DESIGN OF HYBRID ASSESSMENTS FOR JUNIOR ELECTROMAGNETISM COURSES

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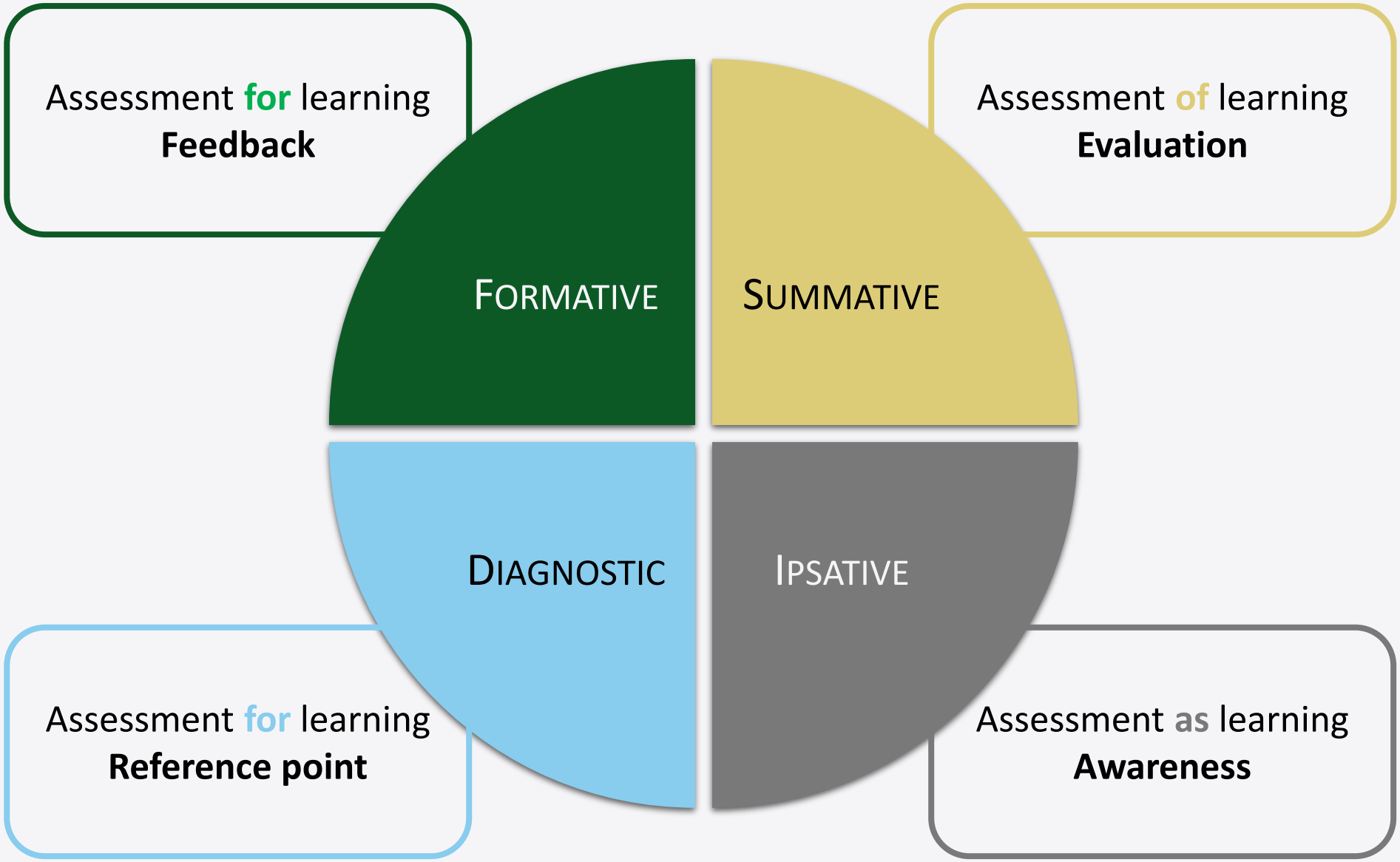
Outline

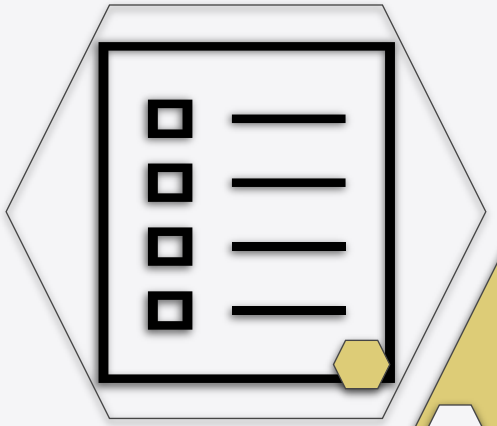
- Assessments
- Motivation
- Transitions
  - Training for summative assessment
  - Summarizing the formative assessment
  - Self-directing the learning process
- Realization

ASSESSMENT



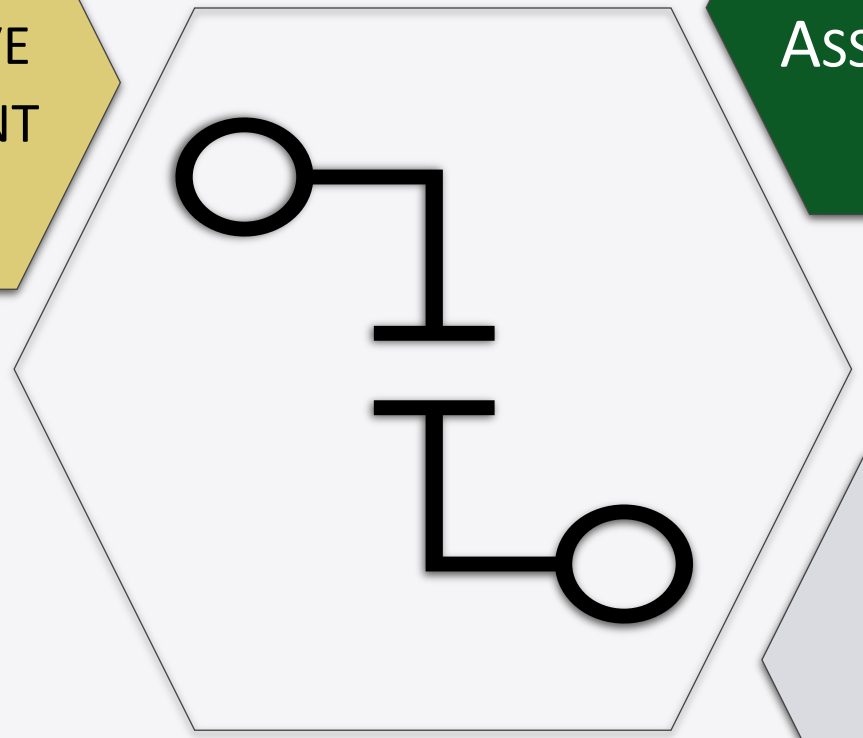
H. L. Andrade and G.L. Cizek, Eds, *Handbook of Formative Assessment,* New York, Springer, 2014, pp 344 – 351
D. Boud, N. Falchikov, Eds, *Rethinking Assessment in Higher Education: Learning for the Longer Term,* Taylor & Francis Group, 2007
Z. S. Siddiqui, Pak. J. Med. Sci, vol 33, no: 2, pp: 5050 – 509, 2017

NARRATIVE

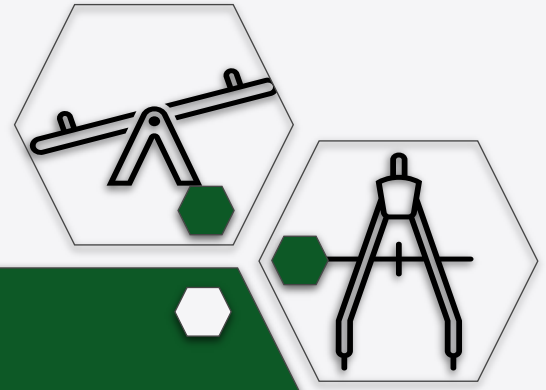


HIGH - EFFORT
RIGID
HIGH - STAKES
ONE – SHOT
PREFERENTIAL

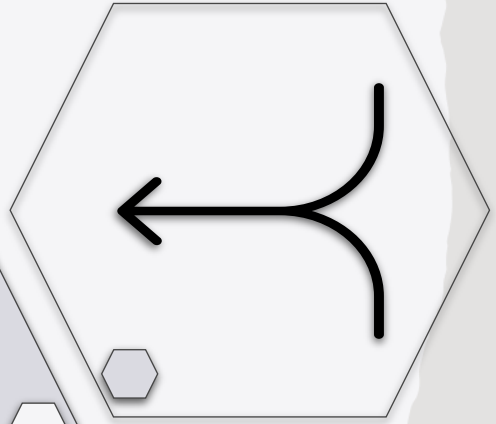
SUMMATIVE ASSESSMENT



WORKLOAD
PRACTICE
ONE – SHOT
GRADE
COMPLIANCE



FORMATIVE ASSESSMENTS



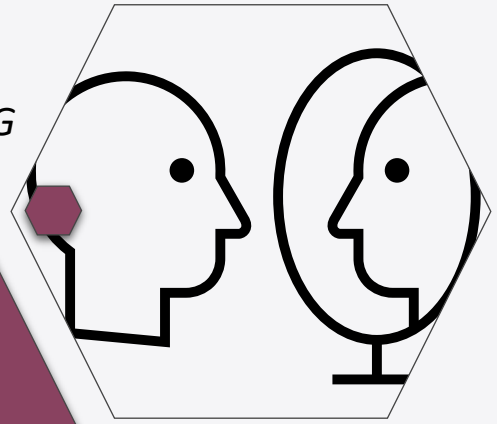
COURSE INCOMES & OUTCOMES

ASSUMED
MAGICALLY ACQUIRED

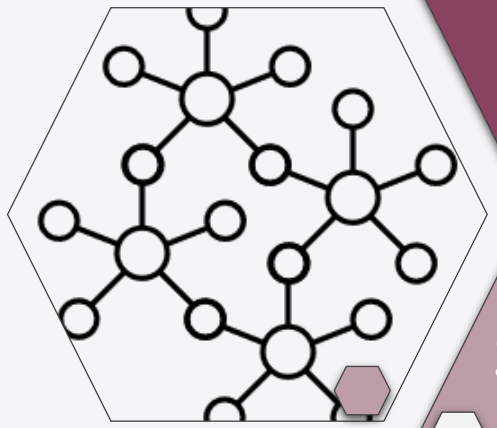
N. F. Buchholtz et al, *ZDM,* vol. 50, pp. 715-728, 2018.
J. Broadbent et al., *As. Eval. High. Educ.,* vol. 43, no. 2, pp. 307-322, 2017.
J. Dolin and R. Evans, Eds*, Transforming Assessment,* New York, Springer, 2018, pp. 53-80.
V. J. Shute & Y. J. Kim, *Handbook of Research and Educational Communications and Technology*, New York, Springer, 2014, pp. 311 - 321.
M. Roman-Gonzalez et al, *Comput. Think. Educ.*, S. C. Kong and H. Abelson, Eds., Singapore, Springer, pp. 79-98.

Narrative

Literature
Research Informed teaching



Reflection & Self Assessment



Learning Community

Learner in the Center
Embracing holistic Approach
Compliance → engagement

Students as Owners of Learning

Workload Management
Meaningful assessments
Creating connections
Learning Paths

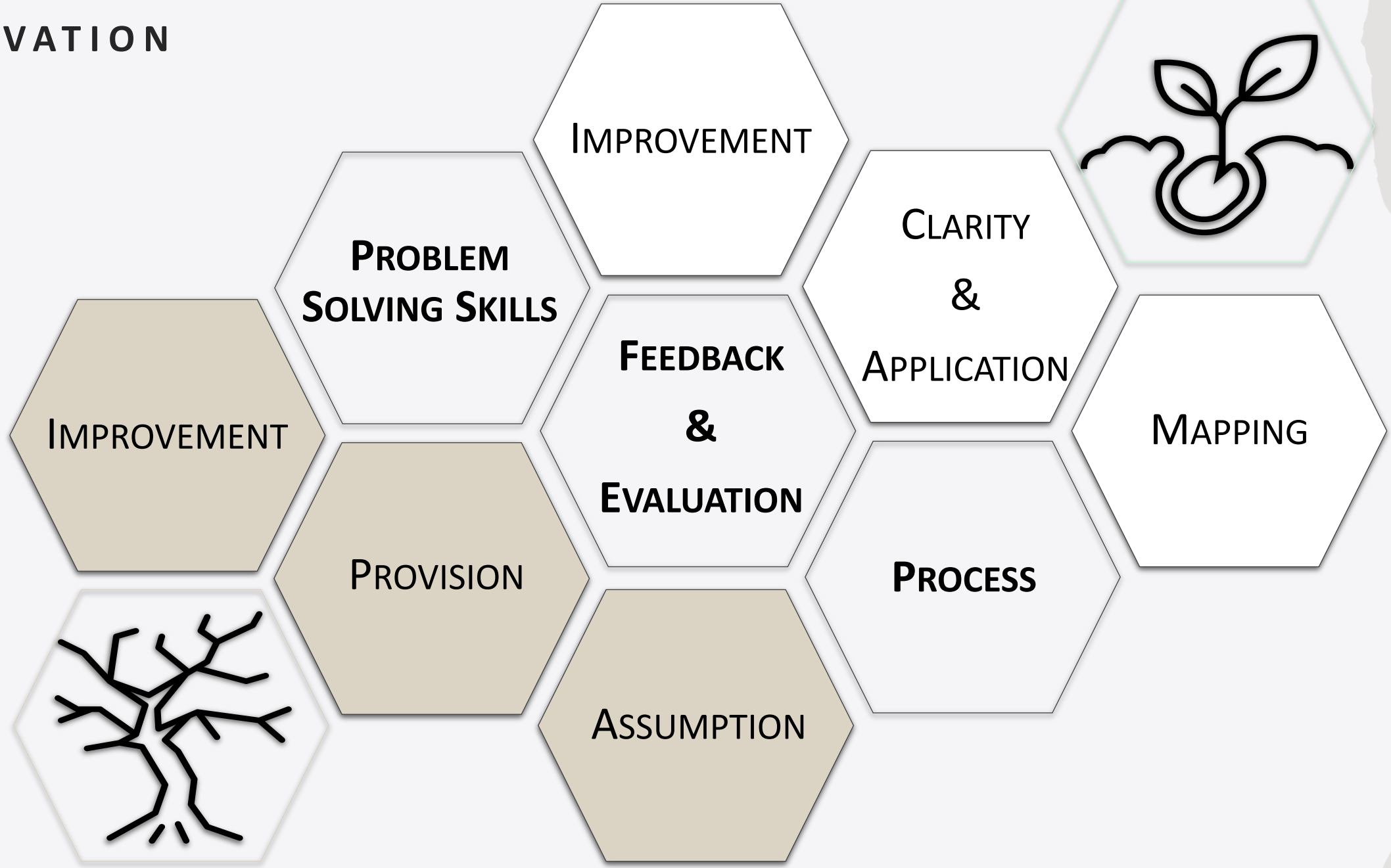
P. Black an D. William, Assess. Educ.: Princ. Polic. Pract. vol.5, no. 1, 7-74, 1998
OECD, *Synergies or Better Learning: An International Perspective on Evaluation and Assessment,* OECD Publishing, Paris, 2013

Outline

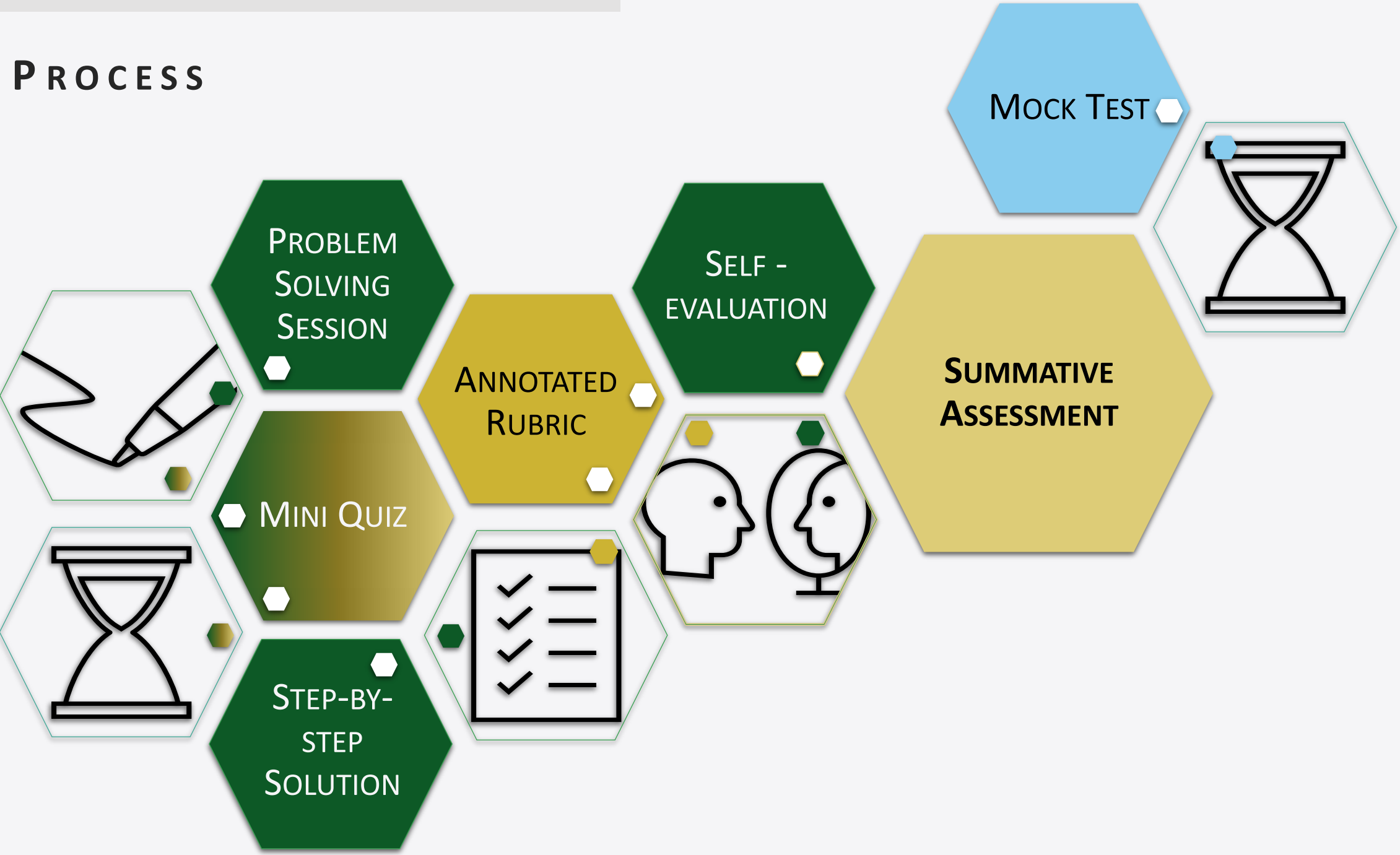
- Assessments
- Motivation
- Transitions
  - Training for summative assessment
  - Summarizing the formative assessment
  - Self-directing the learning process
- Realization

TRAINING FOR SUMMATIVE

Motivation


Improvement
Problem Solving Skills
Clarity & Application
Improvement
Feedback & Evaluation
Mapping
Provision
Process
Assumption

PROCESS


MOCK TEST
PROBLEM SOLVING SESSION
SELF - EVALUATION
SUMMATIVE ASSESSMENT
ANNOTATED RUBRIC
MINI QUIZ
STEP-BY-STEP SOLUTION

FEEDBACK

"Problem sessions."

Introductory Physics I, F2016, when asked to indicate the most valuable component of the course.

"Clearest marking rules ever."

General Physics II, S2015

"I have never appreciated how hard marking is."

General Physics I, W2013

"I don't think I will be able to solve any physics problem without drawing a coordinate system in first."

General Physics II, F2015.

"I think we should incorporate the way you're doing the problem sessions into all our first year courses."

Academic Program Officer, Memorial University, Fall 2015

"It is ridiculous that she makes us mark our own work."

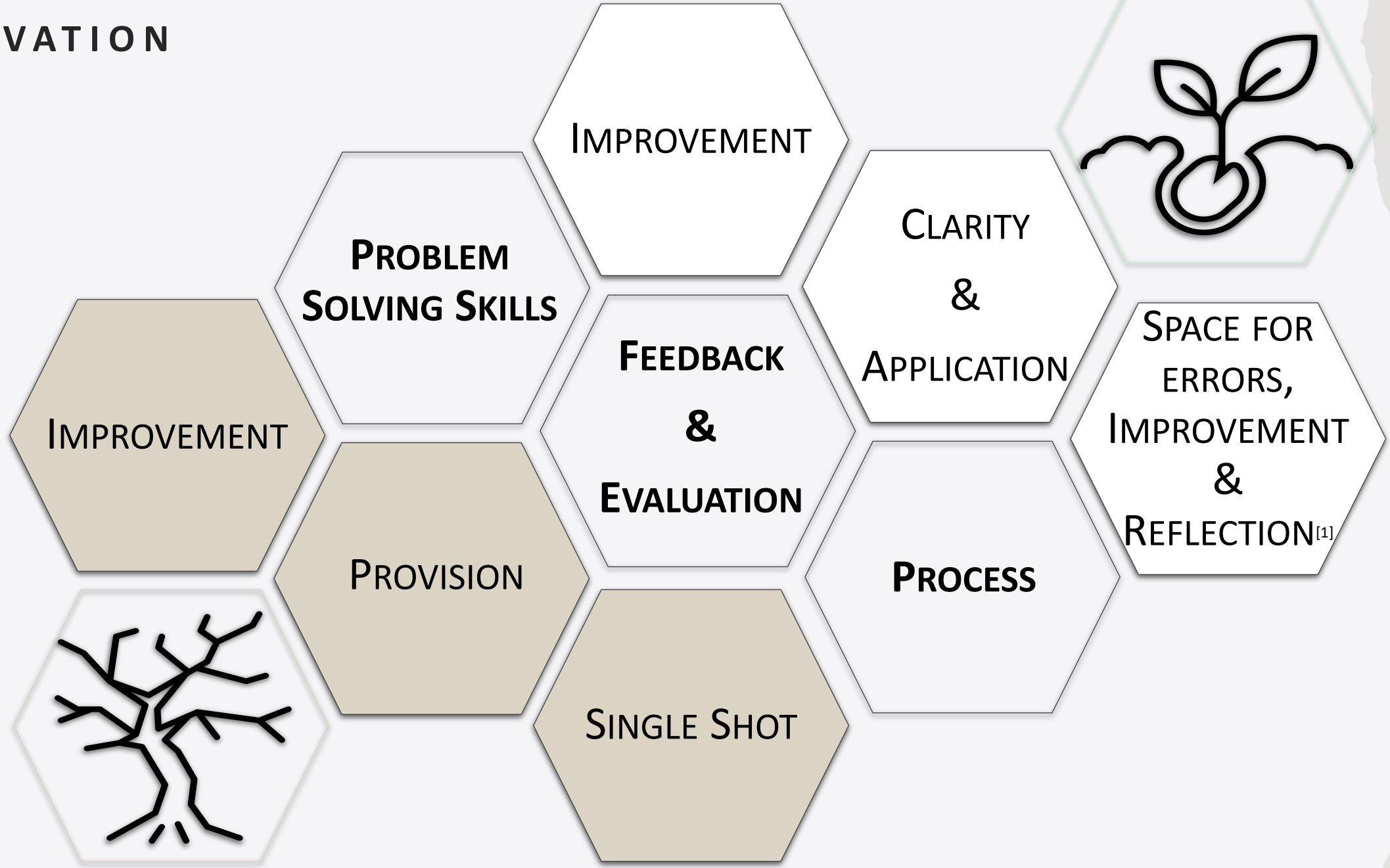
General Physics II, S2014

"Get a TA."

General Physics II, S2015

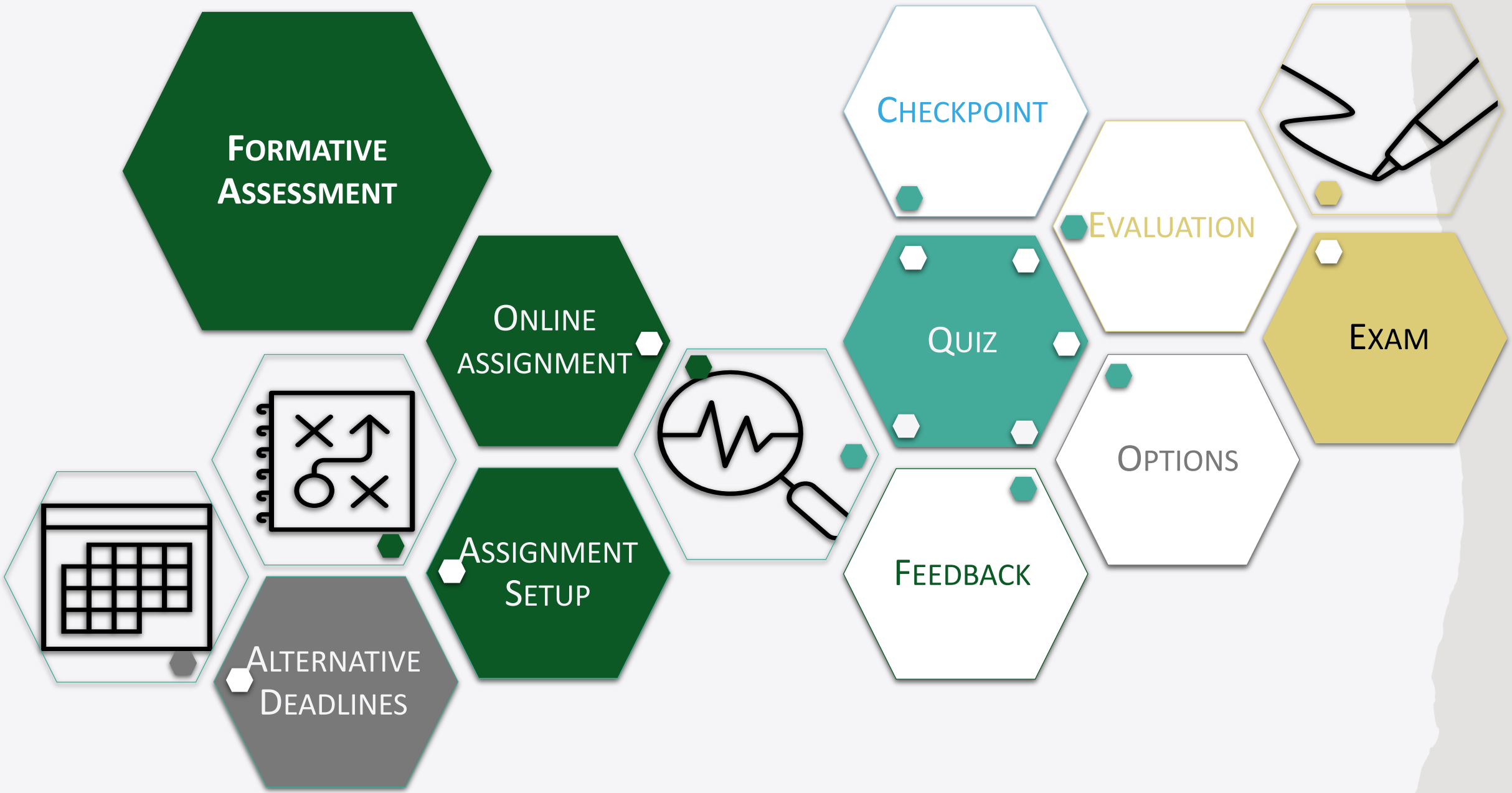
SUMMARIZING THE FORMATIVE

Motivation



[1] A. Astin, Achieving educational excellence. A critical assessment of priorities and practices in higher education. San Francisco: Jossey-Bass Publishers, 1985

Process


Formative Assessment
Online assignment
Assignment Setup
Alternative Deadlines
Checkpoint
Quiz
Feedback
Evaluation
Options
Exam

FEEDBACK

"[...] marking style for assignments and quizzes [...] was a huge weight off my shoulders.

PHYS 355 USRI comment, W2021

Aggregated responses to the question regarding the most valuable aspects of the course on the universal student rating instruction questionnaire in PHYS 321

"[...] opportunities to make mistakes and not have them negatively affect us in the course."

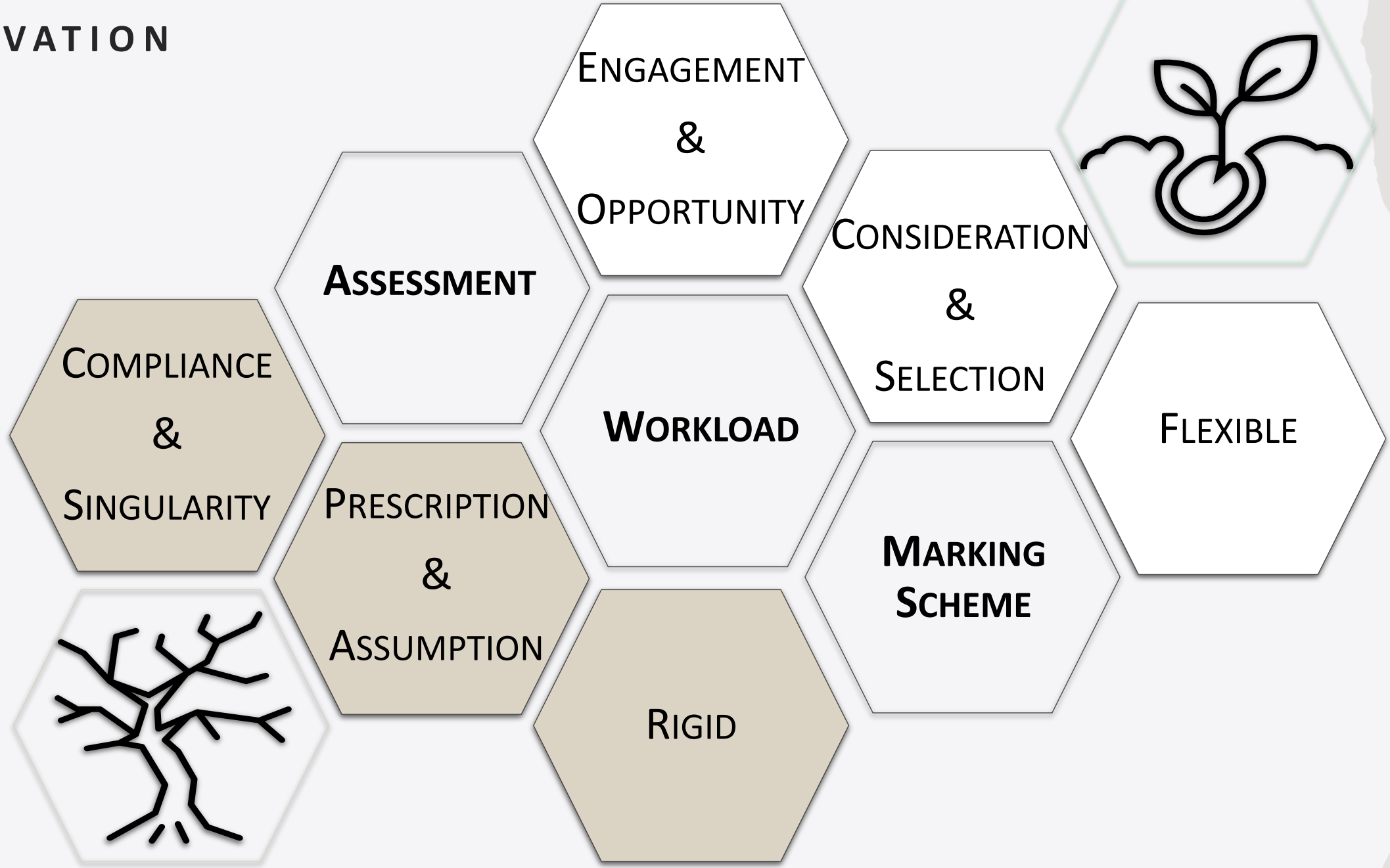
PHYS 355 USRI comment, W2021

"Mistakes feel like learning opportunities [..] instead of „world ending" situations."

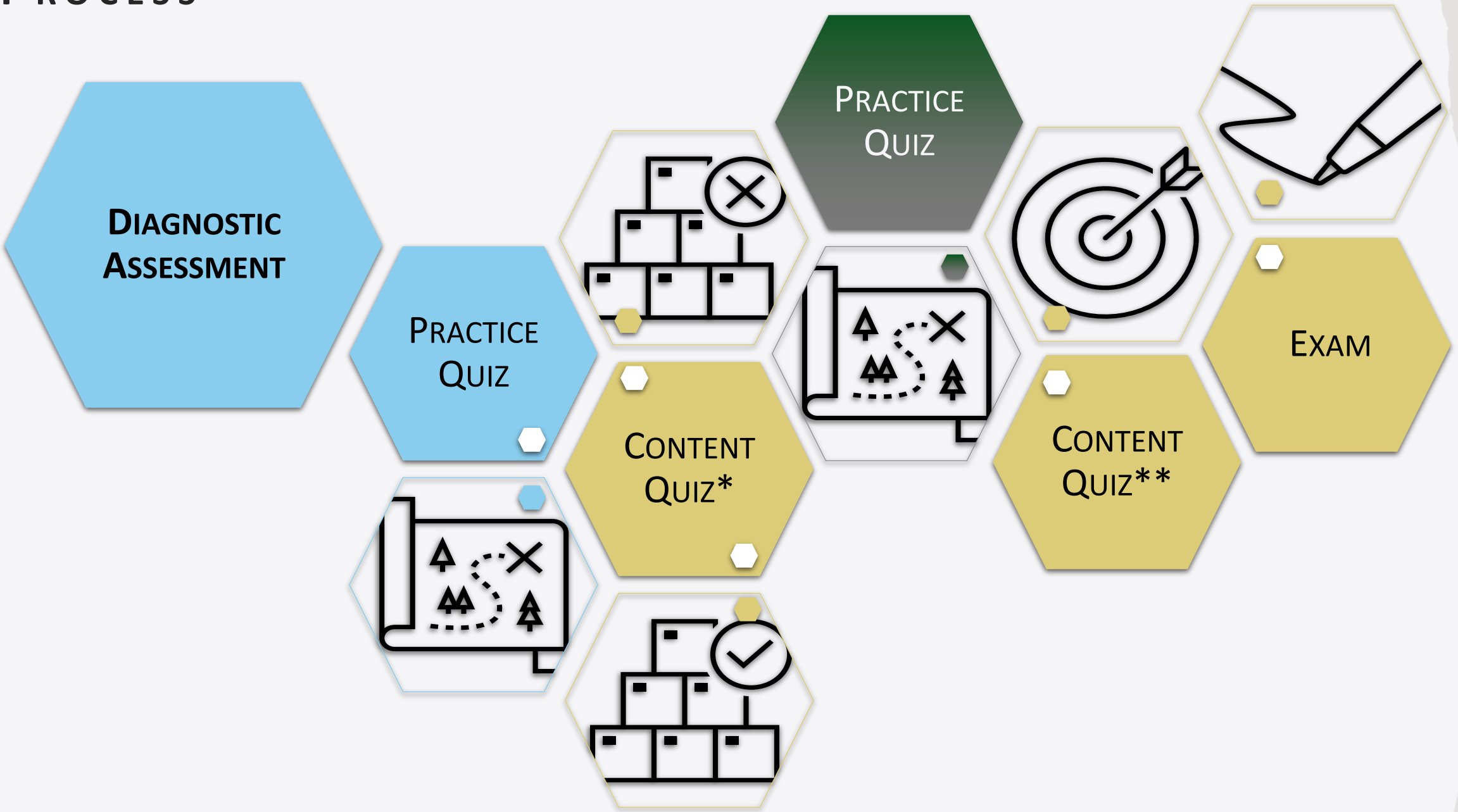
PHYS 355 USRI comment, W2021

SELF-DIRECTING THE PROCESS

Motivation


Engagement & Opportunity
Assessment
Consideration & Selection
Compliance & Singularity
Workload
Flexible
Prescription & Assumption
Marking Scheme
Rigid

PROCESS


DIAGNOSTIC ASSESSMENT
PRACTICE QUIZ
CONTENT QUIZ*
PRACTICE QUIZ
CONTENT QUIZ**
EXAM

FEEDBACK

"I loved the little quizzes she made."

PHY 132 CE comment, W2022

"Questions on the tests were relevant."

PHY 132 CE comment, W2022

„After class quizzes [...] unlimited tries give students the chance to truly learn the material without having to be afraid of failing [...] (*and*) the opportunity to rethink their method of solving the problem instead of just focusing on getting the right answer"

PHY 132 CE comment, W2022

"some test questions highly correlated to learned materials, while others did not and took up un proportional amounts of time."

PHY 132 CE comment, W2022

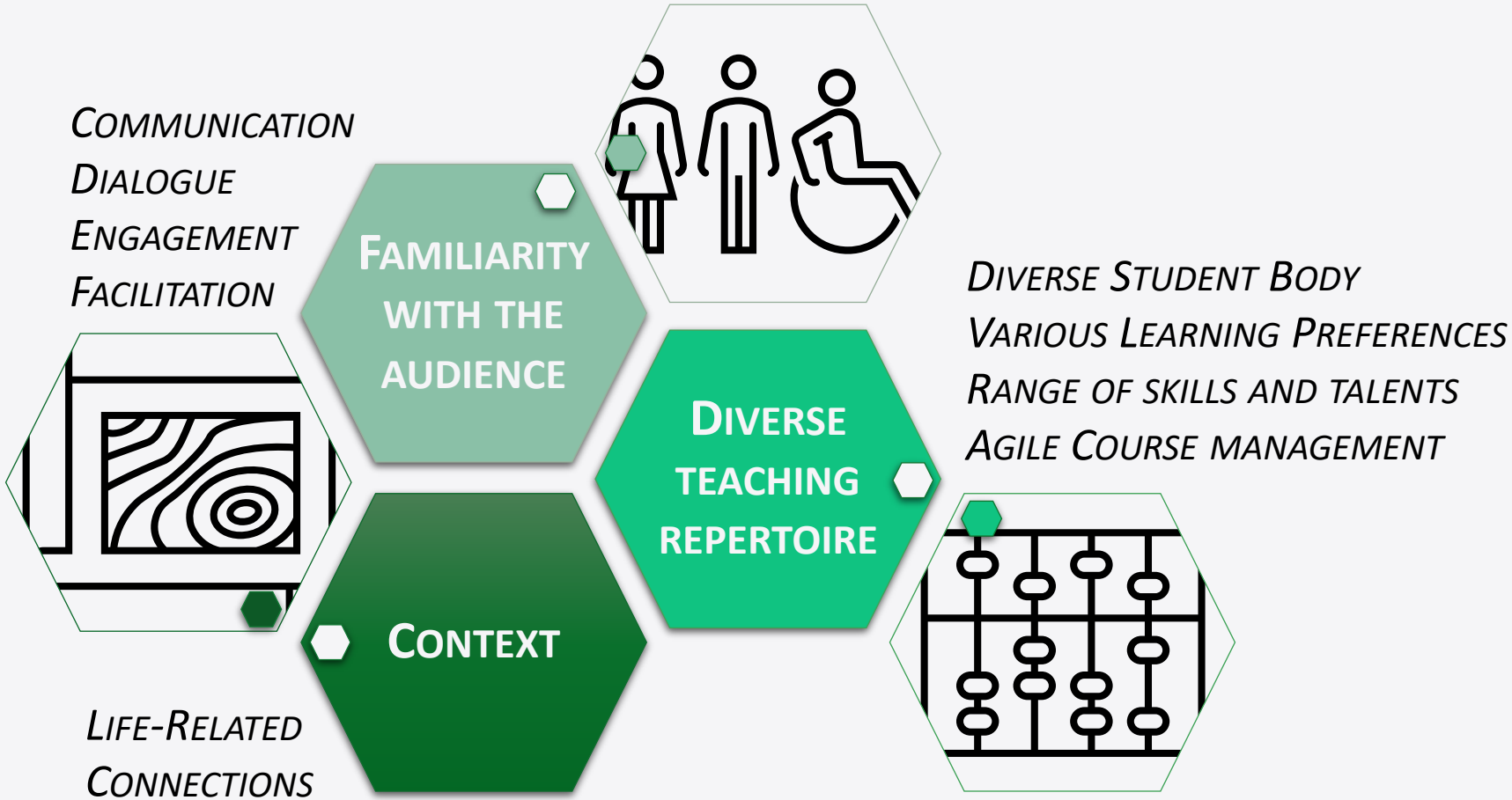
„(teaching team) was helpful in providing overall advice and letting us learn by ourselves while guiding us to make sure we didn't screw up too much."

PHY 224 CE comment, W2022

Teaching Philosophy

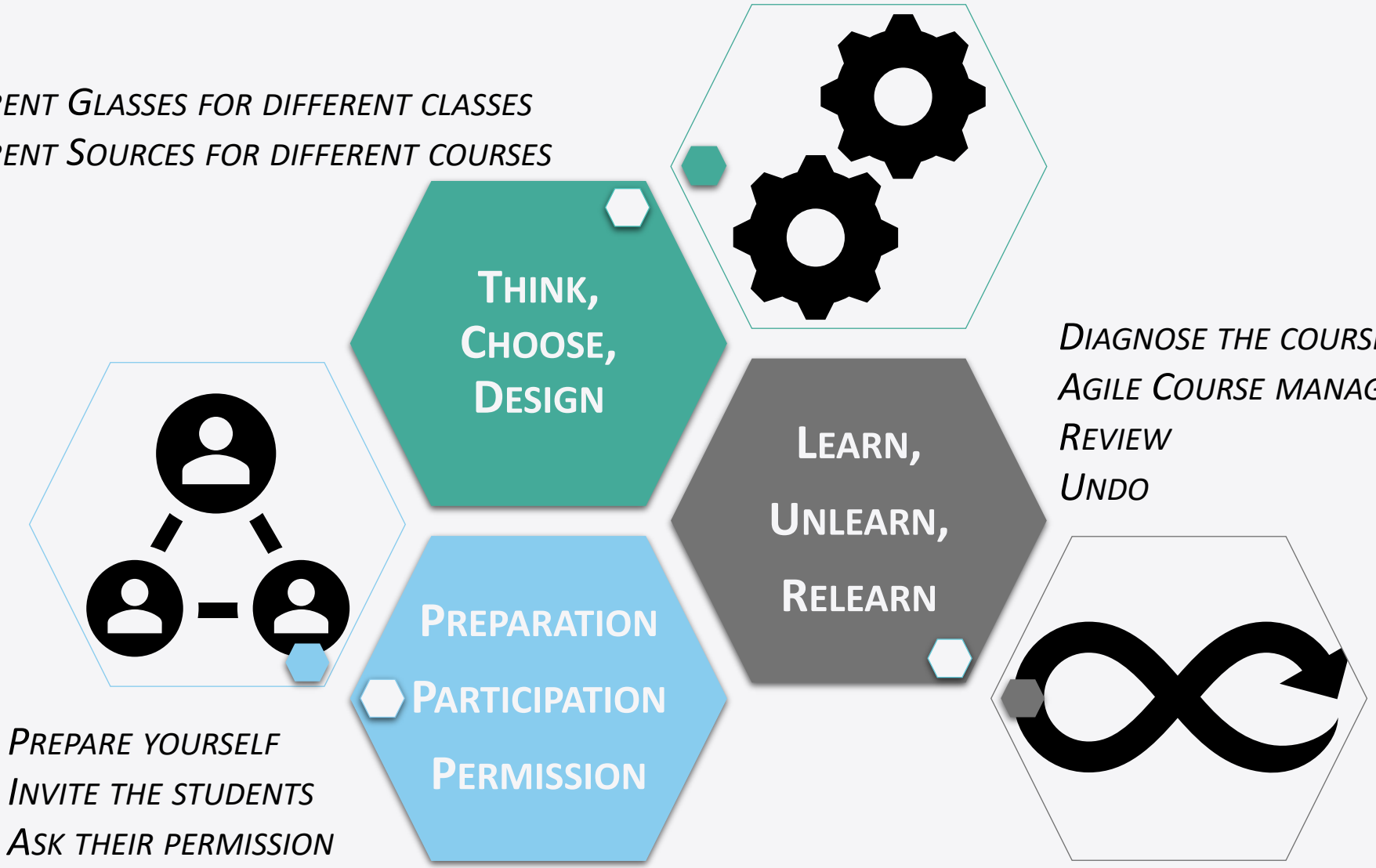
"I believe that the illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn"

Alvin Toffler



SUMMARY

DIFFERENT GLASSES FOR DIFFERENT CLASSES
DIFFERENT SOURCES FOR DIFFERENT COURSES



DIAGNOSE THE COURSE
AGILE COURSE MANAGEMENT
REVIEW
UNDO

PREPARE YOURSELF
INVITE THE STUDENTS
ASK THEIR PERMISSION

D. Boud, N. Falchikov, Eds, *Rethinking Assessment in Higher Education: Learning for the Longer Term,* Taylor & Francis Group, 2007

REALIZATION

Physics 1051 - Spring/Summer 2013. Problem Set IV
Dr. Ania Harlick

Problem 1 A conducting sphere with a radius a (cross section of the system shown in Figure 1) carries an excess charge $-2Q$. It is surrounded by a concentric conducting shell with an inner radius of b and outer radius of c. The field at $r > c$, $\vec{E} = -\frac{kQ}{r^2}\hat{r}$
(a) What is the electric field at a distance r from the center if $r < a$?
(b) What is the surface charge density on the surface $r = a$?
(c) What is the electric field at distance r from center if $a < r < b$?
(d) What is the surface charge density on the surface $r = b$?
(e) What is the surface charge density on the surface $r = c$?
(f) What is the net charge on the **shell**?
(g) What is the total charge on the system?

2 An infinitely long line of charge with charge density $\lambda = -35\ nC/m$ lies along the y-axis. An uncharged conducting cylindrical shell of length $l = 0.05$ m, inner radius $R_I = 0.02$ m and outer radius $R_O = 0.03$ m is oriented so its axis is along the line of charge, as shown in the figure below. Determine surface charge densities for inner and outer surface of the cylindrical shell. $(2.79 \times 10^{-7} C/m^2, -1.86 \times 10^{-7} C/m^2)$

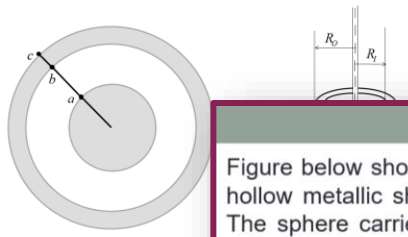


Figure 1: Figures for probl

Problem 3 An electron moves with a speed v of
Determine the magnetic force $\vec{F}$ (give magnitude
a) $\vec{v} = -v\hat{j}$. $[-8 \times 10^{-13}\hat{z}$ N]
b) $\vec{v} = -v\sin\frac{\pi}{4}\hat{j} + v\cos\frac{\pi}{4}\hat{k}$. $[8 \times 10^{-13}$ N, 45^o cl

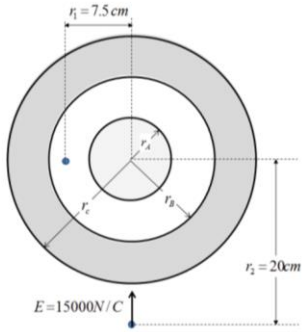
Problem 4 At time $t = 0s$ a proton is moving wit
axis. A uniform magnetic field of magnitude 1.50
a) What will be the y coordinate of the proton 10
b) What is the radius of the particle's orbit. [0.26

PROBLEM SOLVING SESSION

MINI QUIZ

STEP-BY-STEP SOLUTION

Figure below shows a solid metallic sphere with a radius $r_A = 5.0$ cm concentric with a hollow metallic shell with an inner radius $r_B = 10.0$ cm and outer radius $r_C = 15.0$ cm. The sphere carries an excess charge $q = +9.40$ nC. The total charge on the shell is unknown. Electric field measured distance $r_2 = 20.0$ cm from the center of the solid sphere is $E = 15.0$ kN/C and it points toward the center of the system.
All distances are measured from the center of the sphere.
A) Determine the magnitude of the electric field at $r = 2.50$ cm. [2 points]
B) Determine the charge density of the solid metallic sphere. [3 points]
C) Determine the electric field at $r_1 = 7.50$ cm. [3 points]
D) Determine the charge on the outer surface of the shell [2 points]



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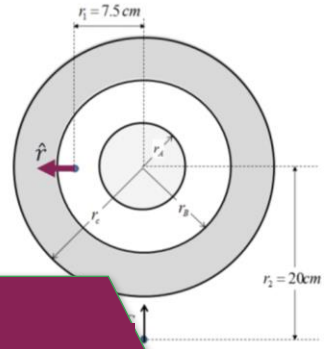


A)
$r_A > r$ 1 mark for recognizing the property
$\therefore$
inside a metallic object in equilibrium
$E = 0$ 1 mark for correct conclusion

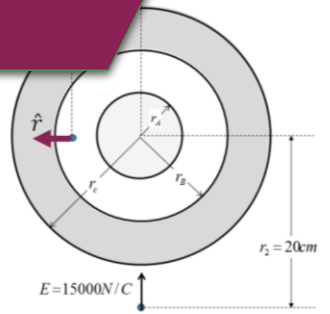
B)
1 mark for identifying variables from the problem

$$\sigma = \frac{Q}{A} = \frac{q}{4\pi r_A^2} = \frac{+9.40 \times 10^{-9}\ \text{nC}}{4 * \pi * (0.05\ \text{m})^2} = 2.99 \times 10^{-9}\ \frac{\text{C}}{\text{m}^2}$$

1 mark for recognizing is a surface density
0.5 mark for numerical solution
0.5 mark for units

lectric field at $r_1 = 7.50$ cm. [3 points]
charge on the outer surface of the shell [2 points]

C)



1 mark for proper equation or Gauss's law

$$r_A < r_1 < r_B$$
$$\vec{E}_{sphere}(r > R) = \frac{k_e Q_{sphere}}{r^2}\hat{r}$$
$$\vec{E}_{sphere}(r > R) = \frac{k_e q}{r_1^2}\hat{r}$$

0.5 mark for correct variables

$$\vec{E}_{sphere}(r > R) = \frac{\left(8.99 \times 10^9\ \text{N} * \frac{\text{m}^2}{\text{C}^2}\right) * 9.40 \times 10^{-9}\ \text{C}}{(0.075\ \text{m})^2}\hat{r}$$
$$\vec{E}_{sphere}(r > R) = 1.5 \times 10^4\ \frac{\text{N}}{\text{C}}\hat{r}$$

0.5 mark for calculations
0.5 mark for reporting magnitude and direction

0.5 mark for identifying $\hat{r}$

D) Metal in equilibrium: net charge of the system resides on the outer surface
Shell can be treated as a sphere with a net charge

$$\vec{E}_{sphere}(r > R) = \frac{k_e Q_{total}}{r^2}\hat{r} \rightarrow Q_{outer} = \frac{E r_2^2}{k_e}$$

1 Mark for the method to get Q_{outer}

As $\vec{E}_{sphere}$ points toward the center of the system, $Q_{outer} < 0$
$Q_{outer} = -6.69 \times 10^{-7}$ C

1 Mark for sorting out the sign

REALIZATION

ONLINE ASSIGNMENT

ASSIGNMENT SETUP

ALTERNATIVE DEADLINES

QUIZ

Part #1

Assignment Due: Monday, 15 March 2021

Assignment Availability: 01 March 2021 - 22 March 2021

Material: **17.7-17.12, 18.1-18.11, 19.1-19.8**

Questions in this part are supposed to help in setting up/solving questions in Part #2 of this assignment. All questions will provide instantaneous feedback and you have unlimited number of tries to complete them. They are marked 50% for participation and 50% for correctness.

Assignment Due: Monday, 15 March 2021

Assignment Availability: 01 March 2021 - 22 March 2021

Material: **17.7 - 17.12, 18.1 - 18.11, 19.1-19.8**

All questions will provide instantaneous feedback and you have unlimited number of tries to complete them. They are marked 50% for participation and 50% for correctness.

Written solution to **Question 4.2.5** needs to be submitted by 13:59 on **15 March** to the Assignment 4 Dropbox (due to the late release of this assignment the dropbox will be opened for additional 24 hours).