

Chemistry Homework and Assessments

The screenshot shows the LON-CAPA login interface for Simon Fraser University (SFU). At the top, there is a green banner with the LON-CAPA logo and the text "The LearningOnline Network with CAPA". To the right is a red SFU logo. Below the banner is a "Log in" section with a green header. The login form includes fields for "Username:" (containing "Ray Batchelor"), "Password:" (containing "Chemistry"), and "Domain:" (containing "sfu"). A "Log in" button is located below the domain field. To the right of the login form is the text "The LearningOnline Network with CAPA" and a small LON-CAPA logo. Below this text is a photograph of a modern building with a staircase and a colorful mural. At the bottom left, there is a status section with the following information: "Domain: sfu", "Server: sfua2 (access)", "Server Load: 12.0 percent", and "2.10.1-2011113023". To the right of the status section is the SFU logo and the text "SIMON FRASER UNIVERSITY ENGAGING THE WORLD".

*SFU Chemistry used CAPA from 1996 and in 2001 migrated to LON-CAPA.



Overview by Tasks in SFU Chemistry

I. Lecture homework

- A. Regular assignments
 - in Intro, General, Analytical
 - sometimes Physical, Organic
- B. Quizzes/Tests/Surveys

II. Laboratories

- A. Pre-lab homework assignments
- B. Managing 'Unknowns'
- C. Reports
- D. 'Dry-labs'

III. Exams (paper)

- A. Bubble sheet / Machine-graded
 - 1. Multiple Choice
 - 2. Numerical
- B. Written / Marker-graded

IV. Application Forms

- Submission, review & ranking

Summary of regular and intermittent usages.

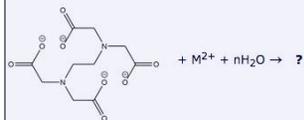
Orange text -- in constant use.

SFU: trimester system with different people teaching -- each with their own preferences and methods.

2017, taking stock: creating new resources, making obsolete some old resources.

Organizing sequences according to topics.

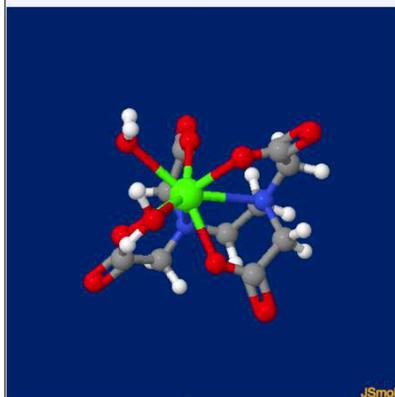
EDTA Complexes



7: What is the maximum *coordination number* of tin when Sn^{4+} is fully complexed in basic, aqueous, EDTA solution? (Note: The *coordination number* of a central atom in a complex is the total number of σ -bonds to that atom.)

A score has been assigned. [Previous Tries](#)

6: How many **EDTA-ligand atoms** coordinate **calcium** in the complex ion $\text{Ca}(\text{EDTA})(\text{H}_2\text{O})_2^{2-}$?



A score has been assigned. [Previous Tries](#)

3-d animated visualizations.

SFU resources which used JMOL, are now revised to use JSMOL.

2758 mol or pdb files published in LON-CAPA.

1883 in MSU domain.

630 in NAU domain.

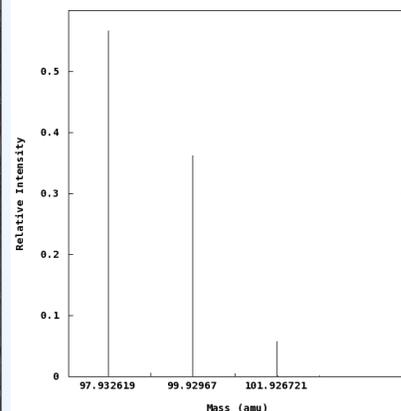
129 in SFU domain.

107 in FSU domain.

Mass Spectrum of Molecular Parent Ion

In a *mass spectrometer*, molecules can be ionized into singly positively charged molecular ions which are then separated according to their masses and counted. The resulting *spectrum* is essentially a histogram showing the relative numerical abundances of ions of different masses.

Phosgene, a highly toxic, gaseous, industrial chemical (used somewhat unsuccessfully as a chemical warfare agent in WWI) has the molecular formula COCl_2 . A portion of the mass spectrum of phosgene is represented below.



Given the following natural isotopic abundances (and atomic masses):

- ^{12}C 98.9% (12.000000 amu)
- ^{13}C 1.1% (13.003355 amu)
- ^{16}O 99.76% (15.994915 amu)

Enter the atomic mass of the **most abundant isotope of chlorine** present in the sample (in amu, to at least 4 decimal places). **34.9689 amu**

1 pts

Computer's answer now shown above. Tries 0/5

Assign masses (amu) to the following molecular ions:

102.930076: $^{13}\text{C}^{16}\text{O}^{37}\text{Cl}_2^+$

100.933025: $^{13}\text{C}^{16}\text{O}^{35}\text{Cl}^{37}\text{Cl}^+$

99.92967: $^{12}\text{C}^{16}\text{O}^{35}\text{Cl}^{37}\text{Cl}^+$

1 pts

Computer's answer now shown above. Tries 0/5

Enter the approximate % isotopic abundance of the **most abundant isotope of chlorine** present in the sample (try to get it within $\pm 1\%$). **75.7700 %**

1 pts

Computer's answer now shown above. Tries 0/5

Overall Assessment Statistical Data

Statistics calculated for number of students:	15255
Average number of tries till solved:	2.61
Degree of difficulty:	(0.66)
Degree of discrimination:	(0.14)

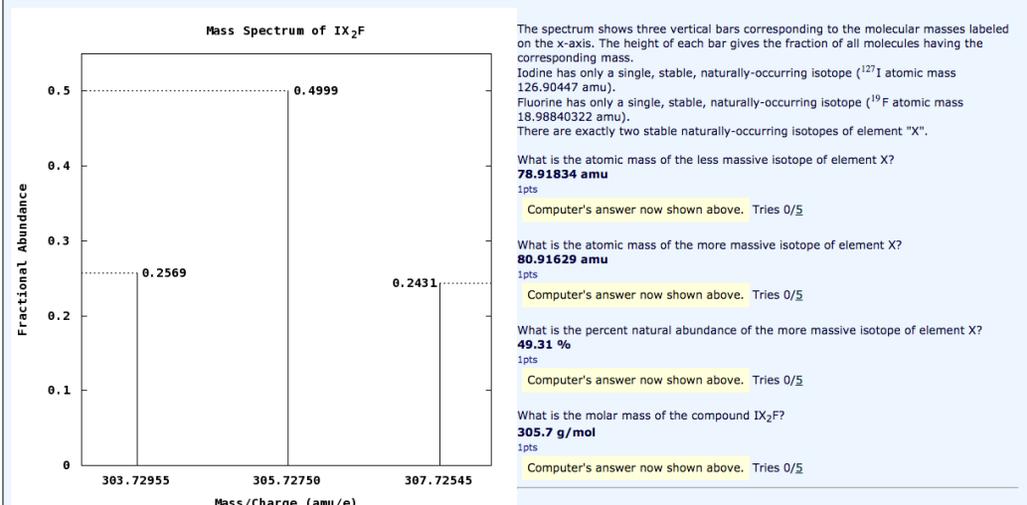
Recent Detailed Assessment Statistical Data

Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Dis
sfu	Chem121 2016-3 Lecture (Burnaby)	all	506	11	2.48	0.65	
sfu	Chem121 2016-3 Lecture (Burnaby)	all	494	14	2.13	0.58	
sfu	Chem121 2016-3 Lecture (Burnaby)	all	462	16	2.16	0.61	

This question has been used many years, but is still considered difficult.

In part to avoid scamming of answers off the web, I made new differing versions of this problem, which were intended to be a bit easier AND have different questions and phrasing than the old one — so it is not as easy to search out.

Mass Spectrum of Molecular Parent Ion (4parts)



Overall Assessment Statistical Data		Recent Detailed Assessment Statistical Data								
Statistics calculated for number of students:	444	Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Degree of Discrimination	Time of computation
Average number of tries till solved:	2.21	sfu	Chem121 2017-2 Lecture	D100	160	11	2.51	0.65	0.21	Thu May 25 02:45:20 pm 2
Degree of difficulty:	(0.57)	sfu	Chem121 2017-2 Lecture	D100	157	13	1.69	0.45	0.20	Thu May 25 02:45:20 pm 2
Degree of discrimination:	(0.23)	sfu	Chem121 2017-2 Lecture	D100	153	15	3.21	0.81	0.52	Thu May 25 02:45:20 pm 2
		sfu	Chem121 2017-2 Lecture	D100	140	17	1.58	0.42	0.09	Thu May 25 02:45:20 pm 2
		sfu	Chem121 2017-1 Lecture	all	284	11	2.80	0.71	0.47	Tue Jan 24 02:14:38 pm 2
		sfu	Chem121 2017-1 Lecture	all	264	13	1.81	0.48	0.21	Tue Jan 24 02:14:38 pm 2
		sfu	Chem121 2017-1 Lecture	all	261	15	2.57	0.68	0.51	Tue Jan 24 02:14:39 pm 2
		sfu	Chem121 2017-1 Lecture	all	253	17	1.36	0.29	0.15	Tue Jan 24 02:14:39 pm 2

Version of problem used in Spring 2017:
 Students are quick to use 'tutoring' services online.
 Google search for words in the problem statement find services with answers.
 NOT free though. \$\$

Question: Homework poi Connect inbox Computing ID Look ault ...

Elemental and Compound Composition

Chlorophyll molecules are responsible for the green pigmentation of plants. Differing chemically isolated molecular chlorophyll compounds are named as "Chlorophyll X" (where "X" is a variable denoting the actual molecular fragments which are represented by the labels R_1 , R_2 , R_3 , R_4 , R_5 , R_6 , R_7).

Suppose one molecule of Chlorophyll X contains 5 oxygen atoms, and Chlorophyll X is 13.09 % oxygen by weight. Using only this information and the atomic mass of oxygen, determine the molecular mass of Chlorophyll X.

ans:

[Submit Answer](#) Tries 0/5

The Chlorophyll X molecule contains one magnesium atom. What mass of magnesium is found in 5.75 g of Chlorophyll X compound?

ans:

[Submit Answer](#) Tries 0/5

16122253_140495...jpg

Elemental and Compound Composition

Chlorophyll molecules are responsible for the green pigmentation of plants. Differing chemically isolated molecular chlorophyll compounds are named as "Chlorophyll X" (where "X" is a variable denoting the actual molecular fragments which are represented by the labels R_1 , R_2 , R_3 , R_4 , R_5 , R_6 , R_7).

Suppose one molecule of Chlorophyll X contains 5 oxygen atoms, and Chlorophyll X is 13.09 % oxygen by weight. Using only this information and the atomic mass of oxygen, determine the molecular mass of Chlorophyll X.

611 amu

ans

Incorrect. Computer's answer now shown above. Tries 1/5 [Previous Tries](#)

The Chlorophyll X molecule contains one magnesium atom. What mass of magnesium is found in 5.75 g of Chlorophyll X compound?

2.29 x 10⁵ g

ans

Incorrect. Computer's answer now shown above. Tries 5/5 [Previous Tries](#)

Show transcribed image text

Only one student had this particular rendition of this question. They submitted a photo of their display to a commercial homework help site. The student was working up to near the deadline on the assignment, but did not receive the answer in time. Viewed Sun Jan 15, 2017 6:25PM until 11:25PM (due at 11:59PM). Student's final view of their problem (at lower right).

Gravimetric Analysis -- Binary Mixture

(2003 - 2016 — 130 courses)

Antimony is alloyed with lead to increase the rigidity of components used in the construction of lead storage batteries.

1.011 g of a particular metallic alloy, compounded of only Pb and Sb, can be quantitatively converted into a 1.172-g mixture of the oxides PbO_2 and Sb_2O_4 .

What was the percentage (by mass) of antimony in the alloy?

%

Submit Answer Tries 0/5

Overall Assessment Statistical Data

Statistics calculated for number of students:	13319
Average number of tries till solved:	2.39
Degree of difficulty:	 (0.65)
Degree of discrimination:	 (0.21)

Recent Detailed Assessment Statistical Data

Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Deg Discrim
sfu	Chem121 2016-3 Lecture (Burnaby)		all	434	0	2.20	0.64

Gravimetric Analysis -- Binary Mixture

(2017 — 2 courses)

Amounts of tin may be alloyed with copper to produce bronzes of varying composition and properties.

7.8470 g of a particular bronze, compounded of only Cu and Sn, can be quantitatively converted into a 9.8429-g mixture of the oxides CuO and SnO_2 .

(Use the atomic masses: Cu 63.546, Sn 118.71, O 15.9994.)

What was the percentage (by mass) of tin in the alloy?

%

Overall Assessment Statistical Data

Statistics calculated for number of students:	367
Average number of tries till solved:	2.32
Degree of difficulty:	 (0.68)
Degree of discrimination:	 (0.00)

Recent Detailed Assessment Statistical Data

Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Degree of Discrim
sfu	Chem121 2017-2 Lecture	all	130	0	2.22	0.69	
sfu	Chem121 2017-1 Lecture	all	237	0	2.38	0.68	

Goggle-search finds a solution for the old problem, but not (yet) for the new problem. Average number of tries by student and the overall degree of difficulty similar.

2004-2016
8 variations
DoD=0.61
<Tries> = 2.28

2017
26 variations
DoD=0.67
<Tries>=2.35

Bond Energies and Heat of Reaction

Use the given bond energy values to estimate ΔH for the following gas-phase reaction.



(Simple energy units required for the answer.)

D-values in kJ/mol

$D_{\text{H-H}} = 432$	$D_{\text{H-Br}} = 363$	$D_{\text{H-C}} = 413$
$D_{\text{H-N}} = 391$	$D_{\text{H-O}} = 467$	$D_{\text{C-C}} = 347$
$D_{\text{C=C}} = 614$	$D_{\text{C#C}} = 839$	$D_{\text{C-N}} = 305$
$D_{\text{C=N}} = 615$	$D_{\text{C#N}} = 891$	$D_{\text{C-O}} = 358$
$D_{\text{C=O}} = 745$	$D_{\text{C=O (CO}_2)} = 799$	$D_{\text{C#O}} = 1072$
$D_{\text{C-Br}} = 276$	$D_{\text{N-N}} = 160$	$D_{\text{N=N}} = 418$
$D_{\text{N=N}} = 941$	$D_{\text{O-O}} = 146$	$D_{\text{O=O}} = 495$
$D_{\text{N-O}} = 201$	$D_{\text{N=O}} = 607$	$D_{\text{Br-Br}} = 193$

Submit Answer Tries 0/5

[Threaded View](#) [Chronological View](#) [Other Views...](#)

[Export](#)

Anonymous 1 Reply (Tue Oct 25 06:06:17 pm 2016 (PDT))

Just in case if anyone wants to know:

Hold On, Don't Panic!

Okay, this question may seem very scary, but it can be broken down easily!

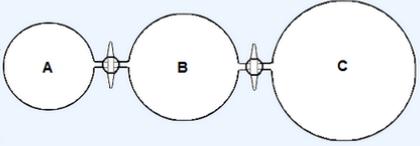
- Look carefully at the diagram, this isn't something new; the last two questions are just the same!
- The table offers WAY more information than you actually need, worry not
- A strategic recommendation is to work left to right, write out what the bonds are, and how many there are
- It is also a good idea to keep the molecules separate of each other until the sum at the end - that way, mistakes can be avoided
- be careful as solid lines aren't the only bond! Elements adjacent to each other **are bonds too**; they will need to be considered
- Note that double (or triple) bonds are NOT the same as single bonds
- Once again, keep in mind the positive and negative signs

Take a deep breath, it's okay! Not too bad, right?

Creating new problems with more variations.

LON-CAPA student discussion/help for others seemed to work well in this instance, without resort to other online 'help' sites. Suspect that student was likely getting 'help' before posting to the in-course discussion.

Diffusion -- Partial Pressure -- Mole Fraction



Three glass bulbs, joined by closed stopcocks, have the following volumes and initial pressures of the specified gases.
 Bulb A: 250. mL of Kr(g) at 570. torr
 Bulb B: 500. mL of CO₂(g) at 0.500 atm
 Bulb C: 1.25 L of N₂(g) at 25.331 kPa

After both stopcocks are opened and the gases allowed to diffuse throughout, what will be the final total pressure?

P_{total} =
 1 pts
 Submit Answer Incorrect. Tries 3/5 Previous Tries

What is the *partial pressure* of Kr(g)?
P_{Kr} =
 1 pts
 Submit Answer Tries 0/5

What is the *mole fraction* of CO₂(g)?
X_{CO₂} =
 1 pts
 Submit Answer Tries 0/5

For question 1:
 I think the total pressure of e
 and how do you find the pa
 Show transcribed image text

Get this answer with Chegg Study

[VIEW THIS ANSWER](#)

OR

[VIEW THIS ANSWER](#)

Expert Answer

Chegg (“chicken or egg”) : originally started for/by students at Iowa State U.

— is an online textbook rental company, also providing:
 homework help (answers) and online tutoring.

It is based in Santa Clara California.

Some students seem prompt to access this service and pay\$.

Diffusion -- Partial Pressure -- Mole Fraction

Viewed by < 324 students only in Spring 2017

Diffusion -- Partial Pressure -- Mole Fraction



Network-wide courses using resource:

- [Chem121 2016-3 Lecture \(Burnaby\) \(sfu\)](#)
- [Chem121 2017-1 Lecture \(sfu\)](#)
- [Chem121 2017-2 Lecture \(sfu\)](#)
- [Chem121/120 2017-2 Surrey Lecture \(sfu\)](#)
- [Testing in 2.11 \(sfu\)](#)

Overall Assessment Statistical Data

Statistics calculated for number of students:	270
Average number of tries till solved:	1.90
Degree of difficulty:	 (0.50)
Degree of discrimination:	 (0.00)

Recent Detailed Assessment Statistical Data

Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Degree of Discrimination	Time of computation
sfu	Chem121 2017-1 Lecture	all	270	12	2.31	0.60	0.00	Fri May 26 10:20:18 am 2017 (PDT)
sfu	Chem121 2017-1 Lecture	all	261	13	1.63	0.42	0.00	Fri May 26 10:20:18 am 2017 (PDT)
sfu	Chem121 2017-1 Lecture	all	252	15	1.74	0.47	0.00	Fri May 26 10:20:18 am 2017 (PDT)

You are correct. Computer's answer now shown above.

Spring 2017 — Problem restricted to one class of SFU students only.

271 out of 323 registered students (84%) attempted this question.

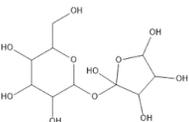
42 of whom (15%) got all or part of it wrong (5 tries allowed for each part)

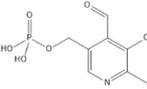
Can easily identify the student who posted to CHEGG, because of the many variations of the problem.

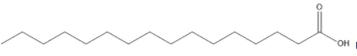
This student used his/her 3rd try to input 152 kPa. Feb 3 2017, at 1:18PM, before posting for help.

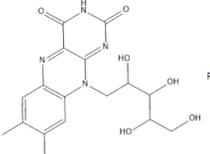
On 5th and last try they entered the correct answer as 0.375 atm on Sunday Feb 5, 2017 at 4:56 PM. (C student.)

There was only one other student with an identical variation of the problem (in a class of 323)— and that person's submission profile did not match.

water-soluble:  Sucrose

water-soluble:  Pyridoxal Phosphate (vitamin B6)

insoluble in water:  Palmitic Acid

water-soluble:  Riboflavin (vitamin B2)

insoluble in water:  Benzene

Submission #	Try	When	Submitted Answer
1	Correct. (Try 1)	Sun Apr 9 11:06:56 pm 2017 (PDT)	water-soluble water-soluble insoluble in water water-soluble insoluble in water

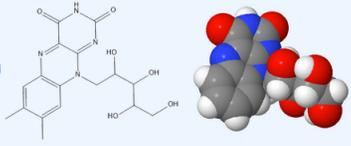
You are correct. Computer's answer now shown above. Your receipt no. is 156-4616 [?](#) [Previous Tries](#)

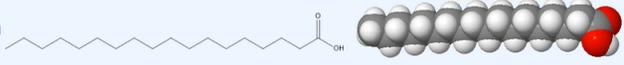
Student first viewed this problem at 5:08PM Sun April 9, 2017.

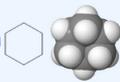
Answered it on their first try at 11:07PM Sun April 9, 2017 (Due date), presumably after having received the answer from the commercial 'help' site.

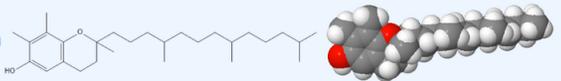
C student.

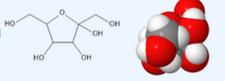
Choose which substances are hydrophobic and which are hydrophilic.











Tries 0/5

Same problem using JSMOL visualization of molecules as well as the 2-dimensional line drawings.

2004 - 2017 103 courses

Internal Energy of a Monatomic Ideal Gas at Constant Pressure and Variable Temperature

A helium-filled balloon at 1.00 atm pressure has a volume of 1.330 L. It is placed in a freezer and its volume decreases, stopping at 0.960 L. (Assume that the static internal and external pressures are equal, that the balloon contains only helium, and helium behaves as an ideal gas.) Calculate ΔE for the gas in the balloon.

2017
261 students
Average number of tries 1.69
Degree of Difficulty 0.43

Wed Feb 1, 2017 - Sun Feb 12, 2017 1 course

Overall Assessment Statistical Data

Statistics calculated for number of students:	15228
Average number of tries till solved:	2.07
Degree of difficulty:	(0.54)
Degree of discrimination:	(0.08)

Ideal Gas Decompression at Constant Volume. State Functions.

An ideal gas sealed in a rigid 5.45-L cylinder, initially at pressure $P_i=13.80$ atm, is cooled until the pressure in the cylinder is $P_f=1.49$ atm. What is the enthalpy change for this process?

$\Delta H =$

1pts

Tries 0/5

What is the change in internal energy for this process?

$\Delta E =$

1pts

Tries 0/5

Overall Assessment Statistical Data

Statistics calculated for number of students:	233
Average number of tries till solved:	1.75
Degree of difficulty:	(0.47)
Degree of discrimination:	(0.00)

New problem (bottom) possibly a little easier than old problem (top).
Google search for postings containing the wording of the problem.
Next slide

Ideal Gas Decompression at Constant Volume. State Functions.

An ideal gas sealed in a rigid 5.87-L cylinder, initially at pressure $P_i=12.50$ atm, is cooled until the pressure in the cylinder is $P_f=1.49$ atm. What is the enthalpy change for this process?

$\Delta H = ?$

What is the change in internal energy for this process?

$\Delta E = ?$

Expert Answer

No answer yet. Submit this question to the community.

ASK QUESTION

Ideal Gas Decompression at Constant Volume. State Functions.

An ideal gas sealed in a rigid 5.87-L cylinder, initially at pressure $P_i=12.80$ atm, is cooled until the pressure in the cylinder is $P_f=1.49$ atm. What is the enthalpy change for this process?

$\Delta H = -1.68 \times 10^4 \text{ J}$
1 pts
Computer's answer now shown above. Tries 0/5

What is the change in internal energy for this process?

$\Delta E = -1.01 \times 10^4 \text{ J}$
1 pts
Computer's answer now shown above. Tries 0/5

Student submitted their problem to CHEGG.

Only two students had this specific variation.

Neither of them made ANY attempt to answer this problem (presumably because no answer was forthcoming).

One was working on the assignment over 3 days culminating on the due date.

The other only worked on the assignment on the due date sporadically from 5:41PM until 11:16PM. (Due at midnight).

Due in 8 hours, 20 minutes

1 homework point(s)

Elemental Analysis and Empirical Formula

The class of *ternary* compounds called *chlorofluorocarbons* (CFC's, or sometimes *Freons*) have proved to be very valuable as refrigerants and as cleaning agents for circuit boards. Unfortunately, in the atmosphere these compounds produce chlorine atoms that catalyze the decomposition of the ozone that protects the earth from ultraviolet radiation.

A particular CFC has the following mass percentages: 69.6%Cl and 11.78%C.

Choose appropriate coefficients for the *empirical formula*.

C Cl F

Submit Answer

Tries 0/5 Previous Tries

Post Discussion

Send Feedback

Overall Assessment Statistical Data

Statistics calculated for number of students:	448
Average number of tries till solved:	1.70
Degree of difficulty:	 (0.46)
Degree of discrimination:	 (0.18)

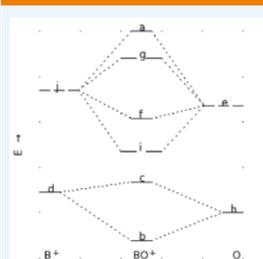
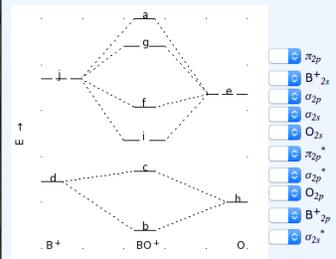
Recent Detailed Assessment Statistical Data

Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Degree of Discrimination	Time of computation
sfu	Chem121 2017-2 Lecture	D100	161	0	1.63	0.43	0.20	Thu May 25 02:45:21 pm 2017 (PDT)
sfu	Chem121 2017-2 Lecture	all	159	0	1.62	0.43	0.00	Tue May 30 09:08:09 am 2017 (PDT)
sfu	Chem121 2017-1 Lecture	all	287	0	1.78	0.50	0.26	Tue Jan 24 02:14:40 pm 2017 (PST)

Demo of new rendition of old problem.

Diatomic Molecular Orbital Energy Diagram

For the diatomic molecular cation BO^+ , match each atomic or molecular orbital designation with the corresponding letter label from the MO-energy-level diagram.



Get this answer

1pts
Submit Answer Tries 0/5

Does this diagram display the effect of s-p orbital mixing?
 Yes!
 No!

.25pts
Submit Answer Tries 0/1

Which kind of magnetism would be observed for this cation?
 diamagnetism
 paramagnetism

.25pts
Submit Answer Tries 0/1

What is the bond order for this cation?

.5pts
Submit Answer Tries 0/1

Overall Assessment Statistical Data

Statistics calculated for number of students:	245
Average number of tries till solved:	1.13
Degree of difficulty:	(0.31)
Degree of discrimination:	(0.00)

π_{2p}^*
 σ_{2p}^*
 π_{2p}^*
 σ_{2p}^*
 π_{2p}^*
 σ_{2p}^*
 π_{2p}^*
 σ_{2p}^*

Recent Detailed Assessment Statistical Data

Domain	Course	Section(s)	Num Students	Part	Mean Tries	Degree of Difficulty	Degree of Discrimination
sfu	Chem121 2017-1 Lecture	all	214	11	1.55	0.41	0.
sfu	Chem121 2017-1 Lecture	all	245	14	1.00	0.24	0.
sfu	Chem121 2017-1 Lecture	all	243	17	1.00	0.26	0.
sfu	Chem121 2017-1 Lecture	all	234	20	1.00	0.35	0.

New rather easy problem (2017). Nonetheless students still submitted it to commercial web sites for answers.

Raymond John Batchelor (Course Coordinator) **Chemistry 215 Laboratory 2014-2** (More ...) [New Messages](#) Roles Help Logout

[Main Menu](#) | [Return to Last Location](#) | [Course Contents](#) | [Course Editor](#) | [Groups](#) | Switch course role to...

Chemistry 215 Laboratory 2014-2 » **Chart** [Chart ?](#)

Sections ? **Groups ?** **Student Data ?** **Access Status ?** **Sequences and Folders ?** **Output Format ?** **Output Data ?**

all WPA TPA

all T1112 T12 T34 T56

all fullname username domain id

Currently Has Access Will Have Future Access Previously Had Access Any Access Status

Expt-A. Prelab Exercises. Expt-A. Gravimetry Results Expt-B. Prelab Exercises. Expt-B. TGA Results Expt-C. Prelab Exercises.

HTML, with links **HTML, with all links** HTML, without links Excel CSV

Scores Summary Scores Per Problem Tries Parts Correct

Status: Done

Select One Student Clear Caches

Generate Chart

All sections. Groups T12, T34, T56, W12, W34 and W56. Active access status.

Show links in new window

Chemistry 215 Laboratory 2014-2 Mon Jun 2 11:12:38 am 2014 (PDT)

Score on each Problem Part

username	section	groups	Expt-A. Gravimetry Results	Expt B. TGA Results	total
(Hidden for demo)					
TPA	T12	uuuuuuu4	4.00/5.00	uu3 3.00/5.00	7.00 / 10
WPA	W12	uuuuuuu4	4.00/5.00	uu5 5.00/5.00	9.00 / 10
TPA	T12	uuuuuuu0	0.00/5.00	uu4 4.00/5.00	4.00 / 10
TPA	T12	uuuuuuu0	0.00/5.00	uu4 4.00/5.00	4.00 / 10
TPA	T12	uuuuuuu0	0.00/5.00	uu0 0.00/5.00	0.00 / 10
TPA	T56	uuuuuuu0	0.00/5.00	uu4 4.00/5.00	4.00 / 10
TPA	T12	uuuuuuu0	0.00/5.00	uu* 3.20/5.00	3.20 / 10
TPA	T34	uuuuuuu0	0.00/5.00	u 0.00/5.00	0.00 / 10
TPA	T34		/5.00	uu 0.00/5.00	0.00 / 10
WPA	W12	uuuuuuu3	3.00/5.00	uu5 5.00/5.00	8.00 / 10
TPA	T34	u	0.00/5.00	uu1 1.00/5.00	1.00 / 10

Droplists to select filters for display or output of Chart.

Note blue "?"s which appear liberally throughout the interface, give contextual help.

Displayed part scores (integers or single-character symbols) are each a LINK to the grading inter face for that particular resource and the individual student. Very COOL!

When the exact score cannot be represented by an integer, an asterisk is displayed which then pops the actual score when moused-over.

Next, click on the Expt B result for the student who scored 3.2/5.

View of the problem

Due in 4 hours, 1 minute

Exp B. TGA Results

Enter the following data and calculated results from your lab notebook:

FIRST, CAREFULLY enter your Unknown Sample Number.

It must be correctly entered as a simple integer, between 1 and 999.

Subsequent results input fields will not become available until this has been done.

Unknown Sample # =

Answer Submitted: Your final submission will be graded after the due date. Tries 1/1 Previous Tries

1. Data:

Sample	Mass	Heating Rate
CaC ₂ O ₄ ·xH ₂ O	4.864480mg	30°C/min
Polyethylene glycol	5.266522mg	30°C/min
Unknown sample	5.676756mg	30°C/min
Antacid tablet	7.668478mg	30°C/min

Answer Submitted: Your final submission will be graded after the due date. Tries 3/10 Previous Tries

2. Enter the Unknown weight percent Ca²⁺ and its uncertainty.

(The submitted values will be entered in the table in Report I.)

(Do NOT include any units, NOR the % symbol in either field. i.e. If your result uncertainty is absolute, (not relative).)

Wt% Ca = ±

Answer Submitted: Your final submission will be graded after the due date. Tries 3/10 Previous Tries

Submission #	Try	Submitted Answer
1	Answer Submitted: Your final submission will be graded after the due date. (Try 1)	22.64 0.0003
2	Answer Submitted: Your final submission will be graded after the due date. (Try 2)	22.64 5.36
3	Answer Submitted: Your final submission will be graded after the due date. (Try 3)	22.64 7.07

Note student's reported Wt%Ca and the unreasonably large Uncertainty.

Can pop-up the students "Previous Tries".

'Uncertain about uncertainty'.

This student seems to remain confused about the meaning of "absolute" vs "relative" uncertainty.

Automatic score of 3.2/5 arises from granting 4/5 for accuracy of Wt% Ca, which is reduced to 3.2/5 for inappropriate uncertainty.

Quantum Numbers, Valence Electrons, Orbitals

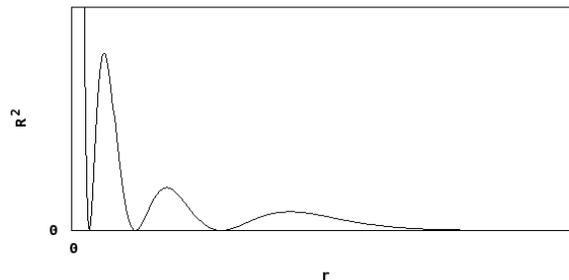
What is the total number of **p** electrons in a single (ground state) **Ba** atom?

What is the principal quantum number (**n**) for the valence electrons in **germanium**?

For the hydrogen atom, the square of the wave function $\psi^2(\theta, \phi, r)$ for an electron in a particular orbital (designated by the quantum numbers n and l) gives the relative probability of finding that electron at a single point (defined by the angles θ , ϕ , and the distance r from the nucleus). This also may be called the relative electron density at a single point in the orbital.

The wave function ψ can be factored into the product of the angular and radial functions $\Theta(\theta)\Phi(\phi)R(r)$.

The graph below represents the relative electron density ($R^2(r)$) for an **s-orbital**. What is its principal quantum number **n**?



n =

Submit Answer Tries 0

New problem sample using dynamically generated gnu plots for different quantum numbers.

Creating a new problem resource.

The requested file /priv/batchelo/testing/JME/demo_organicresponse_CSC.problem currently does not exist.

To create a new problem, select a template from the list below. Then click on the "Create problem" button.

Algebraic Response Problems

- Formula Response using Computer Algebra System [Example](#)
- Formula Response using Computer Algebra System R and Data Plot [Example](#)
- Formula Response using Computer Algebra System and Hints [Example](#)
- Formula Response with Samples [?](#) [Example](#)
- Math Response using Computer Algebra System MAXIMA [?](#) [Example](#)
- Math Response using Computer Algebra System R [?](#) [Example](#)
- Math Response using Computer Algebra System and Hints [?](#) [Example](#)
- Unordered Multi-Answer Formula Response Problem [Example](#)

Chemistry Problems

- Chemical Reaction Response [Example](#)
- Chemical Reaction Response with Hints [Example](#)
- Organic Material Response [Example](#)
- Organic Material Response with Hint [Example](#)

Free Form Problems

- Custom Response [?](#) [Example](#)
- Custom Response using Computer Algebra System and Hints [?](#) [Example](#)
- Custom Response with Partial Credit [?](#) [Example](#)
- External Response [Example](#)
- String Response [?](#) [Example](#)
- String Response with Pre-Processing [?](#) [Example](#)

Handgraded Problems

- Essay Response [Example](#)

Input-Dependent Problems

- Using Learner Answer in Multipart Numerical Problem [Example](#)
- Using Learner Formula in Graph with Formula Response [Example](#)
- Using Learner Formula in Graph with Math Response [Example](#)

Miscellaneous

- Blank Problem [Example](#)
- Click-On-Image Problem [Example](#)
- Simple Formula Problem [Example](#)

Multiple Choice Problems

- Matching Response [Example](#)
- Option Response - Concept Groups [Example](#)
- Option Response - Matching [?](#) [Example](#)
- Option Response - True/False [Example](#)
- Radio Button Response [?](#) [Example](#)
- Randomized Question Stem Radio Button Response [?](#) [Example](#)
- Randomly Labelled Image with Option Response [Example](#)
- Rank Response [?](#) [Example](#)

Numerical Problems

- Curve Plot with Numerical Response [Example](#)
- Data Plot with Numerical Response [Example](#)
- Numerical Response [?](#) [Example](#)
- Numerical Response with Custom Units [Example](#)
- Numerical Response with Pre-Processing [Example](#)
- One of Multiple Answers Numerical Problem [Example](#)

Many templates as shown by the offerings when initiate the creation of a new resource.

Programming definitely NOT required, but can be advantageous.

Can mix and match or devise your own special types of assessments.

Have not even attempted ALL of these templates.

Let's try something a bit different...

In CSTR, create New problem "SampleOrganicResponse" -- click on "Go"

Problem Testing ?

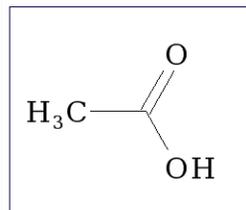
Problem Status: Problem Type: Show All Foils

Feedback Mode: Apply style file: [Select](#)

Language: Math Rendering:

for versions. ?

The image below is acetic acid $C_2H_4O_2$



Complete acetic acid.

This is the organicresponse TEMPLATE.
Idea is to present a molecule and require the student to draw a molecule, not necessarily the same molecule though.
Will EDIT the question and use a molecule which displays potential stereoisomerism.
Click on "Edit" to go to the GUI editor.

Construction Space

Functions    

Construction Space: /priv/batchelo/testing/JME/demo_organicresponse_CSC.problem
--- Recent ---

Problem Editing 

Discard Edits and View EditXML Undo Save and Edit Save and View

Insert: Image

Text Block Delete? Edit Math  Greek Symbols  Other Symbols  Output Tags 

Rich formatting »

<p>The image above is phenoxymethylpenicillin.</p>

Check Spelling

Insert an image "tag" .
I'm going to ask for a specific stereoisomer of penicillin V".
Click "Save and Edit"

Construction Space

Functions    

Construction Space: /priv/batchelo/testing/JME/demo_organicresponse_CSC.problem
 --- Recent ---

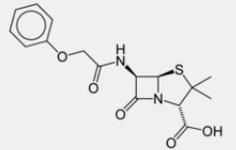
Problem Editing [?](#)

Discard Edits and View EditXML Undo Save and Edit Save and View

Insert:

Image Delete? Image Options [?](#)

Image Url: /res/sfu/batchelo/testing/JME/Phenoxymethylpenicillin.png Select Search
 Description: Penicillin V
 width (pixel): height (pixel):
 TeXwidth (mm): TeXheight (mm): Alignment: TeXwrap: Encrypt URL: no



Insert:

Text Block Delete? Edit Math [?](#) Greek Symbols [?](#) Other Symbols [?](#) Output Tags [?](#)

Rich formatting »

<p>The image above is phenoxymethylpenicillin.</p>

IF one knows where the image is located they can just type it in,
 OR one could use "Select" or "Search" to either browse or search in repository for a published image.

Click "Save and Edit"

The screenshot shows a LON-CAPA interface. At the top, there are tabs for "Text Block", "Delete?", "Edit Math", "Greek Symbols", "Other Symbols", and "Output Tags". Below these is a "Rich formatting" section with a text area containing a prompt: "The image above is phenoxymethylpenicillin. Please draw the diastereomer (2S,5S,6S)-3,3-dimethyl-7-oxo-6-[(phenylacetyl)amino]-4-thia-1-azabicyclo[3.2.0] heptane-2-carboxylic acid." A "JME Editor" window is open, displaying the chemical structure of phenoxymethylpenicillin. The editor has a toolbar with various drawing tools and a "Select substituent" dropdown. Below the editor are buttons for "Insert Answer", "Close", and "Help". At the bottom, there is a "Response: Organic Chemical Structure" section. It contains a "Starting Molecule" field with a pencil icon, a "Correct Answer" field with a SMILES string, and a "JME string of the answer" field with a pencil icon. There are also checkboxes for "Auto E,Z stereochemistry", "Multipart Structures", "No stereochemistry", "Is a reaction", and "Able to number atoms".

Notice the pencil icon just after the "Starting Molecule" field. Click on it to use applet to insert and save atomic coordinates & bonds for "starting" point drawing.

Next click the pencil icon over on the right and draw the CORRECT answer with full stereochemistry using wedge bonds.

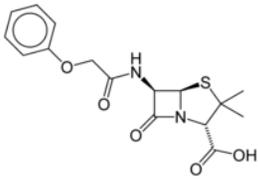
Clicking "Insert Answer" in this case does two things:

Saves the coords and bonds needed to produce the "correct" answer displayed.

Saves and inserts the SMILES (Simple Molecular Input Line-Entry System) string which uniquely corresponds to the structure, including stereochemistry. This is required for automatic grading of the student's submission.

NEXT Scroll down to SAVE and VIEW the problem you have created.

Edit EditXML



The image above represents **phenoxymethylpenicillin**.

Please draw the diastereomer **(2S,5S,6S)-3,3-dimethyl-7-oxo-6- [(phenylacetyl)amino]-4-thia-1-azabicyclo[3.2.0] heptane-2-carboxylic acid**.



Submit Answer Tries 0

Answer for Part: 0 CC3(C)S[C@H]2[C@@H](NC(=O)COc1ccccc1)C(=O)N2[C@H]3C(=O)O

So, now we have a simple problem to draw a specified stereoisomer of the original molecule.
NEXT Edit XML to show the simple code.

Construction Space » Problem Editing

Functions    

Construction Space: /priv/batchelo/testing/JME/demo_organicresponse_CSC.problem
 --- Recent ---

Problem Editing [Script Functions ?](#) [Greek Symbols ?](#) [Other Symbols ?](#) [Output Tags ?](#)
[Languages ?](#)

Discard Edits and View Edit Undo Edit Math [?](#) Save and EditXML Save and View

```
<problem>
<web><startouttext /><h2>Penicillin V</h2><endouttext />

<script src="/adm/jmol/Jmol.js" type="text/javascript"></script>
<script type="text/javascript">
jmolInitialize("/adm/jmol");
jmolSetAppletColor(boxbgcolor = "#002266",boxfgcolor = "#002266",progresscolor = "#002266");
jmolApplet(400, "load /res/sfu/batchelo/2015tests/jsmol/penicillinV3.mol");
</script>
</web>

<startouttext /><b>Draw penicillin V</b><endouttext />

<organicresponse jmeanser="24 26 C 5.64 -5.18 C 5.64 -3.78 C 4.42 -3.08 C 3.21 -3.78 C 3.21 -5.18 C 4.42 -5.88 O 6.85
-5.88 C 8.06 -5.18 C 9.27 -5.88 N 10.49 -5.18 C 11.70 -5.88 C 12.06 -7.23 N 13.41 -6.87 C 13.05 -5.52 C 14.81 -6.94 C
15.31 -5.64 S 14.23 -4.76 O 9.27 -7.28 O 11.36 -8.44 C 15.57 -8.12 O 14.94 -9.36 O 16.97 -8.04 C 16.18 -4.54 C 16.70
-5.83 1 2 1 2 3 2 3 4 1 4 5 2 5 6 1 6 1 2 1 7 1 7 8 1 8 9 1 9 10 1 11 10 -1 12 13 1 13 14 1 11 14 1 11 12 1 15 16 1 16
17 1 14 17 -1 13 15 1 9 18 2 12 19 2 15 20 -2 20 21 2 20 22 1 16 23 1 16 24 1" options="autoez"
answer="CC3(C)S[C@@H]2[C@H](NC(=O)COC1CCCC1)C(=O)N2[C@H]3C(=O)O" id="11" molecule="24 26 C 4.91 -5.85 C 4.91 -4.45 C
3.70 -3.75 C 2.48 -4.45 C 2.48 -5.85 C 3.70 -6.55 O 6.12 -6.55 C 7.33 -5.85 C 8.55 -6.55 N 9.76 -5.85 C 10.97 -6.55 C
11.33 -7.90 N 12.69 -7.54 C 12.32 -6.19 O 10.63 -9.12 O 8.55 -7.95 C 14.08 -7.62 C 14.59 -6.31 S 13.50 -5.43 C 15.25
-5.07 C 15.83 -6.94 C 14.85 -8.79 O 14.21 -10.04 O 16.24 -8.72 1 2 1 2 3 2 3 4 1 4 5 2 5 6 1 6 1 2 1 7 1 7 8 1 8 9 1 9
10 1 10 11 1 12 13 1 13 14 1 11 14 1 11 12 1 12 15 2 9 16 2 17 18 1 18 19 1 14 19 1 13 17 1 18 20 1 18 21 1 17 22 1 22
23 2 22 24 1">
<textline readonly="yes" spellcheck="none" />
</organicresponse>
<allow src="/adm/jmol/Jmol.js" />
</problem>
```

How about 3-D representation of these molecules? JSMOL

Need to generate some xyz coordinates of the structure. There are a variety of ways that you might do this and diverse programs and databases. Suffice it to say that a file (MDL mol file or Brookhaven PDB file) can be readily obtained or generated for loading into JSMOL to show an interactive 3D-display. Replaced the original tags for the imported image with appropriate tags for the JSMOL application.

Now shows the entire xml code for the revised problem, shown next...

JME and JSMOL

Penicillin V



Draw penicillin V



JSmol

Video demo:

Still in Author's Construction/Testing environment and want to test out the problem.

Rotate molecule, so that one can visualize the required stereochemistry for the specified answer.

Click Pencil icon to open drawing applet.

Choose appropriate wedge-bonds for the displayed molecule and "Insert Answer" to produce the required SMILES string.

Click Submit and see the system's response "Correct".

...

NEXT: Paper Exams.



Exams

- Chemistry Exams in LON-CAPA
 - Multiple Choice
 - Numerical
 - Written
- Pre-assigned specific versions.
- Grading comments displayed in LON-CAPA
- Cumulative stats aid in selection of questions.

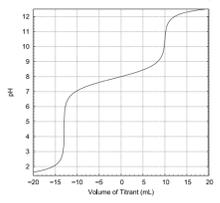
Final
Exam Room: C5601
Exam Date: 09-Dec-2011
Exam Time: 12:00 PM

Department of Chemistry
Exam Seating Chart
CHEM122_2011_BRNBV

Version	CODE	Quantity
1	4371	63
2	4300	63
3	7170	61
4	9637	61
		Total: 248



A buffer solution is comprised of an acid HX and its conjugate base X⁻.
 A 10.00 mL sample of the buffer solution required 10.00 mL 0.1000 M NaOH titrant to reach the Basic equivalence point.
 A second 10.00 mL sample of the same buffer solution required 13.00 mL 0.1000 M HCl titrant to reach the Acidic equivalence point.
 A plot of pH versus both the volume of NaOH and the negative of the volume of HCl is shown below.



[7 pt] 6. What is the pK_a of the acid HX?



Why? Numerous reasons not necessarily individually compelling but collectively so.

Easy to generate new versions of exams, as needed.

Control over dynamically generated content. (show four versions of one problem with graph).

Numerical answers can also be recorded on custom bubble sheet & machine-graded.

Provides a permanent and cumulative association of assessment resources with statistics reflecting their effectiveness, taking advantage of the analytics within the LON-CAPA system.

We are thus able to easily maintain a semi-quantitative evaluation of every Exam question, which can be reviewed when selecting questions for a new exam.

Prepare seating-plans/room maps showing the distribution of different exam versions to minimize lines of sight.

Lay out collated exams and personalized bubble sheets in advance and seat students according to the design.

Three people could set up this room in 10-15 minutes.

Students can find their exam and seat themselves in ~10 minutes, for a room this size.

Simplifies & streamlines attendance-and-identity checking and grading issues.



Individual Student's Exam Score as displayed in **LON-CAPA**



Midterm Results

Total: Mks/Pts = 21.75/24

Multiple Choice: Mks/Pts = 16/18

Numerical: Mks/Pts = 3/3

Written: Mks/Pts = 2.75/3.00

Exam Version: 2222

Your Choices: bdbbdaaead eeacbec

Exam Answers: bdbbdaaead eeacbec

Point Values: 1111111111 11111111

Q1: Student Ans = 1.14E+15 Exam Ans = 1.14E+15 ± 5.68E+13 Pts = 1 Score = 1

Q2: Student Ans = 9.28E-06 Exam Ans = 9.29E-06 ± 4.64E-07 Pts = 1 Score = 1

Q3: Student Ans = 0.00499 Exam Ans = 0.00499 ± 9.98E-05 Pts = 1 Score = 1

Class Average: 15.07/24

Scoring broken down and comments provided to individual students.

NEXT Analytics for exam questions (or other assessments).

Compiling statistics for 34 problems

This will take some time.

Sequence Statistics



Sequence	#Items	Score Mean	Score STD	Score Max	Score Min	Score N	Count Mean	Count STD	Count Max	Count Min	Count N	KR-21
Final	36	21.99	5.48	36.00	6.00	337	21.99	5.48	36.00	6.00	337	0.74

Chemistry 122 Burnaby 2014-1

Compiled on Wed May 21 10:42:29 pm 2014 (PDT)

Final

P#	Title	Part	#Stdnts (plot)	Tries (plot)	tries/correct (plot)	#Wrng (plot)	%Wrng (plot)	DoDiff (plot)	DoDisc (plot)
1	QvsKEqPos.exam	0	337	337	1.6	125.0	37.0	0.37	0.32
2	No Buff	0	332	332	6.4	280.0	84.3	0.84	0.11
3	acidic.or.basic.sol.SASB.exam	0	335	335	1.2	58.0	17.3	0.17	0.27
4	Ka.rxn.def.exam	0	337	337	1.6	127.0	37.6	0.38	0.42
5	pH.water.Kw.Tnot25.exam	0	337	337	1.6	120.0	35.6	0.36	0.39
6	pH.wb.exam	0	337	337	1.4	88.0	26.1	0.26	0.40
7	me/w.sign.isoT.expans.exam	0	337	337	1.9	158.0	46.8	0.47	0.14
8	entropy.fusion.exam	0	337	337	1.1	17.0	5.0	0.05	0.08
9	pH.change.concept.exam	0	336	336	1.2	50.0	14.8	0.15	0.21
10	acid.str.rel.exam	0	337	337	1.7	133.0	39.4	0.39	0.33
11	spontaneity.vs.T.exam	0	337	337	1.5	112.0	33.2	0.33	0.55
12	me/rev.delHf0.mult.exam	0	337	337	2.0	170.0	50.4	0.50	0.54
13	entropy.spont.exam	0	336	336	2.8	214.0	63.6	0.64	0.12
14	ME/NO.Gf.K.exam	0	336	336	3.3	235.0	69.9	0.70	0.42
15	delG0.Kps.thermo.exam	0	328	328	2.5	197.0	60.0	0.60	0.42
16	std.red.pots.rxn.exam	0	337	337	1.2	55.0	16.3	0.16	0.21
17	Selective Electrolysis	0	337	337	1.7	143.0	42.4	0.42	0.18
18	Galvanic.cell.simple.conc.eff.exam	11	337	337	1.2	65.0	19.2	0.19	0.41
19	Galvanic.cell.simple.conc.eff.exam	13	336	336	1.9	163.0	48.5	0.49	0.44
20	ME/car.battery.cell.exam	0	332	332	1.5	116.0	34.9	0.35	0.21

KR-21 reliability index (for what it's worth). $KR21 = (N/(N-1))(1 - M(N-M)) Ns^{*2}$

N=number of items in exam; M=mean score; s=stdev

Mostly good degrees of discrimination.

Difficulty level is variant.

How do these results compare with Historical results for the same questions?

Next slide shows dynamic meta data summary of results for a single re-used question.

Summary Stats for an Individual Question:



Overall Assessment Statistical Data

Statistics calculated for number of students:	2259
Average number of tries till solved:	1.00
Degree of difficulty:	 (0.30)
Degree of discrimination:	 (0.40)

Recent Detailed Assessment Statistical Data

Course	Section(s)	Num Students	Mean Tries	Degree of Difficulty	Degree of Discrimination
Chemistry 122 Burnaby 2011-Spring	D100	454	1.00	0.35	0.39
Chemistry 122 Burnaby 2011-3	D100	235	1.00	0.34	0.46
Chemistry 122 Surrey 2012-Spring	D200	95	1.00	0.22	0.46
Chemistry 122 Burnaby 2012-Spring	D100	332	1.00	0.33	0.37
Chemistry 122 Burnaby 2012-3	D100	242	1.00	0.26	0.43
Chemistry 122 Surrey 2013-Spring	D200	125	1.00	0.30	0.47
Chemistry 122 Burnaby 2013-1	D100	307	1.00	0.22	0.26
Chemistry 122 Surrey 2014-Spring	D200	132	1.00	0.17	0.26
Chemistry 122 Burnaby 2014-1	D100	337	1.00	0.33	0.54

Example for an individual question used in 6 semesters over 4 years.

Stats averaged over all students summarized at top.

Moderate difficulty

Good degree of discrimination

Stats listed for 9 semester-courses -- 5 different instructors -- 2 campuses.

Note that consistency is reasonable. Though, it appears to suggest that individual instructors get "better" with repeat performances.

Overall averages shown to have good predictive value.

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★ LON-CAPA Developers from:

- LON-CAPA Academic Consortium
- Michigan State University
- eduCog LLC

★ Simon Fraser University

- Department of Chemistry
- Faculty of Science
- Information Technology Services

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