is a better building block than a trigonal geometry?

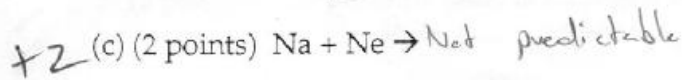
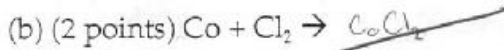
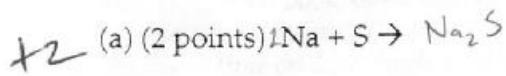
- 0
1. It reduces strain on the bonds cuz there's a bigger angle between the bonds.
 2. It's cooler. I mean, who likes free radicals? I say we shouldn't free them. Except when they're good radicals, but it needs to be dealt with case by case.

26. (2 points) Which of the following are nuclides? Circle them:



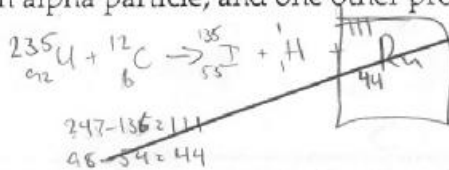
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*27. Complete the following equations when you can be confident of an answer. If it is not possible to predict the reaction, write "not predictable."



28. Imagine you were a nuclear chemist and wanted to do a U-C-I nuclear reaction in which $^{235}_{92}\text{U}$ was bombarded by $^{12}_6\text{C}$ to make $^{135}_{53}\text{I}$.

* (a) (5 points) Assuming that the only other products of this reaction are energy, an alpha particle, and one other product, what would the other product be?



* (b) (2 points) Would this be described as a fusion or fission reaction?

+2 fission

*29. (2 points) Some smoke detectors use radioactive decay to detect smoke. On the basis of information discussed in H90, why do they use alpha emitters instead of beta emitters?

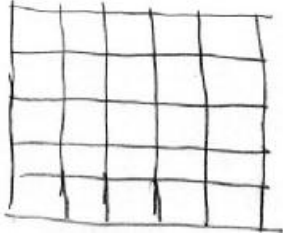
alpha particles are lighter, so a change in their medium would have a freaking huge effect on their movement, unlike beta particles, which are fat on skw

SEND MORE MONEY \rightarrow 9567
1085
10652

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Lanthanides	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (144.91)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
Actinides	89 Ac (227)	90 Th 232.04	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

On a 5×5 board, place 5 black queens and 3 white kings
s.t. none of the kings are in check.



have fun 😊