

Science Education for Public Understanding Program (SEPUP)

- Based at the Lawrence Hall of Science, University of California, Berkeley
- Funded by the National Science Foundation (NSF) since 1988
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INCORPORATED

EXPERIENCING SCIENCE

Science Literacy for All Students...

- SEPUP is a complete program that helps students develop deep understanding of important scientific concepts.
- SEPUP is based on:
 - Decades of research on how students learn and best practices in science teaching
 - Extensive field testing in diverse urban, suburban, and rural classrooms



The SEPUP Approach to Teaching and Learning

- Science content through the context of real-world issues
- Embedded literacy strategies
- A consistent approach to individual and cooperative learning, 4-2-1 Approach



The SEPUP Approach to Teaching and Learning

- Inquiry-based instructional strategies
- An assessment system integrated into the curriculum for both summative and formative evaluation
- Spiraling of key concepts and skills
- Science concepts are developed through a variety of activities, not just based on text, to meet the needs of diverse learners

Inquiry Through Issues

- *How do you decide what type (s) of medication, if any, to take when you are ill?*
- *How might you accidentally introduce a new species into a local ecosystem?*
- ***What can you do to reduce the risk of catching an infectious disease?***

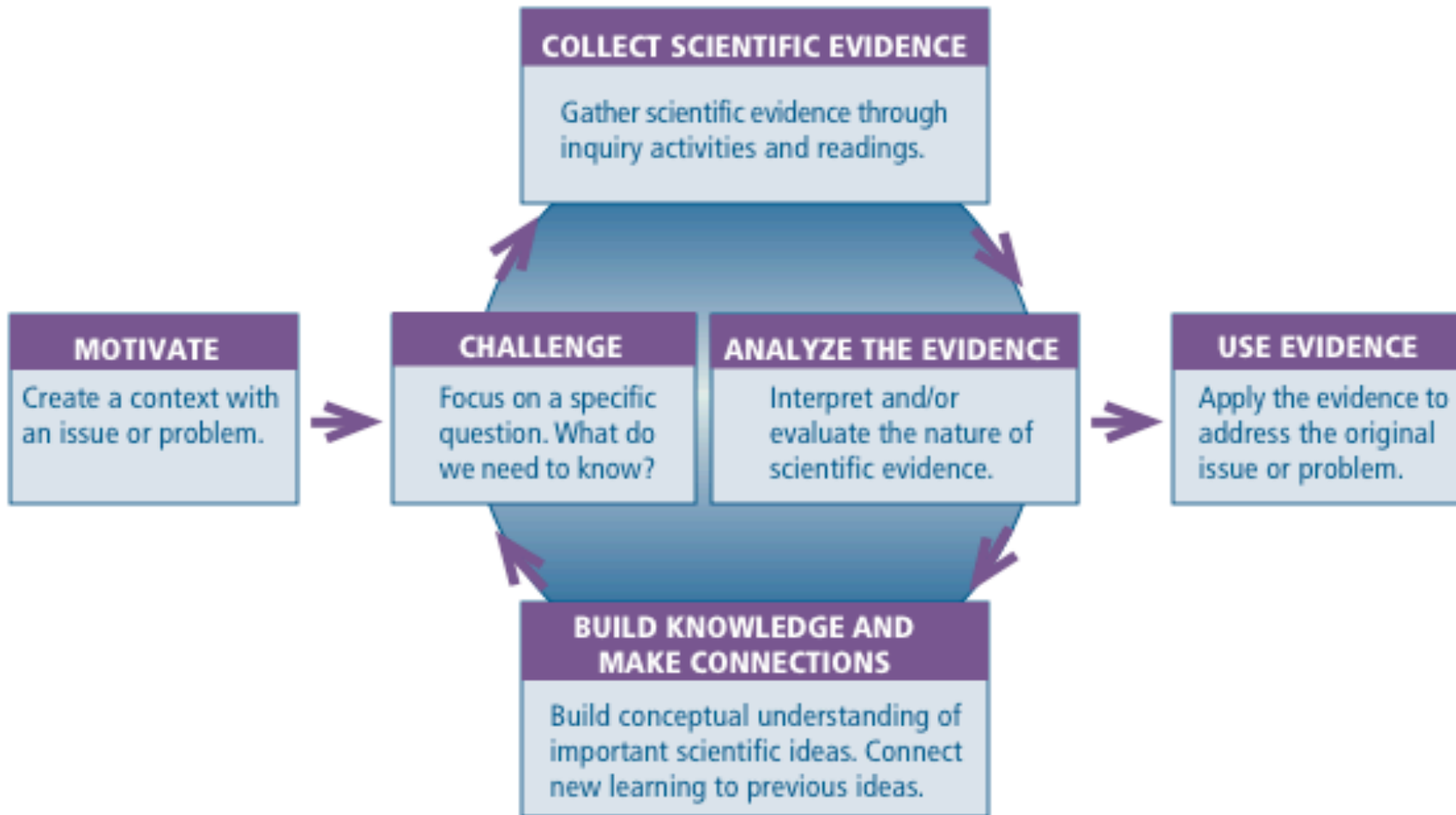
Inquiry Through Issues

- *Are manufactured diamonds as valuable as mined diamonds?*
- *What can you do to reduce the risk of catching an infectious disease?*
- *How can a motor vehicle be made safer?*

Inquiry in SEPUP

- Deepens understanding of science content while teaching process skills
- Varies from guided inquiries to more open-ended investigations
- Engages students in the five essential components of inquiry defined in the National Science Education Standards (NSES)

SEPUP Learning Cycle



Issues and Physical Science

- Studying Materials Scientifically
- The Chemistry of Materials
- Water
- Energy
- Force and Motion



Activity 15 - Families of Elements

1. Compare physical and chemical properties of 13 elements and sort them into groups based on common properties.
2. Compare your classifications with groups – or families – of elements as defined by scientists and displayed in the Periodic Table of Elements.

Synthesizing concepts & vocabulary

Atom

Atomic Mass

Element

Family (of elements)

Metal

Periodic Table of the Elements

Families of Elements

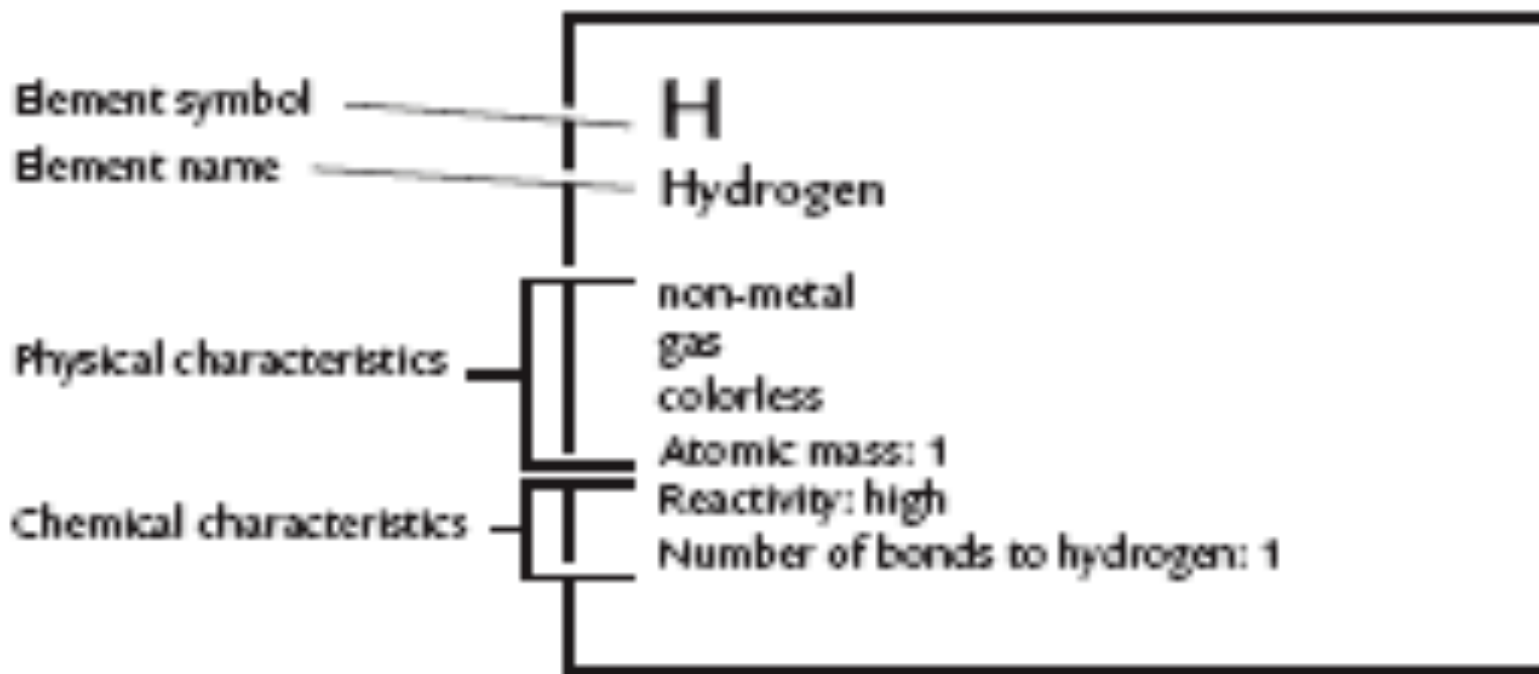
CHALLENGE: How can elements be grouped based on their physical and chemical properties?

ASSESSMENT – Understanding Concepts (UC)

Analysis #5

The element strontium (Sr) is below calcium (Ca) in Column 2 on the periodic table. Design an Element Card that shows the properties you predict for strontium.

Information on Element Card



Periodic Table of the Elements

1 H Hydrogen 1.008																	18 He Helium 4.002
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 18.99	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.31											13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.88	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.64	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.9	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3
55 Cs Cesium 132.9	56 Ba Barium 137.3	57 La* Lanthanum 138.9	72 Hf Hafnium 178.5	73 Ta Tantalum 180.9	74 W Tungsten 183.8	75 Re Rhenium 186.2	76 Os Osmium 190.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Tl Thallium 204.4	82 Pb Lead 207.2	83 Bi Bismuth 208.9	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac* Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (264)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (277)	114 Uuq Ununquadium (289)		116 Uuh Ununhexium (288)		118 Uuo Ununoctium (294)	

Lanthanide Series	58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium (145)	62 Sm Samarium (150.4)	63 Eu Europium 152.0	64 Gd Gadolinium 157.3	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 174.9
	88 Th Thorium 232.0	91 Pa Protactinium (231)	92 U Uranium (238)	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (260)
Actinide Series														

Shading Key
A Solid at room temperature
A Liquid at room temperature
A Gas at room temperature

Scoring Guide: Understanding Concepts (UC)

What to Look For

Response identifies and describes scientific concepts relevant to a particular problem or issue.

Level 4 <i>Above and beyond</i>	Student accomplishes Level 3 AND goes beyond in significant way, such as <ul style="list-style-type: none">· using relevant information not provided in class to elaborate on your response.· using a diagram to clarify scientific concepts.· relating your response to other science concepts.
Level 3 <i>Complete and correct</i>	Student accurately and completely explains or uses relevant scientific concepts.
Level 2 <i>Almost there</i>	Student explains or uses scientific concepts BUT has some omissions or errors.
Level 1 <i>On your way</i>	Student incorrectly explains or uses scientific concepts.
Level 0	Student's response is missing, illegible, or irrelevant.
X	Student had no opportunity to respond.

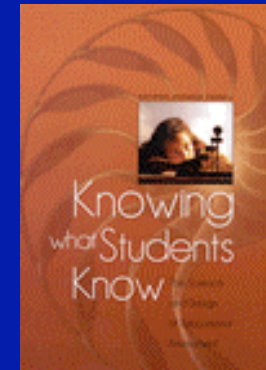
The SEPUP Assessment System

- Developed in collaboration with assessment researchers at the University of California, Berkeley
- Assesses a range of learning outcomes, including:
 - Content knowledge
 - Conceptual understanding
 - Inquiry skills
 - Application of scientific information

Assessment in SEPUP

The SEPUP Assessment System has been cited in numerous journal articles and publications, as an exemplary approach to assessing student learning.

***Knowing what Students Know**

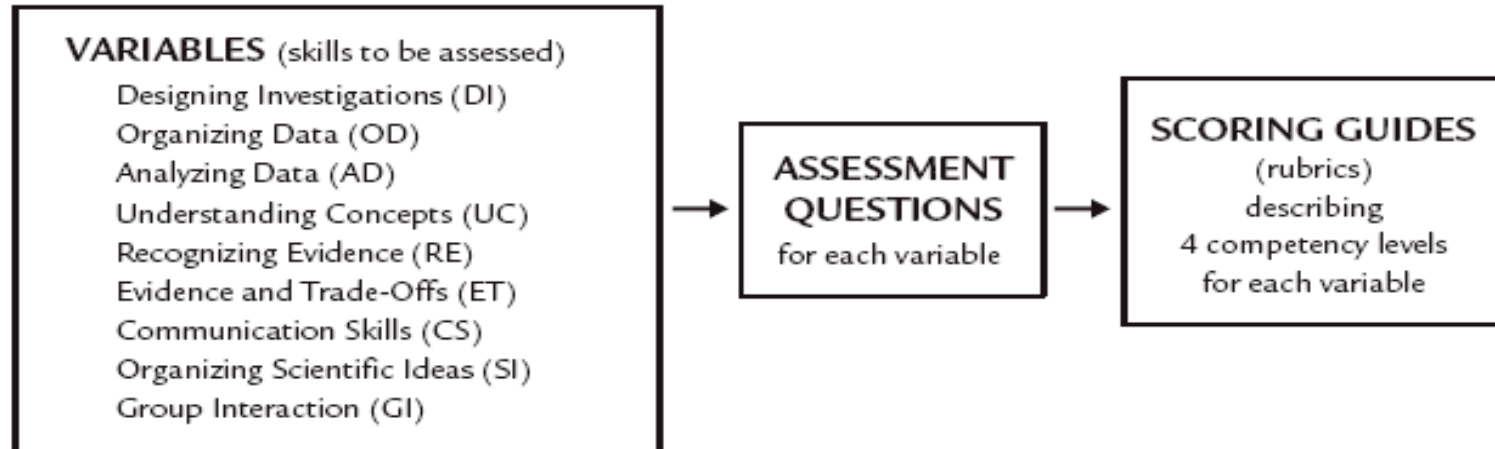


***Classroom Assessment and the National Science Education Standards (National Research Council, 2001)**



Assessment in SEPUP

COMPONENTS OF THE SEPUP ASSESSMENT SYSTEM



ASSISTANCE FOR TEACHERS

BLUEPRINTS/OVERVIEWS

showing where assessment tasks are found throughout course or module

EXEMPLARS

of student work for each competency level in the Scoring Guide

MODERATION

collaboration with other teachers for setting criteria in scoring

ITEM BANKS

for tests and quizzes

QUICK CHECKS

for informal assessment

Literacy

- Embedded literacy strategies scaffold students' reading, writing, group discussions, vocabulary acquisition, and synthesis of concepts within the context of science.

Literacy Strategies Embedded in SEPUP Core Curriculum

Literacy Category	Literacy Strategy
Supporting Reading Comprehension	<ul style="list-style-type: none">● Anticipation Guide● Directed Activities Related to Text (DART)● Listen, Stop, Write● Reading Scientific Procedures● Three-Level Reading Guide
Enhancing Student Writing	<ul style="list-style-type: none">● Keeping a Science Notebook● Writing a Formal Investigation Report● Writing Frame Writing Review● Research Project● Assessment: Communicating Scientific Information
Facilitating Group Discussion	<ul style="list-style-type: none">● Discussion Web● Intra-act● Oral Presentation● Walking Debate● Assessment: Group Interaction
Synthesizing Concepts and Vocabulary	<ul style="list-style-type: none">● Categorization Activity● Concept Map● KWL● Talking Drawing● Venn Diagrams

Diverse Learners

- The SEPUP materials encourage and support differentiated instruction so that all learners have opportunities to succeed.

Strategies for Diverse Learners

	Strategy
Students with Learning Disabilities	<ul style="list-style-type: none">· Hands-on activities provide concrete experiences.· Optional student sheets provide step-by-step procedures for open-inquiry labs.· Literacy strategies support improvement of reading comprehension and writing skills.· Discussion strategies facilitate communication.· Scoring guides state clear assessment goals.
English-language Learners	<ul style="list-style-type: none">· Vocabulary is introduced with operational definitions that connect concepts to learning experiences.· 4-2-1 cooperative groupings encourage student interactions in an unthreatening environment.· Discussion strategies enhance speaking and listening skills.· Literacy strategies strengthen reading and writing skills.
Academically Gifted Students	<ul style="list-style-type: none">· Issues stimulate evaluation of problems in real-world contexts.· Lab activities encourage students to design complex investigations.· Scoring guides challenge students to demonstrate their depth of understanding.· Extension activities encourage in-depth inquiry into related topics.