

An tSraith Shóisearach do Mhúinteoirí

Junior **CYCLE** for teachers

Resource Booklet

Science

Day 3



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Checking in on the CBA and the SLAR Process

What have you learned about managing the CBA process?



Blank response area for the question: What have you learned about managing the CBA process?

What is the impact of engaging with the CBA on students' learning?



Blank response area for the question: What is the impact of engaging with the CBA on students' learning?



Blank response area for the question: What have you learned about managing the CBA process?



Blank response area for the question: What is the impact of engaging with the CBA on students' learning?

What is the value of the CBA as a way of gathering information about the learners in your classroom?



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How has your experience of the SLAR process supported your learning about your subject and your understanding of standards?



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Blank response area for the question: What is the value of the CBA as a way of gathering information about the learners in your classroom?

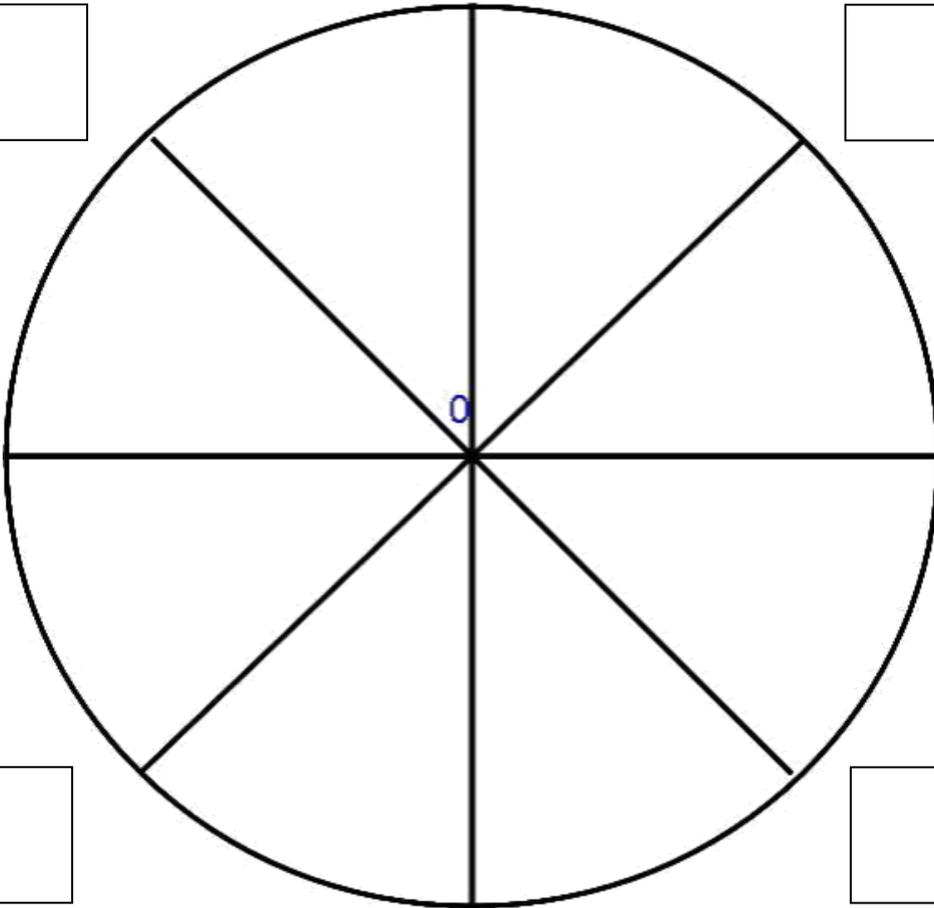


Blank response area for the question: How has your experience of the SLAR process supported your learning about your subject and your understanding of standards?

Building a Picture - My Professional Learning

Throughout today, you will be invited to pause at intervals and add to the boxes below, aspects of your own professional learning which you may like to engage with upon returning to school. Score yourself from 0-10 (0 = need a lot of work, 10 = I am confident in this area).

10

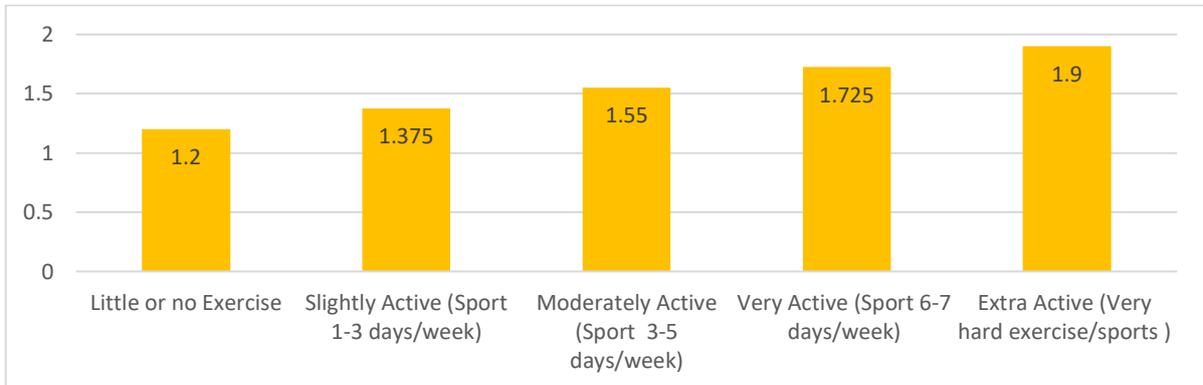


Evaluating Data – BW 6

BW 6: Students should be able to evaluate how human health is affected by: inherited factors and environmental factors including nutrition; lifestyle choices; examine the role of micro-organisms in human health

4

Physical Activity Levels (P.A.L.)



Nutrition Activities 1 – 4

Activity 1: Calculate your client's daily energy needs

Formula: $BMR \times PAL = \text{Daily Energy Needs (kcal)}$

Client	BMR	PAL	Daily Energy Needs (kcal)

Do you have enough information to evaluate if this meal is suitable for your client? Please circle your answer:

Yes

No

Why?

Activity 2: Calculate your client's energy needs for dinner only

Formula: Daily Energy Needs (kcal) X Fraction = Dinner Energy Needs (kcal)

Daily Energy Needs (kcal)	Fraction Needed for Dinner	Dinner Energy Needs (kcal)

(Answer from Activity 1)

Do you have enough information to evaluate if this meal is suitable for your client? Please circle your answer:

Yes

No

Why?

Activity 3: Modify your client's dinner

Food	Original Meal		Modified Meal	
	Mass (g)	Energy (kcal)	Mass (g)	Energy (kcal)
Pasta	70	263.8		
Bacon	50	229.7		
Courgette	100	16.5		
Mushroom	50	14.3		
Sweetcorn	50	49.3		
Cream	30	101		
Cheese	5	21		
	Total (kcal)	695.6	Total (kcal)	

Do you have enough information to evaluate if this meal is suitable for your client? Please circle your answer:

Yes

No

Why?

Activity 4: Suggest recommendations for your client's dinner based on inherited factors and lifestyle choices (use the nutritional data labels on the next page).

If you want to calculate your own Basal Metabolic Rate, follow your choice of link:



<http://www.calculator.net/bmr-calculator>

Nutritional Information

Nutrition Facts

Dry Pasta

Serving Size: \blacklozenge 70g

Amount Per Serving		Calories from Fat 9.6
kcal	263.8	
		% Daily Value*
Total Fat 1.1g		2%
Saturated Fat 0.2g		1%
<i>Trans</i> Fat 0g		
Polyunsaturated Fat 0.4g		
Monounsaturated Fat 0.1g		
Cholesterol 0mg		0%
Sodium 4.3mg		0%
Potassium 158.8mg		5%
Total Carbohydrates 53.8g		18%
Dietary Fiber 2.3g		9%
Sugars 1.9g		
Protein 9.3g		
Vitamin A		0%
Vitamin C		0%
Calcium		1.5%
Iron		12.5%

Nutrition Facts

Gluten Free Pasta

Serving Size: \blacklozenge 70g

Amount Per Serving		Calories from Fat 4.6
kcal	88	
		% Daily Value*
Total Fat 0.5g		1%
Saturated Fat 0.1g		0%
Polyunsaturated Fat 0.2g		
Monounsaturated Fat 0.1g		
Cholesterol 0mg		0%
Sodium 0mg		0%
Potassium 21.5mg		1%
Total Carbohydrates 19.5g		7%
Dietary Fiber 3.4g		13%
Protein 1.9g		
Vitamin A		0.8%
Vitamin C		0%
Calcium		0.1%
Iron		0.9%

Nutrition Facts

Courgette

Serving Size: \blacklozenge 100g

Amount Per Serving		Calories from Fat 3.5
kcal	16.5	
		% Daily Value*
Total Fat 0.4g		1%
Saturated Fat 0.1g		0%
<i>Trans</i> Fat 0g		
Polyunsaturated Fat 0.2g		
Monounsaturated Fat 0g		
Cholesterol 0mg		0%
Sodium 3.3mg		0%
Potassium 286.5mg		8%
Total Carbohydrates 2.9g		1%
Dietary Fiber 1.1g		4%
Sugars 1.9g		
Protein 1.3g		
Vitamin A		24%
Vitamin C		23.5%
Calcium		1.9%
Iron		2.3%

Nutrition Facts

Bacon

Serving Size: \blacklozenge 50g

Amount Per Serving		Calories from Fat 155.5
kcal	229.7	
		% Daily Value*
Total Fat 17.1g		26%
Saturated Fat 5.8g		29%
<i>Trans</i> Fat 0.1g		
Polyunsaturated Fat 3g		
Monounsaturated Fat 7.7g		
Cholesterol 48.5mg		16%
Sodium 828.9mg		35%
Potassium 245.4mg		7%
Total Carbohydrates 0.8g		0%
Dietary Fiber 0g		0%
Sugars 0g		
Protein 17.1g		
Vitamin A		0.4%
Vitamin C		0%
Calcium		0.5%
Iron		2.6%

Nutrition Facts

Mushroom

Serving Size: \blacklozenge 50g

Amount Per Serving		Calories from Fat 2.1
kcal	14.3	
		% Daily Value*
Total Fat 0.3g		0%
Saturated Fat 0g		0%
<i>Trans</i> Fat 0g		
Polyunsaturated Fat 0.1g		
Monounsaturated Fat 0g		
Cholesterol 0mg		0%
Sodium 1mg		0%
Potassium 180.6mg		5%
Total Carbohydrates 2.6g		1%
Dietary Fiber 1.1g		4%
Sugars 1.2g		
Protein 1.1g		
Vitamin A		0%
Vitamin C		3.4%
Calcium		0.3%
Iron		5%

Nutrition Facts

Sweetcorn

Serving Size: \blacklozenge 50g

Amount Per Serving		Calories from Fat 7
kcal	49.3	
		% Daily Value*
Total Fat 0.8g		1%
Saturated Fat 0.1g		1%
<i>Trans</i> Fat 0g		
Polyunsaturated Fat 0.3g		
Monounsaturated Fat 0.2g		
Cholesterol 0mg		0%
Sodium 0.5mg		0%
Potassium 112.5mg		3%
Total Carbohydrates 11g		4%
Dietary Fiber 1.2g		5%
Sugars 2.3g		
Protein 1.7g		
Vitamin A		2.7%
Vitamin C		4.8%
Calcium		0.2%
Iron		1.3%

Nutrition Facts

Parmesan Cheese

Serving Size: \blacklozenge 5g

Amount Per Serving		Calories from Fat 13
kcal	21	
		% Daily Value*
Total Fat 1.4g		2%
Saturated Fat 0.8g		4%
<i>Trans</i> Fat 0g		
Polyunsaturated Fat 0.1g		
Monounsaturated Fat 0.4g		
Cholesterol 4.3mg		1%
Sodium 90mg		4%
Potassium 9mg		0%
Total Carbohydrates 0.7g		0%
Dietary Fiber 0g		0%
Sugars 0g		
Protein 1.4g		
Vitamin A		1%
Vitamin C		0%
Calcium		4.3%
Iron		0.1%

Nutrition Facts

Cream

Serving Size: \blacklozenge 30g

Amount Per Serving		Calories from Fat 97
kcal	101	
		% Daily Value*
Total Fat 11g		17%
Saturated Fat 6.9g		35%
<i>Trans</i> Fat 0.4g		
Polyunsaturated Fat 0.5g		
Monounsaturated Fat 2.7g		
Cholesterol 34mg		11%
Sodium 8mg		0%
Potassium 28mg		1%
Total Carbohydrates 0.8g		0%
Dietary Fiber 0g		0%
Sugars 0.9g		
Protein 0.8g		
Vitamin A		8.8%
Vitamin C		0.3%
Calcium		2%
Iron		0.2%

Nutrition Facts

Cheese, Lactose Free

Serving Size: \blacklozenge 15g

Amount Per Serving		Calories from Fat 4.5
kcal	30	
		% Daily Value*
Total Fat 0.5g		1%
Saturated Fat 0.5g		3%
<i>Trans</i> Fat 0g		
Cholesterol 5mg		2%
Sodium 120mg		5%
Total Carbohydrates 1g		0%
Dietary Fiber 0g		0%
Sugars 0g		
Protein 5.5g		
Vitamin A		0%
Vitamin C		0%
Calcium		10%
Iron		0%

Science Department - Collaborative Planning Document

Unit _____ Duration 6 weeks Term _____ Year _____

Learning Outcome

CW9: Students should be able to consider chemical reactions in terms of energy, using the terms exothermic, endothermic and activation energy, and use simple energy profile diagrams to illustrate energy changes

Action Verb 1

Consider - describe patterns in data; use knowledge and understanding to interpret patterns; make predictions and check reliability

Action Verb 2

Use - apply knowledge or rules to put theory into practice

Key Learning for this Unit Unpacked (Understanding, skills and values)

- 1) Understand that chemical reactions involve the rearranging of atoms, which can result in a difference in energy between the reactants and the products.
- 2) Explain and use correctly the terms exothermic and endothermic as they relate to chemical reactions.
- 3) Consider how data shows whether an endothermic or exothermic reaction is taking place.
- 4) Understand that activation energy is the minimum energy particles need in order for a chemical reaction to take place.
- 5) The energy changes taking place during a chemical reaction can be represented by graphs/diagrams.
- 6) Use simple energy profile diagrams to illustrate energy changes.
- 7) Make predictions.
- 8) Interpreting patterns allows us to make predictions.

Agreed Assessment Checks

- 1) Can students use the terms exothermic, endothermic and activation energy in the context of describing chemical reactions?
- 2) Can students correctly interpret data about chemical reactions to decide which are exothermic and which are endothermic?
- 3) Can students make predictions about energy changes in chemical reactions?
- 4) Use simple energy profile diagrams to illustrate energy changes in a chemical reaction.

Nature of Science- Agreed Assessment Checks

- 1) What constitutes a pattern? (NoS 4)
- 2) Can students apply learning about chemical reactions and energy in one context to solve a problem in another context? (NoS 5)

Planning a Unit of Learning

https://www.jct.ie/science/planning_next_steps



Science Department - Collaborative Planning Document

Unit _____ Duration 6 weeks Term _____ Year _____

9

Learning Outcome

PW6: Students should be able to explain energy conservation and analyse processes in terms of energy changes and dissipation

Action Verb 1

Explain - give a detailed account including reasons or causes

Action Verb 2

Analyse - study or examine something in detail, break down something in order to bring out the essential elements or structure; identify parts and relationships, and interpret information to reach conclusions

Key Learning for this Unit Unpacked (Understanding, skills and values)

- 1) Understand that energy cannot be created or destroyed but changes form.
- 2) Understand that energy can be stored, for example as potential energy, chemical energy.
- 3) Identify different forms of energy and analyse processes to identify energy changes, including potential, kinetic, electrical, thermal and chemical.
- 4) Understand that not all energy changes are useful, and that energy can be dissipated, i.e. it changes into forms from which it is not recoverable.
- 5) Analyse processes for energy dissipation.

Agreed Assessment Checks

- 1) Explain the law of conservation of energy using practical examples, identifying energy changes in various processes.
- 2) Analyse processes to identify energy changes including potential, kinetic, electrical, thermal and chemical.
- 3) Interpret information about processes to deduce useful energy conversions and whether energy has been dissipated.
- 4) Demonstrate understanding of the dissipation of energy

Nature of Science- Agreed Assessment Checks

- 1) Can students apply learning about energy conservation to solve problems in unfamiliar contexts? (NoS 5)

Science Department - Collaborative Planning Document

Unit _____ Duration 6 weeks Term _____ Year _____

Learning Outcome

BW3: Students should be able to outline evolution by natural selection and how it explains the diversity of living things

Key Learning for this Unit Unpacked (Understanding, skills and values)

- 1) Understand what is meant by the term evolution.
- 2) Natural selection as the differential survival of some and elimination of others.
- 3) Role of mutation in evolution.
- 4) As survival depends on suitability to the environment, different inherited characteristics might thrive in different environments.
- 5) Appreciate that survival is dependent on being well adapted to the environment – survival of the fittest.
- 6) Understand that better adapted organisms survive and can pass on their genetic variation to their offspring, leading to diversity in different environments
- 7) Appreciate that evolution takes time.
- 8) Use natural selection to explain diversity in different contexts.
- 9) Ability to summarise

Action Verb 1

Outline - to make a summary of the significant features of a subject

Action Verb 2

[Click here to choose an Action Verb](#)

Agreed Assessment Checks

- 1) Can students summarise the significant features of natural selection as a mechanism for evolution?
- 2) Can students use evolution by natural selection to explain diversity in a number of given examples?

Nature of Science- Agreed Assessment Checks

- 1) Can students apply learning to solve problems in unfamiliar contexts? (NoS 5)
- 2) Can students explain what is meant by a theory? (NoS 1)

Planning for L2LP

Priority Learning Unit	Elements	Learning Outcomes
Numeracy	<p>Developing an awareness of numbers</p> <p>Developing an awareness of temperature</p> <p>Developing an awareness of time</p>	<p>B4: Subtract two-digit whole numbers in the context of an everyday situation</p> <p>C1: Use appropriate words to describe temperature (hotter/colder)</p> <p>C2: Identify instruments for indicating temperature</p> <p>J4: Solve problems to work out the passage of time</p>
Communicating and Literacy	<p>Speaking appropriately for a variety of purposes and demonstrating attentiveness as a listener</p> <p>Using technologies for a range of purposes</p>	<p>A1: Listen to obtain information relating to more than one option</p> <p>A5: Participate in practical, formal and informal communication</p> <p>F2: Use technology for education</p> <p>F9: Access a range of websites</p>
Preparing for work	<p>Developing an awareness of health and safety using equipment</p>	<p>D1: Give examples of safe practices in a science lab</p>

Learning Unit

To access the planning documents and other resources from this learning unit, follow your choice of link:



<https://padlet.com/JCTScience/Sample>

Activities for Students Following L2LP

Activity One

Title: Looking at changes in temperature

Complete the table below.

State what was added together	Starting Temperature (°C)	Finish Temperature (°C)	Difference between the two temperatures	Did the chemicals get hotter or colder? Please circle
				Hotter Colder
				Hotter Colder
				Hotter Colder

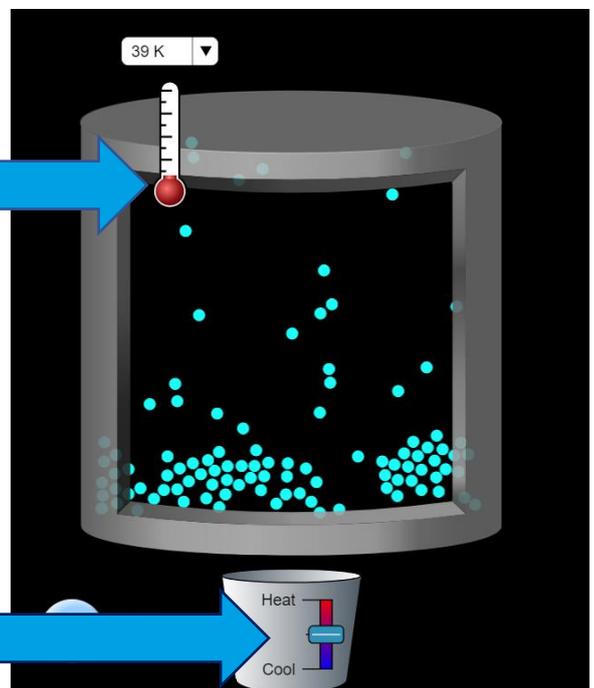
Activity Two

Pick a word from the red box to complete the statements in the green boxes.

- TEMPERATURE
- THERMOMETER
- HOTTER
- COLDER

This is a _____

It measures the _____



Moving the slider up makes it _____

Moving the slider down makes it _____

Mode 1 – Completion Questions

Completion Questions are types of supply response questions, where students provide very short, often 1-word answers. They can include:

- fill in the blanks
- complete the phrase
- direct questions with very short answers

Cognitive Level

Knowledge	Understanding	Application	Analysis	Synthesis	Evaluation
✓					

Comparing Effectiveness of Questions



In pairs, compare the questions in the following examples and discuss **why** one question is more effective than the other.

Example 1

Less Effective	More Effective	Why?
The _____ absorbs digested food.	Digested food is absorbed in the _____.	

Example 2

Less Effective	More Effective	Why?
Every atom has a central _____ called a nucleus	Every atom has a central core called a _____.	

Example 3

Less Effective	More Effective	Why?
The sub atomic particle that orbits the nucleus of an atom is known as an _____	The sub atomic particle that orbits the nucleus of an atom is known as a(n) _____	

Example 4

Less Effective	More Effective	Why?
The moon sometimes passes directly behind the earth and into its shadow. This is a _____.	The moon sometimes passes directly behind the earth and into its shadow. This is called a(n) _____.	

Example 5

Less Effective	More Effective	Why?
<p>_____ + _____ water</p> <p style="text-align: center;">→</p> <p>_____ + _____</p>	<p>Complete the following word equation for photosynthesis:</p> <p>_____ + _____ water</p> <p style="text-align: center;">→</p> <p>_____ + _____</p>	



Once you have finished discussing the questions, open the envelope on the table, find the card that applies to this mode of assessment and follow the instructions.



Read the following and discuss

Advantages

- Good for who, what, where, when content
- Minimises guessing
- Student must know the answer vs. recognising the answer
- Can usually provide an objective measure of student’s ability to recall and memorise facts

Disadvantages

- Difficult to assess higher levels of learning because the answers to completion items are usually limited to a few words
- May overemphasise memorisation of facts
- Questions may have more than one correct answer

“Fill-in-the-blank-type questions differ from the other question types in that they demand recall skills. Multiple-choice, true-false, and matching all rely on recognition, since all response possibilities are given, and the learner must merely identify the correct one. But fill-in-the-blank-type questions require producing a concept and therefore, test learners’ knowledge of individual terms and concepts at a deeper level than recognition question types “

(<https://www.ispringsolutions.com/blog/8-tips-for-writing-good-fill-in-the-blank-questions-in-e-learning-courses/>)

Mode 2 - Multiple Choice Questions

Multiple Choice Questions (MCQs) are types of select response questions where students are given a choice of answers to select from. MCQs can include:

- question with answers
- incomplete statements
- calculations, etc

Cognitive Level

Knowledge	Understanding	Application	Analysis	Synthesis	Evaluation
✓	✓	✓	✓	✓	✓

Comparing Effectiveness of Questions



In pairs, compare the questions in the following examples and discuss **why** one question is more effective than the other.

Example 1

Less Effective	
What piece of equipment would be most suitable to measure 100 cm ³ of water?	
A. Mass balance B. Retort stand	C. Funnel D. Graduated cylinder
More Effective	
Which graduated cylinder would be best suited to accurately measure 15cm ³ of water?	
<input style="width: 100px; height: 40px; border: 1px solid black;" type="text"/>	
Why?	

Example 2

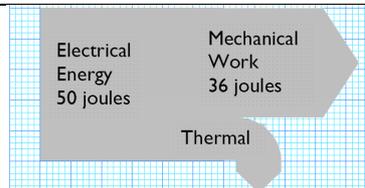
The following table lists 3 metals and their corresponding densities. Use the information provided to calculate the volume of lead that would have a mass of 0.560kg?		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Substance</th> <th style="padding: 2px;">Density g/cm³</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Copper</td> <td style="padding: 2px;">8.9</td> </tr> <tr> <td style="padding: 2px;">Lead</td> <td style="padding: 2px;">11.2</td> </tr> <tr> <td style="padding: 2px;">Gold</td> <td style="padding: 2px;">19.3</td> </tr> </tbody> </table>	Substance	Density g/cm ³	Copper	8.9	Lead	11.2	Gold	19.3
Substance	Density g/cm ³									
Copper	8.9									
Lead	11.2									
Gold	19.3									
Less Effective	More Effective	Why?								
A. 20 cm ³ C. 40 cm ³ B. 30 cm ³ D. 50 cm ³	A. 0.05 cm ³ C. 20 cm ³ B. 6.272 cm ³ D. 50 cm ³									

Example 3

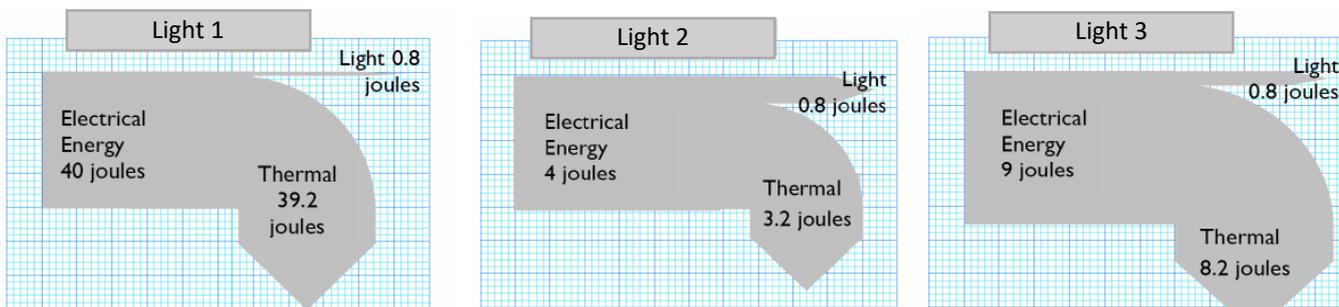
Less Effective

How much thermal energy does the motor produce?

- A. 14 joules
- B. 36 joules
- C. 50 joules
- D. 86 joules



More Effective



If choosing one of the above to provide lighting, which would be the most efficient?

Light 1

Light 2

Light 3

Why?

Example 4

Less Effective	More Effective	Why?
Which acidic substance is known to kill bacteria? A. Starch B. Glucose C. Hydrochloric acid D. Amylase	Which of the following substances is known to kill bacteria? A. Amylase B. Glucose C. Hydrochloric acid D. Starch	



Once you have finished discussing the questions, open the envelope on the table, find the card that applies to this mode of assessment and follow the instructions.



Read the following and discuss

Advantages

- Versatile at all cognitive levels
- Can be used to diagnose misconceptions
- Minimum of writing for students
- Guessing reduced if written effectively

Disadvantages

- Difficult to construct good test items
- Difficult to come up with plausible distractors/alternative responses
- Time consuming to write

“Multiple choice items are considered to be among the most versatile of all item types. They can be used to test factual recall as well as levels of understanding and ability to apply learning. The multiple-choice item can test not only information recall but also the ability to use judgment in analysing and evaluating.”

(Is This a Trick Question? A Short Guide to Writing Effective Test Questions, Ben Clay, Kansas Curriculum Center, 2001)

Mode 3 – Matching Sets

Matching Sets are types of select response questions where students are asked to match question and response items, typically given in 2 lists. They can include:

- terms with definitions
- structures with functions
- problems with solutions, etc

Cognitive Level

Knowledge	Understanding	Application	Analysis	Synthesis	Evaluation
✓	✓				

Comparing Effectiveness of Questions



In pairs, compare the sets in the following examples and discuss **why** one set is more effective than the other.

Example 1

Less Effective	
Match the following:	
<ol style="list-style-type: none"> 1. Where food is absorbed into the bloodstream 2. The organ that produces most of the digestive enzymes 3. The tube that connects the mouth to the stomach 	<ol style="list-style-type: none"> A. Oesophagus B. Small Intestine C. Pancreas.
More Effective	
On the line to the left of each statement in the first column, write the letter of the corresponding answer from the second column. Not every answer may be used.	
<ol style="list-style-type: none"> ___ 1. Where food is absorbed into the bloodstream ___ 2. The organ that produces most of the digestive enzymes ___ 3. The tube that connects the mouth to the stomach 	<ol style="list-style-type: none"> A. Oesophagus B. Small Intestine C. Pancreas D. Liver
Why?	

Example 2

Less Effective

Match the terms with their meanings.

- | | |
|----------------|---------------------------------------------------|
| 1. Heart | A. Natural satellite of the Earth |
| 2. Electron | B. Organ that pumps blood around the body |
| 3. Volt | C. The process by which a liquid turns into a gas |
| 4. Evaporation | D. The S.I. unit for potential difference |
| 5. Moon | |

More Effective

Match the subatomic particle to the relevant statement. Each particle may be used more than once.

- | | |
|---------------------------------------------------|-------------|
| 1. A positively charged particle in the nucleus | A. Electron |
| 2. A negatively charged particle | B. Neutron |
| 3. A particle with no charge | C. Proton |
| 4. A particle which orbits the nucleus of an atom | |
| 5. A particle which has a mass of $1/1840$ a.m.u. | |

Why?



Once you have finished discussing the questions, open the envelope on the table, find the card that applies to this mode of assessment and follow the instructions.



Read the following and discuss

Advantages

- Maximum coverage at knowledge level in a minimum amount of space/prep time
- Valuable in content areas that have a lot of facts
- Suitable for students with lower reading ability

Disadvantages

- Time consuming for students
- May not be appropriate for higher levels of learning

“According to Benson and Crocker (1979) in Educational and Psychological Measurement, students with low reading ability scored better and more consistently with matching questions than the other types of objective questions. They were found to be more reliable and valid. Thus, if a teacher has a number of students who have lower reading scores, they might want to consider including more matching questions on their assessments.”

(<https://www.thoughtco.com/effective-matching-questions-for-assessments-8443>)

Mode 4 – Subjective Response Items

Subjective Response Items are supply response questions that require students to provide more than just a few words in their answers. They can include:

- short answer questions
- extended response (essay styles Q's)
- problems, calculations, graphs, etc

Cognitive Level

Knowledge	Understanding	Application	Analysis	Synthesis	Evaluation
✓	✓	✓	✓	✓	✓

Comparing Effectiveness of Questions



In pairs, compare the questions in the following examples and discuss **why** one question is more effective than the other.

Example 1

Less Effective	More Effective	Why?
Outline how you could investigate the factors that affect photosynthesis.	Outline, using words and/or diagrams, how you might investigate one factor of your choosing that affects photosynthesis. Include in your answer, any equipment you might use and how you would ensure a fair test.	

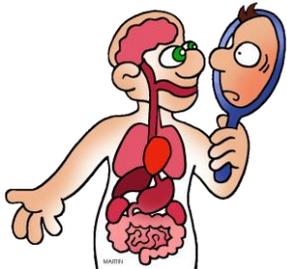
Example 2

Less Effective	More Effective	Why?
<p>“The importing of coal into Ireland should be banned”. Following on from the discussions we had in class, give one argument for and one argument against the above statement. Then give your own opinion as to whether you support the above statement or not, making sure to explain why.</p> <p>[Teacher’s notes: this Q worth 4 marks]</p>	<p>“The importing of coal into Ireland should be banned”. Following on from the discussions we had in class, give one argument for and one argument against the above statement. Then give your own opinion as to whether you support the above statement or not, making sure to explain why.</p> <p>[Teacher’s notes:</p> <p>1 valid argument for = 1 mk</p> <p>1 valid argument against = 1 mk</p> <p>Personal opinion = 1 mk</p> <p>Justification = 1 mk</p>	

Example 3

Less Effective	More Effective	Why?
What is meant by the term 'electron'?	Using words and/or diagrams, compare and contrast the three subatomic particles of the atom. Use the following in your answer: mass, charge and location.	

Example 4

Less Effective	More Effective	Why?
State the functions of the heart, lungs and the small intestines. Explain how they each have a role to play in the process of respiration.	Dónal knows that respiration takes place in the cells of his body. He also knows that his heart, lungs and small intestine are three organs that have a vital role to play so that respiration can take place. Explain how these three organs contribute towards the respiration process. Include references to the functions of the organs in your answer.	



Once you have finished discussing the questions, open the envelope on the table, find the card that applies to this mode of assessment and follow the instructions.



Read the following and discuss

Advantages

- Students less likely to guess
- Easy to construct
- Time consuming to answer
- Stimulates more study
- Can appropriately assess learning intentions which focus on the ability to apply skills or knowledge in the solution of problems

Disadvantages

- Subjective, potentially unreliable marking
- Time consuming to mark
- Not efficient for assessing knowledge of basic facts, provide students more opportunity for bluffing
- Favour students who possess good literacy skills

“When students answer different questions, they are actually taking different tests. If there are five essay questions and students are told to answer any three of them, then there are ten different tests possible. It makes it difficult to discriminate between the student who could respond correctly to all five, and the student who could answer only three. If we are going to compare students for scoring (ranking) purposes, then all students should perform the same tasks.”

(Is This a Trick Question? A Short Guide to Writing Effective Test Questions, Ben Clay, Kansas Curriculum Center, 2001, parentheses added)

Supports for Writing Assessment Items

Completion Questions

Suggestions for writing effective items

1. Do not omit so many words from the statement that the intended meaning is lost. Too many blanks may be confusing for the student and result in meaningless guessing. Either reduce the number of blanks to significant words only or include clear instructions to give the question context.
2. If possible, put the blank at the end of a statement rather than at the beginning. Asking for an answer before the student understands the intent of the statement can be confusing and may require more reading time. Support your students' thought processes by placing the gaps towards the end.
3. Make sure there is only one possible answer! Students might not necessarily answer the question the way you intended. For example, the less effective question in example 4 on page 13 could be answered with the following – **a rare occurrence, a miracle, a scary event, etc.** So make sure you write the question in such a way that there is only one answer that makes sense.
4. Avoid grammatical clues to the correct response. If the indefinite article is required before a blank, use a(n) so the student does not know if the correct answer begins with a vowel or a consonant.

Tips

- Read the question with the answer in mind, to ensure the sentence is grammatically correct.
- It is difficult to write completion items so that there is only one correct answer. When preparing for marking, list the correct answer and any other acceptable alternatives and be consistent.

Matching Sets

Suggestions for writing effective items

1. Use homogeneous content in a matching set. Unrelated topics included in the same matching set may allow for over-obvious matches. To avoid students using the process of elimination to work out the answers, keep the content to one topic or issue.
2. Use uneven number items to match or allow responses to be used more than once. If you have equal numbers of items in both lists, then the last item can be answered using the process of elimination. Try using a different number of items to help reduce guessing and the use of the process of elimination. Your students will also have to think more if they know that some items will be used more than once.
3. Place longer descriptions on the left with shorter response items on the right. Rather than the student having to read through many long phrases to find a match, they only have to read the shorter phrases. Reducing the reading time in this way will be particularly helpful for students with reading difficulties.
4. Include clear instructions which state the basis for matching the stimuli with the responses. Make things clear for your students by explaining whether or not a response can be used more than once and indicating where to write the answer.

Tips

- Avoid asking students to match items using connecting lines. This makes it more difficult to correct. Use capital letters instead of lower case letters as there will be fewer problems when correcting due to poor hand writing.
- Keep the number of items to a minimum, avoid sets with more than ten. Order the responses in some systematic way (e.g. alphabetically) to help the students sort through them.

Multiple Choice Questions

Suggestions for writing effective items

1. Don't give away any clues to the answer!

Make sure that you have no information in the question that will help a student identify the correct answer. Equally, watch out for hints in the answers, particularly grammar hints, that may point out the correct response to a student.

2. Make the problem clear to the student and make sure the answers are plausible.

Put the problem in the question stem so that the student has a clear indication of what is being asked. Also, don't include silly or implausible answers – this will only encourage the use of the process of elimination. Keep answers related to a particular theme.

3. Use multiple-choice questions as diagnostic questions

Multiple-choice questions can be used to diagnose students' misconceptions or common misunderstandings. If you accompany the correct answer with three incorrect answers, where each incorrect answer reveals a specific mistake or misconception, then you will gain valuable insight into why your students got the question wrong.

4. Ensure the question's content and cognitive demand aligns with the learning being tested.

It is important to check the action verb of the LO/LI in question. An effective and valid question should assess not just the appropriate content but also the appropriate cognitive level. Tap into higher cognitive levels by using stimulus materials such as graphs, diagrams or unknown situations where students have to apply what they have learned.

Tips

- Justify – ask students to justify their answer. This will result in reduced guessing and also help identify misconceptions and the reasons for wrong answers.
- Make sure you *randomly* distribute the correct answers among the alternative positions throughout the test so that students can't find a pattern among the correct answers. Make sure answer choices are parallel in grammar and length. Students, if guessing, tend to be drawn towards the longest answer.

Subjective Response Questions

Suggestions for writing effective items

1. Ensure the questions content and cognitive demand aligns with the learning being tested.

It is important to check the action verb of the LO/LI in question. An effective and valid question should assess not just the appropriate content but also the appropriate cognitive level.

2. Use prompts or stimulus material to tap into higher cognitive levels of learning

Using stimulus material can allow students to apply what they have learned to a new situation or think about information in a different way. Alternatively, provide some background information which they must link with what they already know.

3. Develop a marking scheme to accompany each item

It is good practice to decide on how the marks are to be allocated for a question, and what an acceptable answer looks like, **before** you begin marking the test. Having a marking scheme in place beforehand should help eliminate subjectivity and therefore help improve the validity of the questions.

4. Make the question and the nature of the response clear to the student

Unless clear instructions are given, the student's answer may make sense to them but might not be what the you were looking for. It is important to let students know what you expect in an answer.

Tips

- While keeping an eye on the action verbs in the learning outcomes, remember that these were written for teachers. Make sure to use student friendly language in your questions to suit the age and stage of the students
- When solving problems or performing calculations, state clearly if you require students to show their work.

For further supports like these and more, please see our website - www.jct.ie/science/science

Level 2 Learning Programmes

Level 2 Learning Programmes (L2LPs) are designed for a **very specific group of students** who have general learning difficulties in the higher functioning moderate and low functioning mild categories. The special needs of these students are such as to prevent them from accessing some or all the subjects and short courses on offer at Junior Cycle that are broadly aligned with Level 3 National Framework of Qualifications. In a typical post-primary school, the number of students following an L2LP may amount to two or three students. (**Source:** L2LP Guidelines for Teachers)

L2LPs are designed to be suitable for both special schools and mainstream post-primary school settings. It is envisaged that, as far as possible, the students under consideration here, who are in mainstream settings, will undertake the L2LPs **in mainstream classes**.

The L2LPs are built around five Priority Learning Units (PLUs) and two short courses that focus on the social, personal and pre-vocational skills that prepare students for further study, for work and life. They focus the students towards independence and provide them with the opportunity to develop knowledge, skills and attitudes necessary for adult life. Each PLU is broken down into elements, with each element covering a number of learning outcomes.

The PLUs include:

- Communication and Literacy
- Numeracy
- Personal Care
- Living in the Community
- Preparing for Work

Further information can be accessed

at www.jct.ie/l2lp/l2lp



Thinking about Reflection

Why Reflect?

- To understand prior knowledge.
- Impacts motivation for and attitudes towards learning.
- Helps learners understand themselves.
- Allows learners to see their growth over time.
- Goal setting.
- To develop a plan to achieve these goals.

Teachers have to be at the heart of any effort to improve learning and it's widely accepted that where schools reflect on the quality of their work and plan for how it can be improved, students learn better.

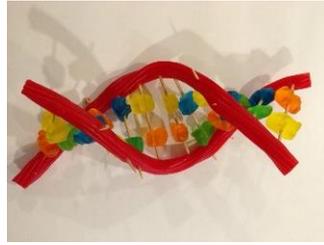
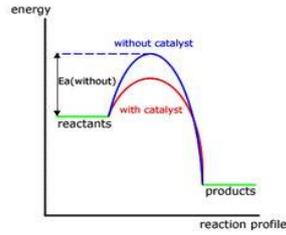
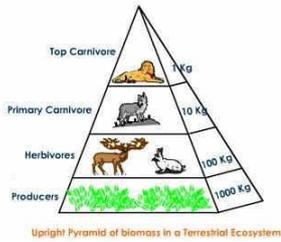
(Looking at our School: A quality Framework for Post-Primary Schools, 2016, page 6)



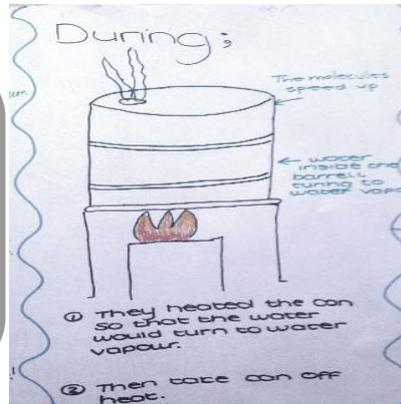
"We do not learn from experience...we learn from reflecting on experience."
—John Dewey



Models and Modelling: An Introduction



A scientific model is a representation of a structure, process, system or phenomenon. Models can take many forms, e.g. diagrams, flow charts, equations, graphs, physical replicas.



Scientific modelling is the process by which ideas about the natural world are represented and used to develop explanations.

Models serve many important functions in science. They help scientists:

- Generate predictions
- Construct explanations
- Show gaps in knowledge
- Pose new questions for investigation.



While using scientific modelling, scientists **collaboratively** make changes to their representations over time in response to new evidence and understandings.

Students might make models in the classroom where the action verb in a learning outcome is **describe**.

Students should be able to **develop** models and **use** them to explain scientific ideas as part of their engagement with E&S4, CW2.

Students will engage with scientific models in their realisation of E&S2, and CW3.

Students might often represent their ideas about science using many forms and types of models.



Students' models could also be used to help test and revise predictions in the process of model-based inquiry.

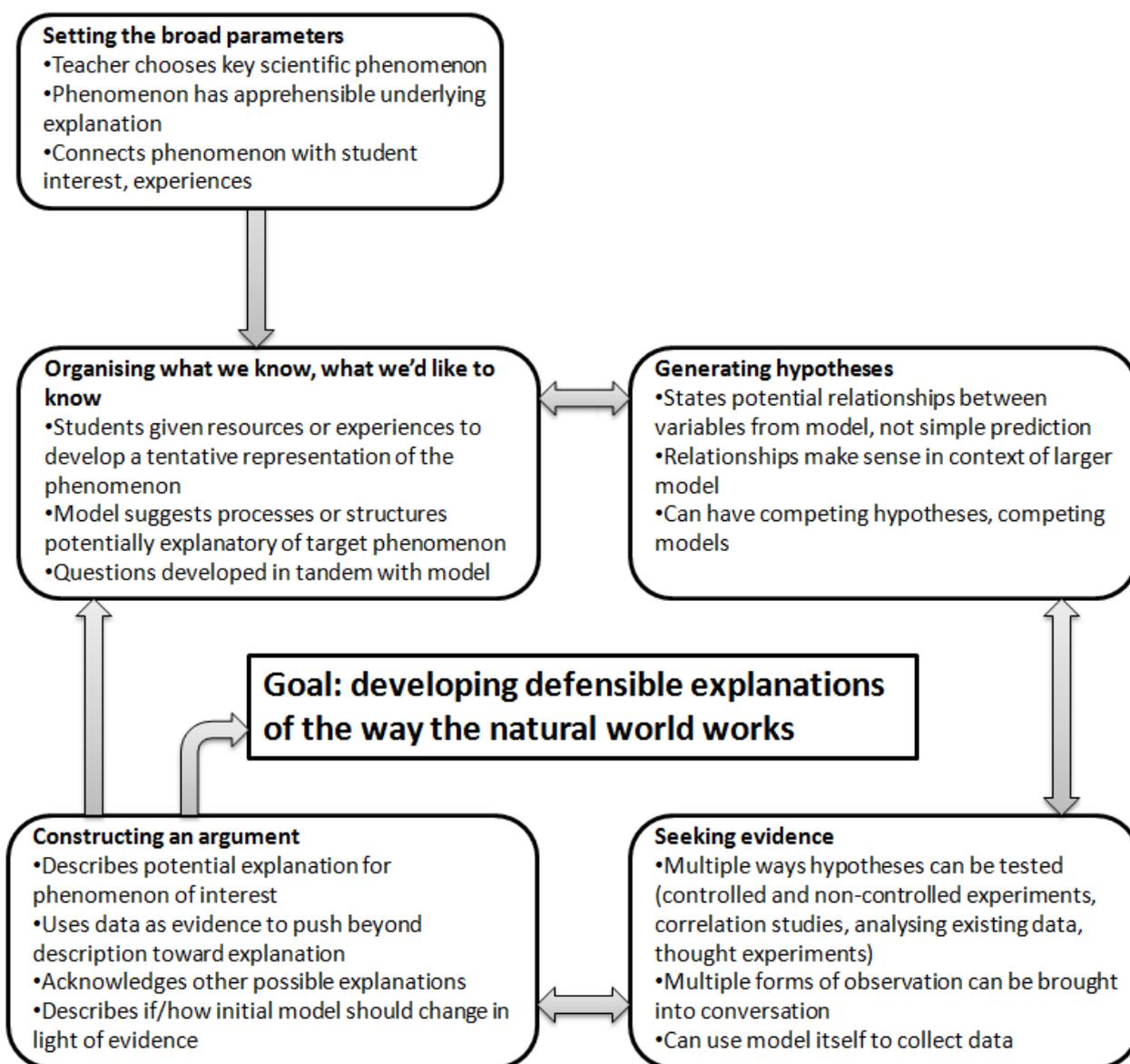
A suitable investigation could be, for example, to identify the cause of the seasons. Students represent their initial ideas by constructing models and then, having engaged with activities, discussion and experiments, make changes to their models over time.

Using modelling in the classroom replicates how scientists work and activates student voice.

Why use Scientific Modelling in the Classroom?

- This is the way in which many scientists work, so it is both a teaching approach and an authentic representation of how science produces explanations.
- Model-based inquiry involves small group activity and discussion, which engages students more deeply with the theory involved in practical work.
- Students see the need to learn new science ideas.
- Students are involved in arguing about evidence and monitoring their own thinking along the way.

The diagram below summarises the key conversations within a model-based inquiry. As students gain experience with guided forms of investigation, they eventually begin asking themselves the relevant questions without prompting. (Taken from Windschitl, M., Thompson, J. and Braaten, M. (2008), 'Beyond the scientific method: Model based inquiry as a new paradigm of preference for school science investigations'.)



Some useful websites

- www.ambitiousscienceteaching.org
- www.nuffieldfoundation.org (Nuffield Practical Work for Learning: Model-Based Inquiry)

Contact Information

Information and resources are available on our website: www.jct.ie

In particular, see CPD Workshops for resources used at today's workshop.



CPD Workshops

For any queries, please contact us on one of the following:



Email: info@jct.ie (Advisors' individual email addresses are available from the Meet the Team section of the website.)



Phone number: 047 74008



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The Science Specification and Guidelines for Classroom-Based Assessments and Assessment Task are available at www.curriculumonline.ie

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