



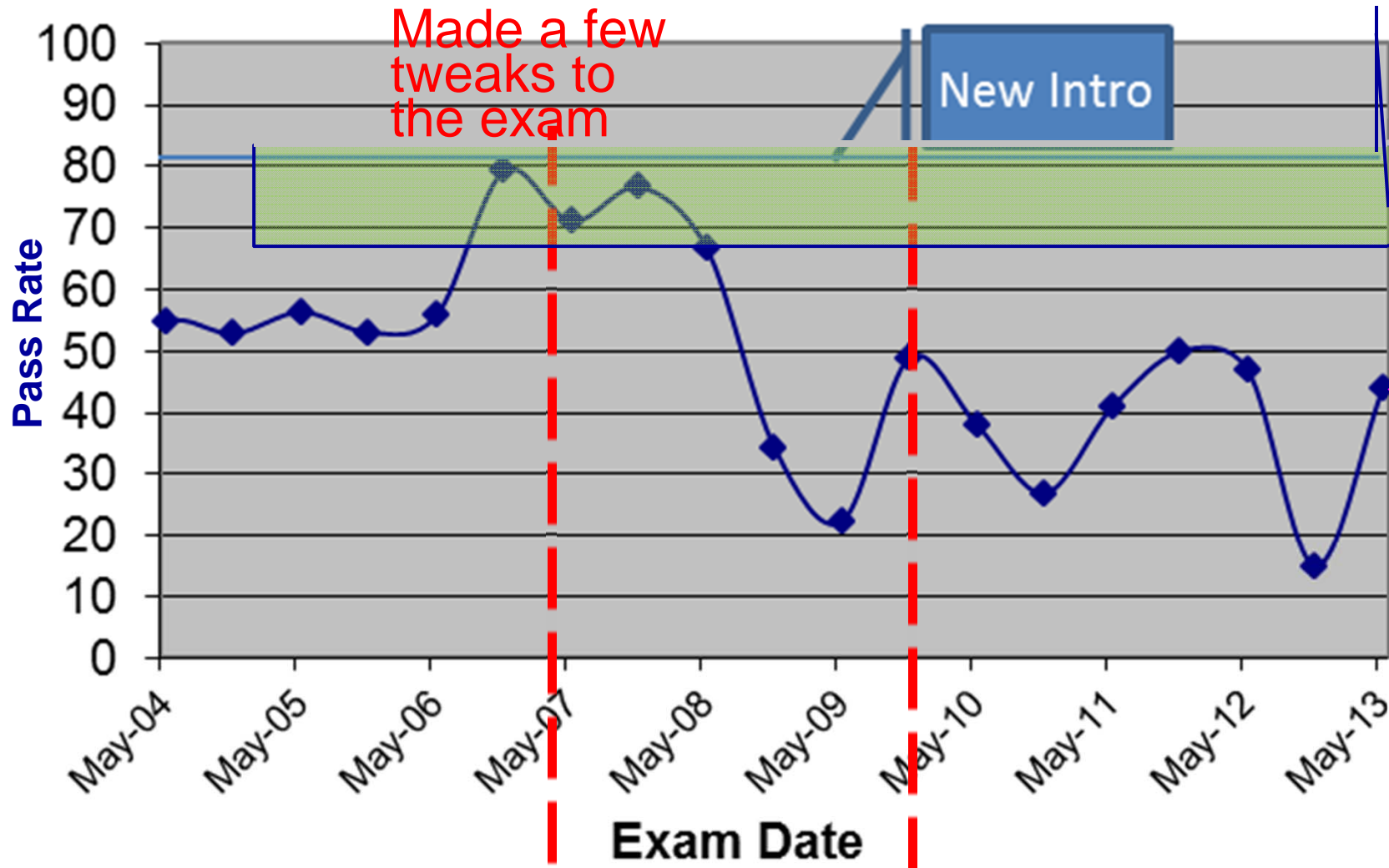
What's in store today

- We have copies of study guides.
- Highlighters and pens for all.
- We'd like to share some approaches to learning and studying.
- Go over some challenging “knowledges” and show to extract key info.
- Then you try some.
- Please ask questions as they strike you.



Historical exam performance

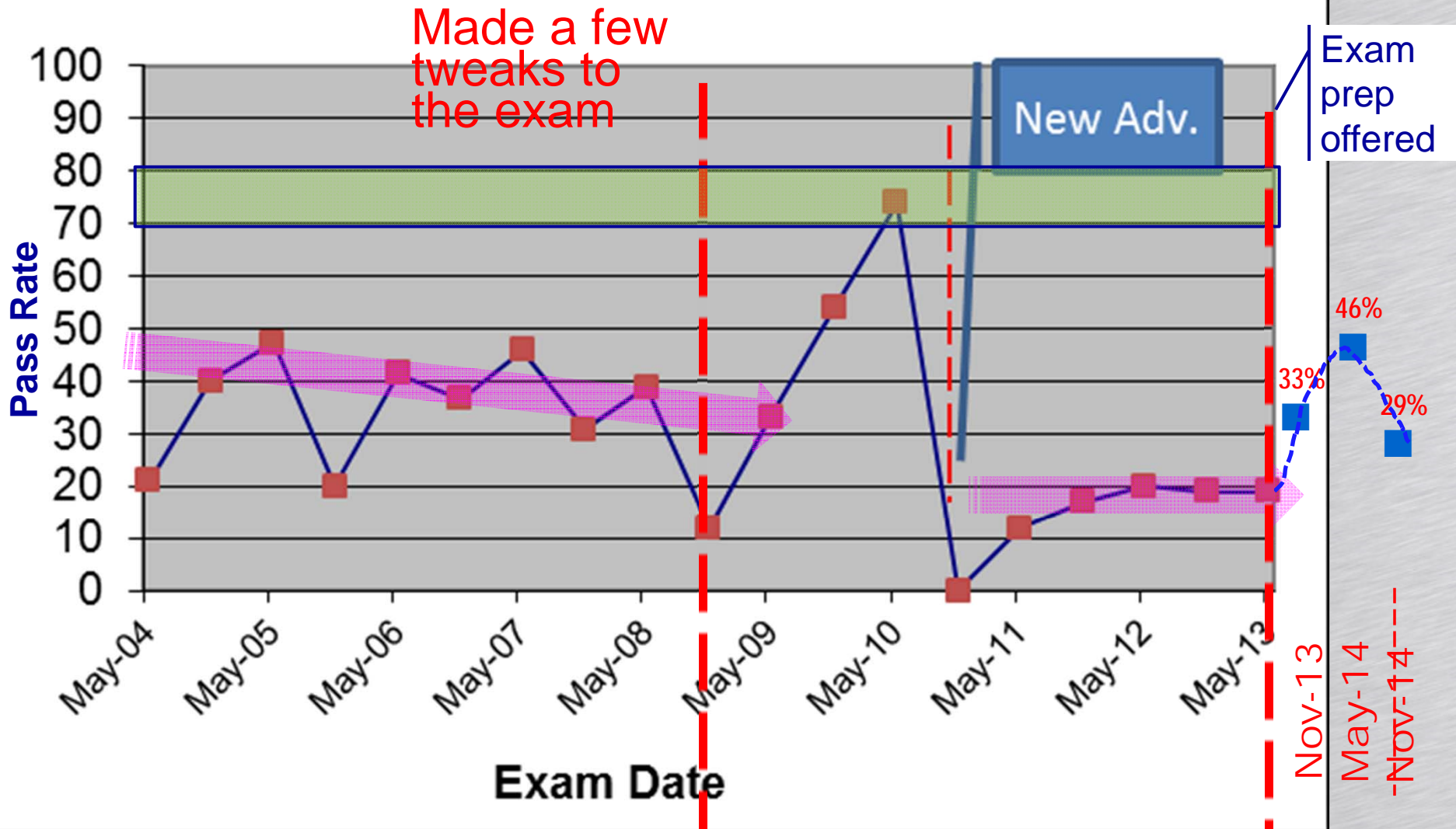
Exam Pass Percentage - Lab Intro





10 yrs...and twice above 50%

Exam Pass Percentage - Lab Advanced





EPIC FAIL

Seriously, how the heck did you manage that?



Evaluating Corrective Action





INTRO EXAM - MAY 2014

52 took the exam, 21 passed = **40% pass rate.**
Average score = 69.8

Those who attended the April 2014 training

10 of 12 taking passed (**83%**), 48% of all passed

Average score = 81.5 (**12 pts better** than all)

Those that took exam previously & attended April training:

1 person doubled their previous test score.



INTRO EXAM - NOVEMBER 2014

73 took the exam, 27 passed = **37% pass rate.**
Average score = 66.6

Those who attended the October 2014 training

12 of 13 taking passed (**92%**), 44% of all passed

Average score = 80.2 (**13.6 pts better** than all)

Pass rate of those **NOT** attending training:

15 of 59 passed or 25.4%

1 person doubled their previous test score.



ADVANCED MAY 2014

48 took the exam, 22 passed = **46% pass rate.**
Average score = 69.4%

Those who attended the April 2014 training

14 of 18 taking passed (**78%**), 64% of all passed

average score= 80.3 (**11 pts better** than all

Those that took exam previously & attended Apr'14:

3 people scored 90% or better.

Overall, a **27 point improvement in scores** from the previous attempt (**about 11 questions**).



ADVANCED NOVEMBER 2014

52 took the exam, 16 passed = **29% pass rate.**
Average score = 68.9%

Those who attended the October 2014 training

11 of 12 taking passed (**92%**), 69% of all passed

average score= 82.3 (**13.4 pts better** than all)

7 people scored 85% or better.

Pass rate of those **NOT** attending training:
5 of 40 passed or 12.5%



Bimodal population scan

Good question

Tough question?

MATRIX OF RESPONSES BY QUINT

	A	B	C	D
5TH:	0	10	0	0
4TH:	0	10	0	1
3RD:	1	8	1	0
2ND:	1	8	1	1
1ST:	0	5	4	1
PROP:	0.04	[0.79]	0.12	0.06
RPBI:	-0.06	[0.38]	-0.37	-0.11

MATRIX OF RESPONSES BY QUINT

	A	B	C	D
5TH:	0	5	4	1
4TH:	2	4	5	0
3RD:	1	2	5	2
2ND:	4	1	5	1
1ST:	1	0	7	2
PROP:	0.15	[0.23]	0.50	0.12
RPBI:	-0.19	[0.49]	-0.19	-0.14

Either chose A or B

Guessing?

MATRIX OF RESPONSES BY QUINT

	A	B	C	D
5TH:	8	2	0	0
4TH:	6	5	0	0
3RD:	6	4	0	0
2ND:	5	6	0	0
1ST:	5	5	0	0
PROP:	[0.58]	0.42	0.00	0.00
RPBI:	[0.21]	-0.21	0.00	0.00

MATRIX OF RESPONSES BY QUINT

	A	B	C	D
5TH:	2	0	3	5
4TH:	1	2	5	3
3RD:	2	1	6	1
2ND:	3	1	6	1
1ST:	5	1	3	1
PROP:	0.25	0.10	0.44	[0.21]
RPBI:	-0.21	-0.05	-0.06	[0.34]



Quintile review

DEPARTMENT OF NATURAL RESOURCES QUINTILE SCORE GROUPS

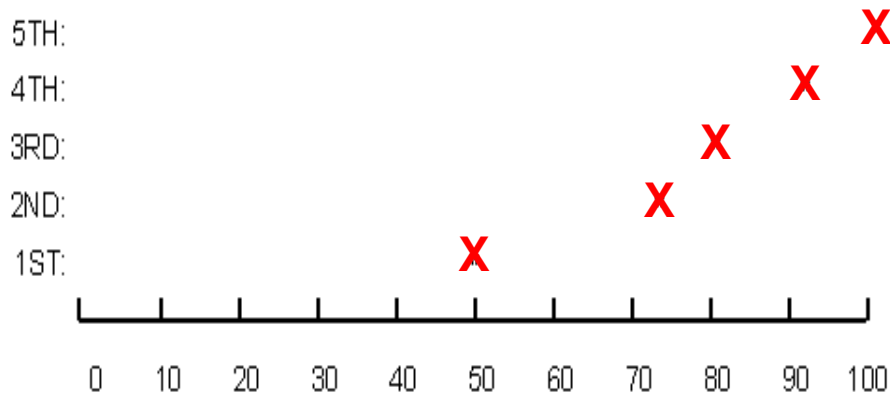
LAB ADV

QUINTILE	SAMPLE SIZE	PROPORTION	SCORE RANGE
5	10	0.19	77.50 - 95.00
4	11	0.21	72.50 - 77.50
3	10	0.19	65.00 - 72.50
2	11	0.21	57.50 - 65.00
1	10	0.19	42.50 - 57.50

Break down exams scores into 5 groups of equal numbers based on score

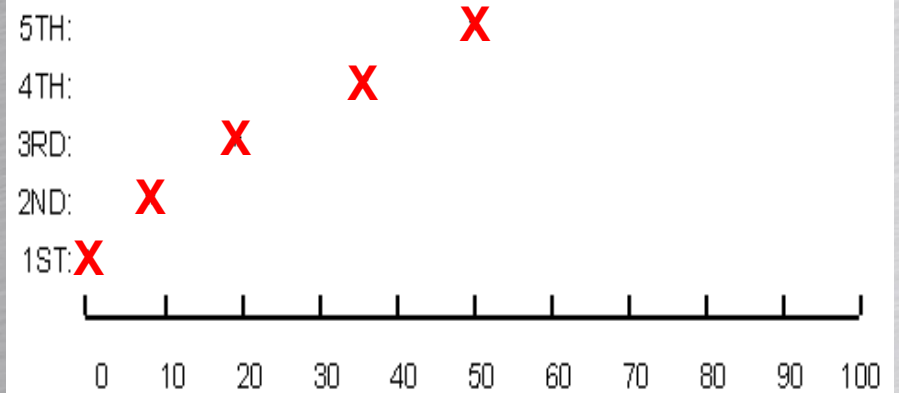
Good question

PERCENT RESPONDING CORRECTLY BY QUINTILE



Tough question?

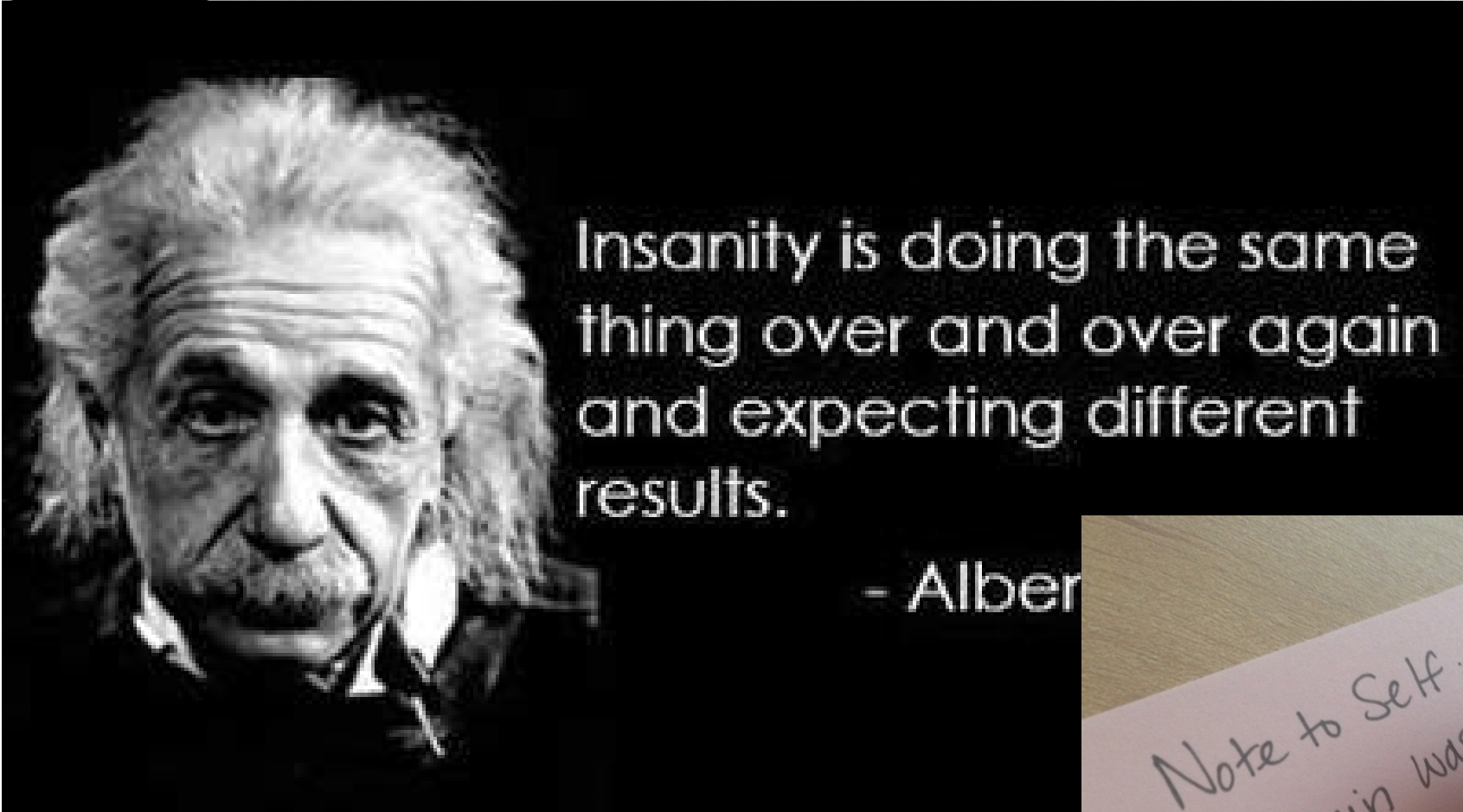
PERCENT RESPONDING CORRECTLY BY QUINTILE





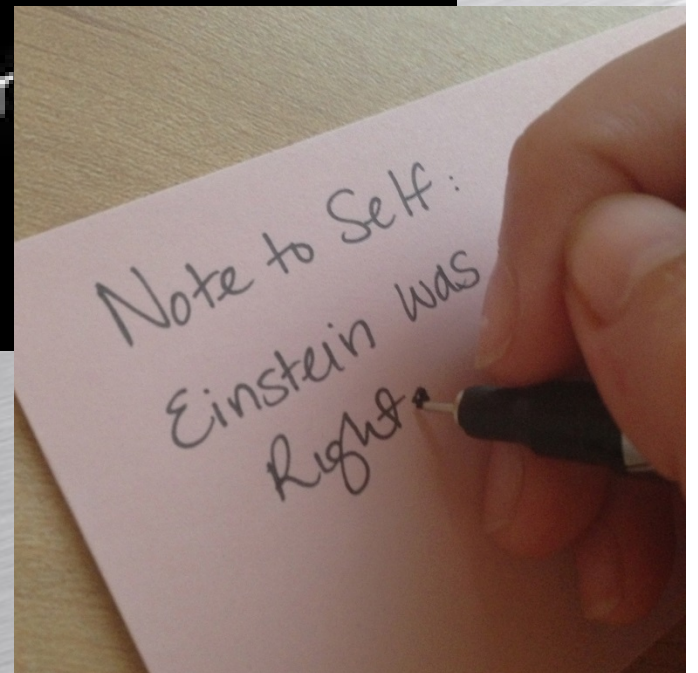
WHY are people failing this exam? | 12 |

- What's hard about it?
- Did you look at the Study Guide first?
- Did you take a prep class?
- If you took a class...do you think it helped?
- No different than corrective action in the lab
- Gun analogy...is it you, the ammo, or the rifle?
- Can we rule out things one at a time?
- **But if you repeat the same process, you should expect the same results.**
- If it's not you or the rifle...maybe switch ammo



Insanity is doing the same thing over and over again and expecting different results.

- Albert

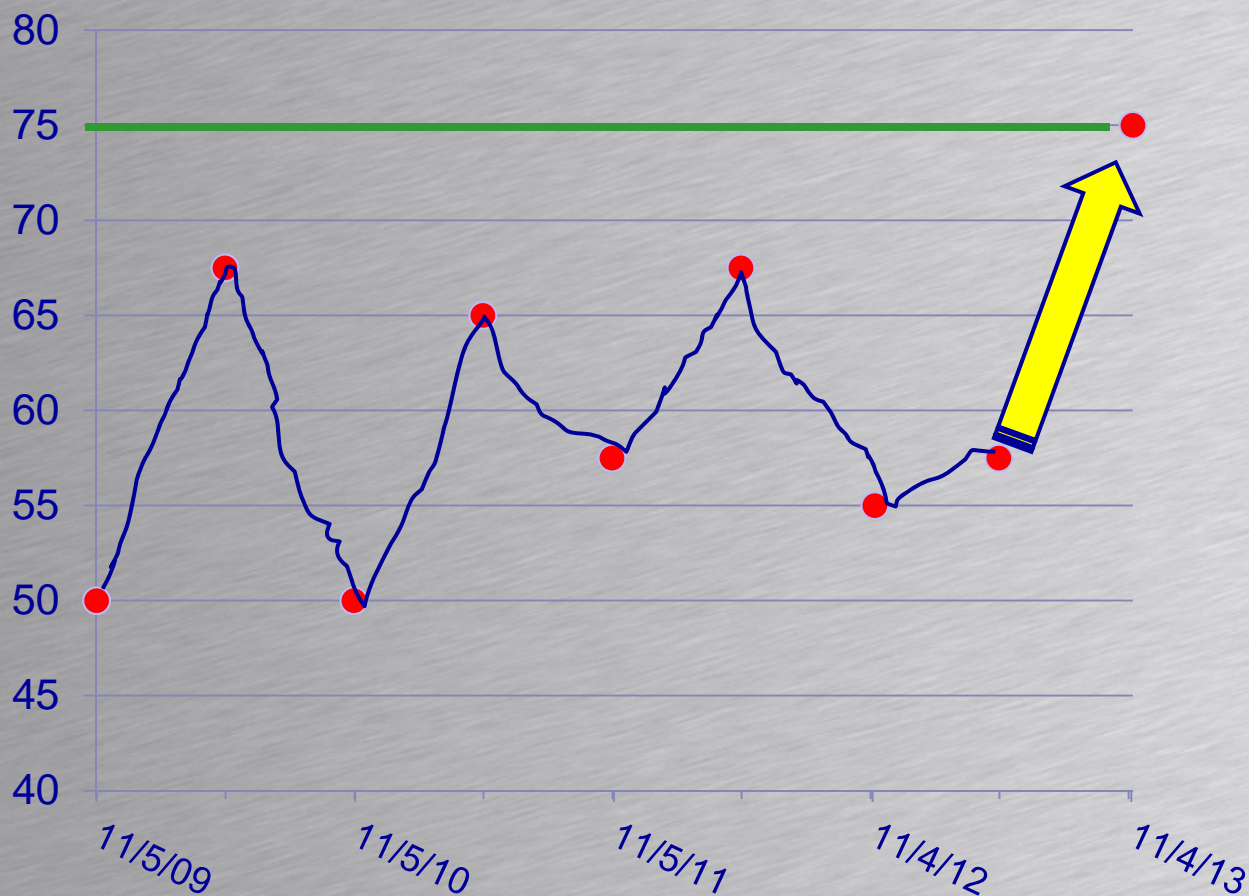




Operator X

- What corrective action did Operator X take over 8 exam cycles for the Adv. Lab Exam?

05-Nov-09	50
05-May-10	67.5
03-Nov-10	50
04-May-11	65
02-Nov-11	57.5
02-May-12	67.5
07-Nov-12	55
01-May-13	57.5
06-Nov-13	75





Myth / Reality

MYTH: One needs to pass the Lab Exam **BEFORE** one does any lab testing.

REALITY:





Exam Review: Good News 1st

INTRO Knowledges with >75% Pass

- 100% can define BOD!
- 99% can explain the function of a desiccator.
- 97% understand proper handling of weights.
- 95% know conditions that affect drying ovens.
- 95% know how and why records need to be permanent.
- 94% know when seeding is required for BOD.
- 92% understand super-saturation. **BUT...**
- 91% know when to use wide-bore pipets.





Now the Not-so-Good News....

INTRO Knowledges with 50 - 75% Pass



- 60%: Know what bias and precision are.
- 59%: Understand the concept of seeding BOD.
- 57%: Know the acceptance criteria for ISE
- 56%: Know the difference between arithmetic and geomean.
- 53%: Understand why, with ISE, samples and standards must be at the same temperature.
- 52%: understand how sample dilution volume affects the LOD for BOD.
- 51%: Given sample data, can calculate BOD.



...and the REALLY
not-so-good news



INTRO Questions with < 50% Pass...

- **56%** still don't know the purpose of NaOH buffer for ammonia by ISE.
- **60%** don't know requirements for certified weights.
- **60%** don't know the best concentration to determine LODs.
- **62%** don't know the required LOD for TSS.
- **74%** don't know about balances.
- **82%** don't know understand LOD/LOQ.
- **85%** don't know calibration requirements for TP.
- **86%** don't know critical conditions for TP color development.



Exam Review: Good News 1st

ADV Knowledges with >75% Pass

- You know about MSDS and Chemical Hygiene plans.
- You know about Beer-Lambert's law.
- You know how to re-certify balance weights.
- You know about reducers.
- You know how to use the $C_1V_1=C_2V_2$ formula.
- You know how oil&grease affects TSS.





Now the Not-so-Good News....

ADV Knowledges with 50 - 75% Pass

- 63%: Understand how incubator temperature affects BOD results.
- 61%: Know when the fill-hole on a pH electrode must be open.
- 60%: Understand deionization & reagent water
- 59%: Can explain what causes slow phosphorus color development..
- 59%: Know how to improve pipeting accuracy.
- 52%: Understand over-dechlorination & BOD.
- 51%: Understand what dictates whether a sample exceeds the calibration range.





...and the REALLY not-so-good news



ADV Questions with < 50% Pass Rate

- 56% still **don't how** an ISE works.
- 57% **don't how** what causes low GGA.
- 61% **don't how** how to determine the best volume for BOD.
- 61% **don't** understand sample pres. Temp.
- 65% **don't** understand linear regression.
- 69% **don't** know how TKN and NO₃+NO₂ re used in process control.
- 73% **don't how** required blanks for TP testing.
- 85% **don't how** causes of reduced color (TP).

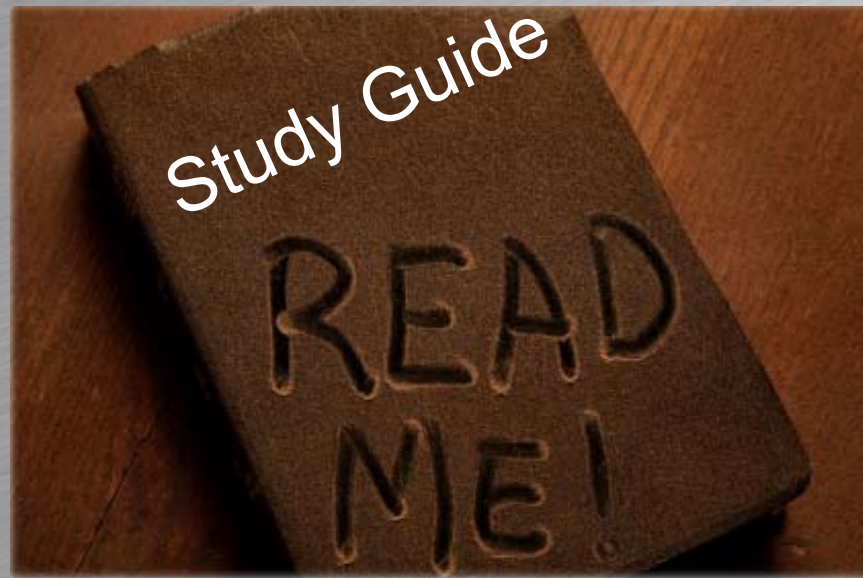


Post-Exam QA/QC

- We DO look at Exam results!
- A Quality Assurance review to ensure that the exam is properly measuring operator knowledge.
- Ask the questions:
 - Is the passing rate acceptable?
 - Particular question(s) too easy?
 - Particular question(s) too difficult?
 - Is there more than one perceived correct answer?
- Additionally, review operator comments/concerns about the exams



READ the Study Guides!



- READ the Study Guides.
- ...and ...don't be like Sherby!



READ THE STUDY GUIDES!

- Kaffee: You gotta trust me, Sherby, you read the Study Guide and your chances of passing the exam increase by a factor of 10





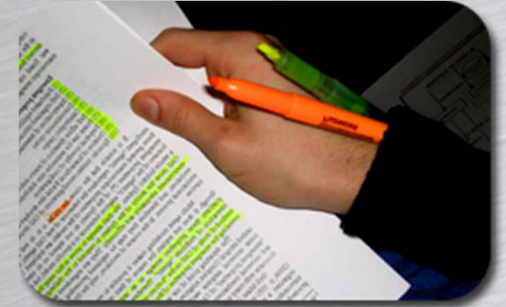
How to
effectively
study/prepare
for an exam:

Reading for
Comprehension





Reading for Comprehension



- **Highlight** important ideas.
- Circle or bracket **key terms**.
- Identify the **main point(s)** of the info.
- Can you eliminate

information?

“extraneous”

- Look for “telling” words: “**always, must, require**”
- What **question(s)** would YOU create?



Reading for Comprehension

isolating critical info

| 27 |

5.1.04 Define super-saturation.

- Supersaturation **means** that the water contains more DO than it SHOULD contain according to physical tables.
- **According to tables,** the saturation point of oxygen in water at 20° and 760 mm pressure -which is standard temperature and pressure at sea level- is 9.06 mg/L. So, yes, at sea level and 20°C, anything over 9.06 mg/L represents supersaturation.
- The method kind of “defines” super-saturation as anything above 9.0 mg/L. **However,** in reality saturation will vary with temperature and pressure. Consult a DO saturation table.



Multiple Choice Test Taking Tips

- Read the question before you look at the answer.
- Come up with the answer in your head before looking at the possible answers, this way the choices given on the test won't throw you off or trick you.
- Eliminate answers you know aren't right.
- Read all the choices before choosing your answer.
- Don't keep on changing your answer, usually your first choice is the right one, unless you misread the question.



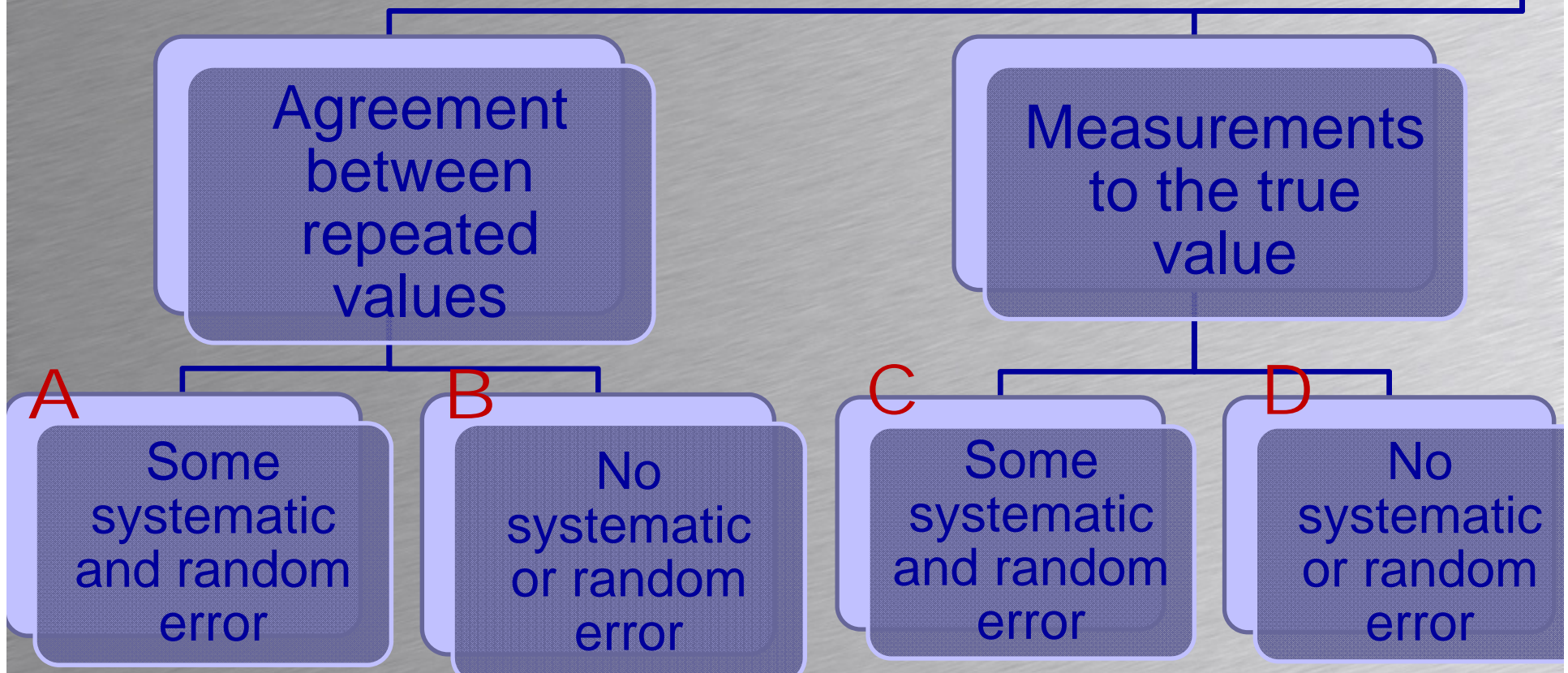
Many multiple choice answers have a dichotomy, or branching, to them. It's almost like a fork in the road and at the end of each fork are two doors.





Good precision can be defined as closeness of....

- A. Agreement between repeated measurements; some systematic/ random error
- B. Agreement between repeated measurements; no systematic/ random error
- C. Measurement to the true value; some systematic/ random error
- D. Measurement to the true value; no systematic/ random error

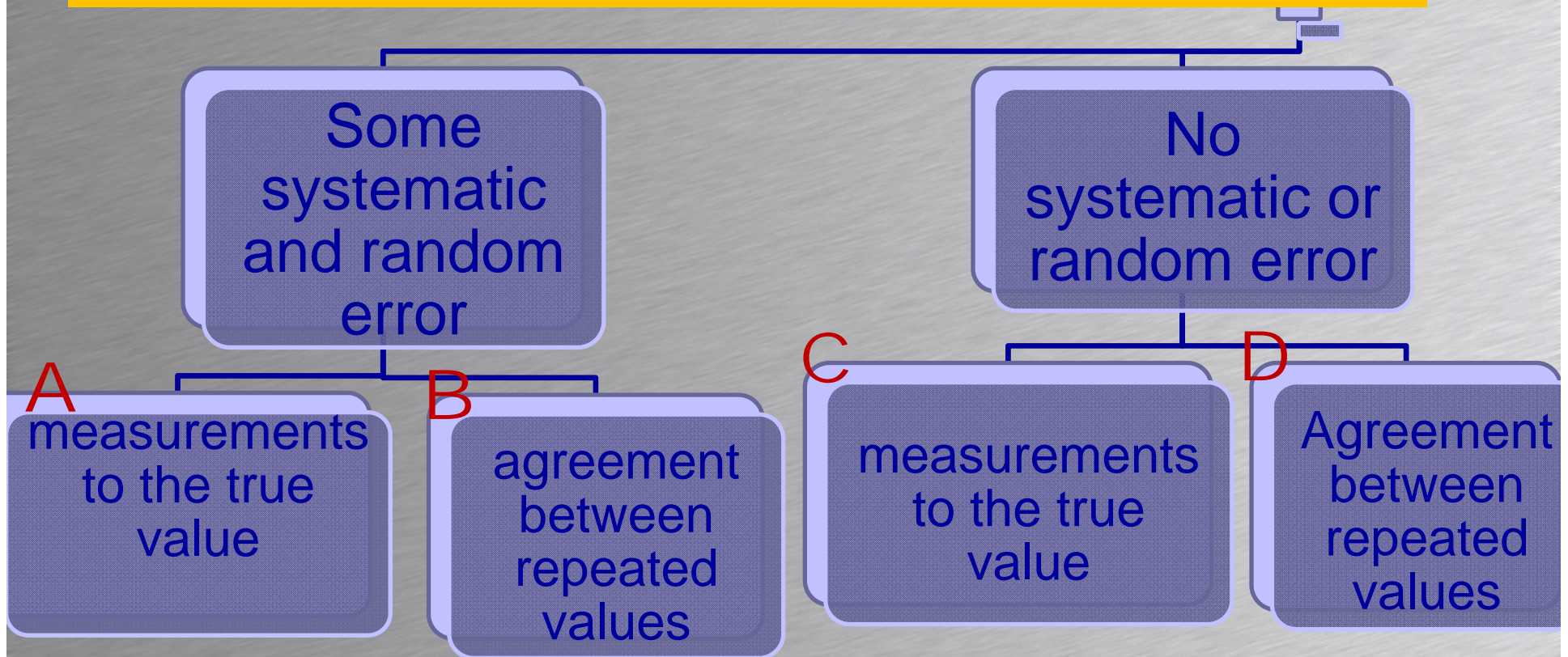




Good precision can be defined as closeness of....

m error
error

Or come at it from the other direction





Let's look at some
sample Lab
related questions
from other exam
sources



PHOSPHORUS

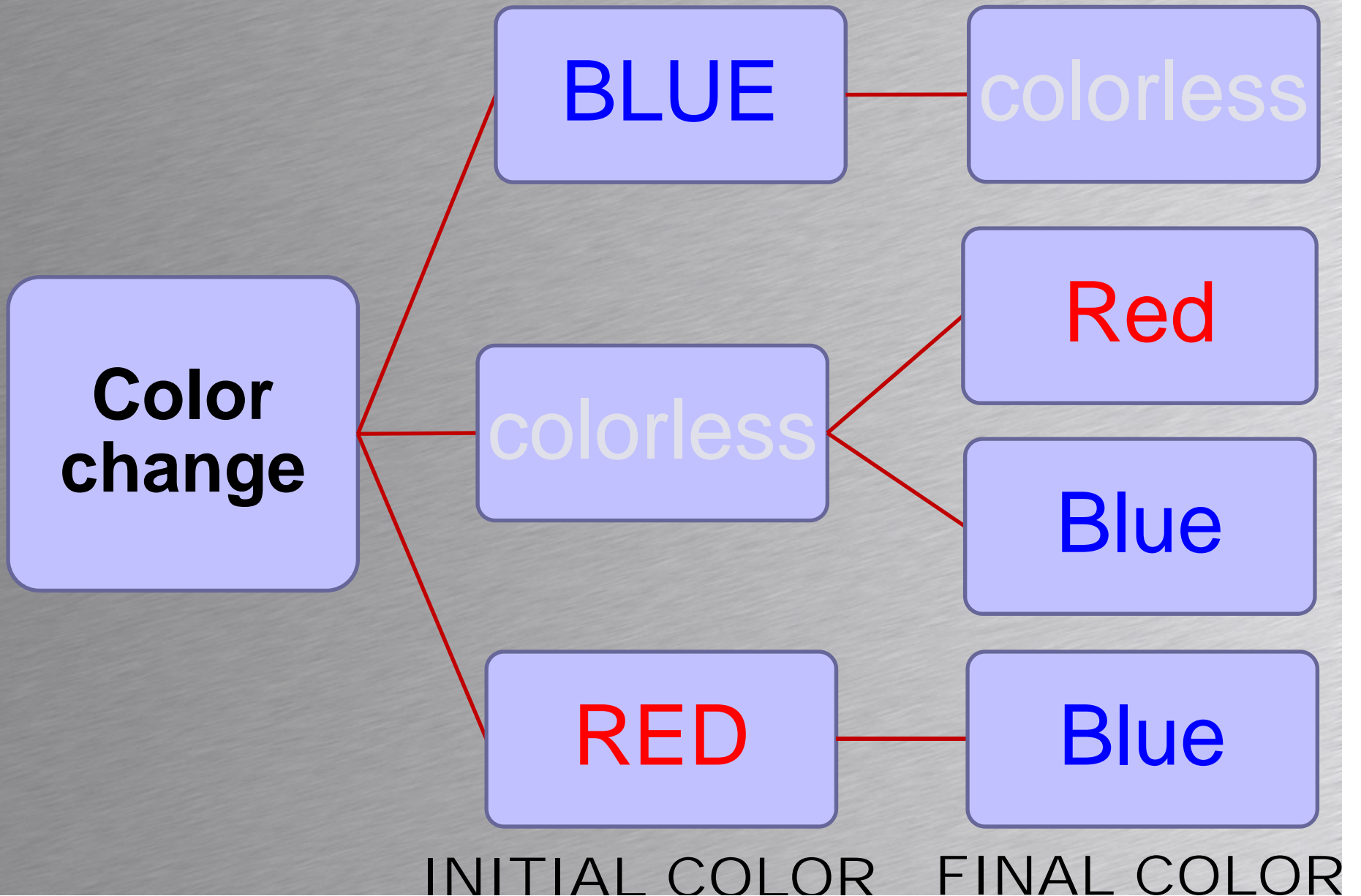
Between the pH range of 8.0 - 9.6 s.u., the indicator phenolphthalein undergoes what color change with increasing pH?

- A. Colorless to blue
- B. Colorless to red
- C. Red to blue
- D. Blue to colorless

- Break this question down to its basics.
- 3 of the 4 answers involve the color blue
- Does phenolphthalein ever give a blue color?
- If so, then at least you've eliminated 25% of the choices
- If not, then you've identified the correct answer



Phenolphthalein color change with increasing pH (8-9.6) | 35 |





Phenolphthalein

From Wikipedia, the free encyclopedia

"phph" redirects here. For Ph-Ph, see biphenyl.

Phenolphthalein /[fiːnɒlfˈθeɪliːn](#)^[1] is a chemical compound with the formula $C_{20}H_{14}O_4$ and is often written as "**HIn**" or "**phph**" in shorthand notation. Often used in **titrations**, it turns colorless in **acidic** solutions and pink in **basic** solutions. If the concentration of indicator is particularly strong, it can appear purple. In strongly basic solutions, phenolphthalein's pink color undergoes a rather slow fading reaction and becomes colorless again. The molecule has four forms:

Species	H_2In	In^{2-}	$In(OH)^{3-}$
Structure			
Model			
pH	0–8.2	8.2–12.0	>12.0
Conditions	acidic or near-neutral	basic	strongly basic
Color	colorless	pink to fuchsia	colorless
Image			

Thanks,
Wikipedia

<8.2 colorless

8.2-12 pink

>12 colorless



Calibration

When calibrating an instrument that uses a linear curve, what is the minimum number of concentrations that must be used?

- A. One
- B. Two
- C. Three
- D. Five

- Read carefully! Do not leap to conclusion or decide on the answer without reading the question fully.
- It says calibrate...not CHECK the calibration.
- MINIMUM...not how many standards YOU use in your lab.



How do you preserve a sample for ammonia if it cannot be analyzed when collected ?

Cool to \leq
 10°C

Add NaOH
to pH > 11

A

Add H₂SO₄
to pH < 2

B

Add NaOH
to pH > 11

C

Cool to \leq
 6°C

Add H₂SO₄
to pH < 2

D

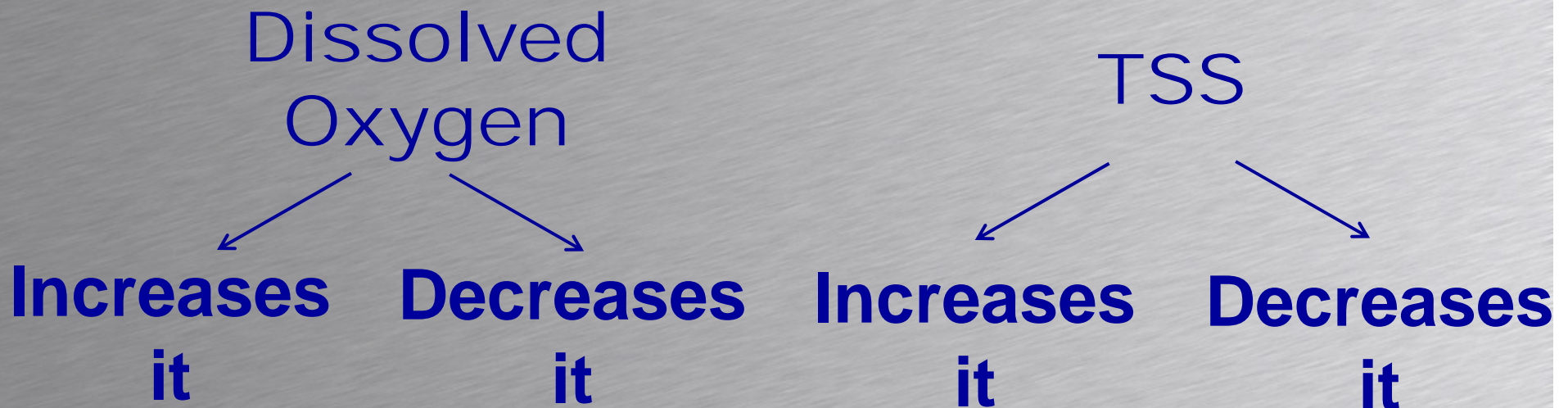
1. Temperature
2. Acid? Or Base



BASIC ?s

Agitating a sample before measuring DO for BOD ...

- a. Decreases the DO.
- b. Increases the DO.
- c. Decreases the SS.
- d. Increases the SS.



Example of a bad question...why?



BASIC - BOD

The BOD of wastewater determines the milligrams per liter of oxygen required...

- a. During stabilization of decomposable organic matter by aerobic bacterial action.
- b. To produce an equilibrium between the oxygen of the wastewater and atmospheric oxygen.
- c. To unite chemically with the inorganic matter present in the sample.
- d. For the oxidation of sulfites and thiosulfates to sulfates.

Minimal rewording of answers



BASIC - BOD

The BOD of wastewater determines the milligrams per liter of oxygen required...

- a. Bacterial action on organic matter
- b. Equalize wastewater Oxygen with air
- c. Bond with inorganic matter
- d. Oxidize sulfites and thiosulfates

Minimal rewording of answers



BASIC - BOD

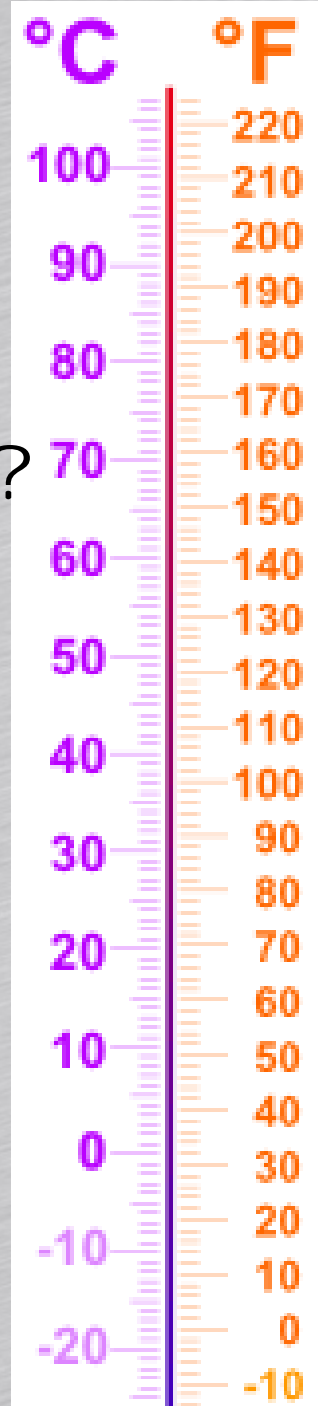
BOD incubation is at:

Incubate? or Hibernation?

- c. 20° F.
- d. 20° C.



- 37 °C equals about 98 °F...so since both can't be right, neither is!
- Where would you prefer to incubate? At 20 °F or 20 °C?





You're guessing!

The temperature preservation requirement for most wastewater tests is that they not be frozen and must be stored at:

- A. ≤ 4 °C [10% chose this]
- B. 4 ± 2 °C [45% chose this]
- C. ≤ 6 °C [43% chose this]
- D. 6 ± 2 °C [2% chose this]

Retired ADVANCED question



Creating Flashcards

- Summarize the **CRITICAL** information from the study guide and copy to index cards.
- Use **THESE** to study

Writing your own questions

- If you were quizzing someone on the topic, what questions would you ask?
- Writing the question and correct answer is the easy part.
- Coming up with 3 “wrong” answers without using all/none of the above and not being too tricky is a challenge!



What questions would YOU write for this?

| 45 |

5.4.10 Explain why temperature is so critical when using the ion-selective electrode.

- Ammonia electrodes function according to the physical constraints of the Nernst equation, and in that equation temperature is the only variable. Each one degree ($^{\circ}\text{C}$) change in temperature is associated with a 1-2% error due to changes in the electrode slope. Therefore, calibration standards and samples must be at the same temperature.



How about these....

- What is the principle that governs electrode operation: **the Nernst equation.**
- What is the only variable in the Nernst equation: **Temperature**
- 1 degree C temp change = **1-2% error.**
- Standards & samples must be: **same temp.**

Study Guide Review...

where the knowledge detail expands considerably.
But stick to your tactical approach!

Identify “buzz” words:

shall, must, require, only always, every, **however**

Take note of any numbers/values (criteria)

Ignore extraneous words

Find the point(s) being made.

Try to separate informative but non-critical info

Create flashcards

Write your own questions