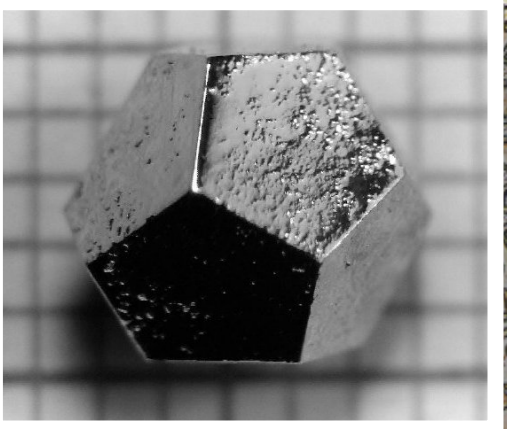
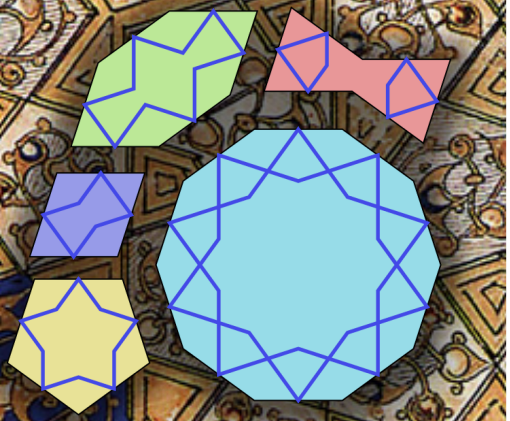
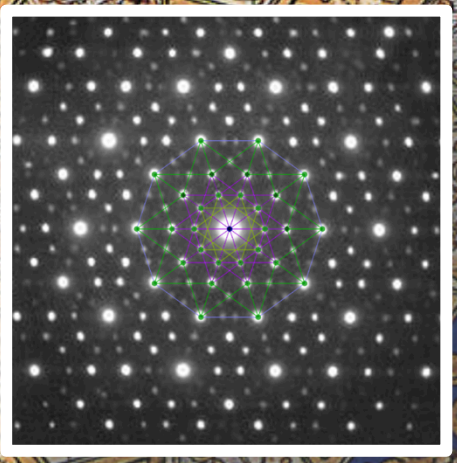
NatureGlo's eScience



Quasicrystals: Unusual Atomic Mosaic Study Guide





Cover image: Background image: Islamic tiles from Turkey, a Creative Commons Image. Overlaid image of more Islamic tiles, a Creative Commons image. The Aluminum alloy crystal photographed by AMES lab., US Department of Energy. The Girih tiles Image created by Cronholm144. The electron microscope diffraction image by Materialscientist.

Connect with Natureglo's eScience today!

Like Natureglo's eScience on Facebook at:
https://www.facebook.com/natureglo1

Follow Natureglo's eScience on Twitter at:
https://twitter.com/natureglo1

Follow NatureGlo's eScience on Pinterest at:
https://www.pinterest.com/natureglo/

You can connect with Natureglo's eScience on Google at
gab21921@gmail.com

Table of Contents

What are Quasicrystals?

Quasicrystals are a new phenomena recently accepted into the scientific community after some rejection. Quasicrystals were investigated & observed in the 1960's, but, systematically observed in the 1980s by Dan Shechtman, who won the Nobel prize for their discovery.

They were previously disregarded in favor of prevailing views about the atomic structure of matter (with only 2, 3, 4, 6-fold symmetries allowed). Quasicrystals are an ordered assembly of atoms resembling a crystal with unusual symmetries including 5, 8 and 12-fold found in aluminum alloys & certain polymers (synthetic plastics & resins) but without consistent periodicity. They relate to the famous Penrose tiles and Islamic tile design. The Golden ratio is also found in many of their dimensions as Golden rhombi.

PowerPoint Interaction Questions – Quasicrystals

Directions: Using NatureGlo's eScience PowerPoint, *Quasicrystals, Unusual Mosaic of Atoms*, answer the questions below.

Slide #3 What is a Quasiperiodic Crystal, or Quasicrystal?

1. True or False. Quasicrystals have unusual atomic crystal arrangements including 5, 8 and 12-fold symmetries found in aluminum alloys & certain polymers (synthetic plastics & resins). _____

Slide #3

2. Multiple choice. Symmetries quasicrystals include are _____.

   a. 1, 2, 3, 4, 5 b. 2, 3, 4, 6 c. 5, 8, 10, 12

Slide #5 Usual Symmetry Types found in Crystallography

3. The usual _____ types found in crystallography include 2-fold as found in equilateral triangles, 4-fold in squares and 6-fold in regular hexagons.

PowerPoint Interaction Questions – Quasicrystals

Slide #8 Quasicrystal's Discovery

4. Fill in the blank. Dan Schectman made electron microscopic observations of quasicrystals and won the _____ in chemistry for his discoveries and work.

Slide #8 The Two Known Quasicrystal Types

5. Multiple choice. The two quasicrystal types are _____.

   a. Polygonal and icosahedral b. triangular and square

   c. Spherical and tabular

Slide #13 Penrose Tiles

6. True or False. A geometric relationship used in approximately modeling quasicrystals, although their original creation wasn't to describe them are Penrose tiles. _____

Slide #13

7. Short answer. _____ _____ are small non-identical shapes arranged to fill a space completely.

PowerPoint Interaction Questions – Quasicrystals

Slide #13 Penrose Tiles

8. True or False. Penrose tiles give us a geometric representation of quasicrystal molecules and atoms and are not made up of Phi. _____

<u>Slide #14 Peter Lu's Girih Tiles with Observations of Islamic Tile Design</u>

9. Strong evidence reveals that _____ mathematicians and artists discovered quasicrystalline properties of "Penrose tilings" hundreds of years before Kepler.

a. Israeli b. European C. Islamic

Slide #23 Quasicrystal Uses

10. _____ use includes razor blades, surgical tools and as a frying pan alloy coating.

Quasicrystals Journal Entry

Name: _____ Date:_____

Directions: Fill in the information below.

Sketch

1). General Description

_____

_____

_____

2). Size

_____

_____

_____

3). Color

_____

_____

_____

4). Patterns

_____

_____

_____

5). Related numbers and geometric shapes

_____

_____

_____

_____

Mathematician/MathArtist Journal Entry

Your Name: **Today's Date:**

Mathematician/MathArtist:

Directions: Select a mathematician or a "MathArtist" (one who used or uses mathematics in their artwork). Follow the guidelines below.

Sketch and or Photos

	1). Life Work • • **2). Related numbers and geometric shapes** • • **3). Other mathematical relationships** • •

Quasicrystal Web Resources

Learn more by visiting Natureglo's eScience Virtual Library at the links below.

Quasicrystals:

http://hascmathart.weebly.com/quasicrystals.html

Project and Activity Ideas

Students can do a research project using the resources from the headings, **Web Resources, Projects and Activities, Live & HYBRID course Videos and Informative Videos** listed on the resource page. A scoring rubric is on the following page for parents who choose to grade any student research project(s) work.

Natureglo's eScience Student Project Rubric:

Usage: PowerPoints, posters & other written research projects

Category	Criteria				Points
	4 Exemplary	**3 Accomplished**	**2 Developing**	**1 Beginner**	
Accurate Research/ Inform-ation Gathering & Citation	All taken from several sources & cited in work	Most taken from sources & cited	Some taken from sources and cited	Little or none taken from sources and or not cited	
Content	Great number of interesting facts around topic	Many interesting or too many facts	Some important facts	Few or no facts	
Graphics/ Sound/ Animation	High quality; enhance understandin g on every page. All borrowed graphics with source cited.	Many enhance understanding on most pages; most borrowed graphics cited.	Some enhance understandi ng; some cited	Zero, unrelated, very few or poor quality graphics and/or none cited	
Organiz-ation & Attractive-ness	Well organized and very attractive; demonstrates creative & logical sequencing and sentence structure	Mostly well organized and attractive; demonstrates logical sequencing and sentence structure	Somewhat organized and attractive, but some illogical sequencing and sentence structure	Unattractive and or weakly organized or disorganized	
Grammar and Mechanics	All correct	1 – 5 errors	5 – 10 errors	Frequent errors	
Divide total points from 20 for grade.			**Total Points/Grade:**		

The Quasicrystals Quiz

Quasicrystals - Quiz

Directions: After completing and studying the PowerPoint review questions, complete the quiz below.

1. True or False. Quasicrystals have unusual atomic crystal arrangements including 5, 8 and 12-fold symmetries found in aluminum alloys & certain polymers (synthetic plastics & resins). _____

2. Multiple choice. Symmetries quasicrystals include are _____.

   a. 1, 2, 3, 4, 5 b. 2, 3, 4, 6 c. 5, 8, 10, 12

3. The usual _____ types found in crystallography include 2-fold as found in equilateral triangles, 4-fold in squares and 6-fold in regular hexagons.

Quasicrystals - Quiz

Slide #8 Quasicrystal's Discovery

4. Fill in the blank. Dan Schectman made electron microscopic observations of quasicrystals and won the _____ in chemistry for his discoveries and work.

Slide #8 The Two Known Quasicrystal Types

5. Multiple choice. The two quasicrystal types are _____.

   a. Polygonal and icosahedral b. triangular and square

   c. Spherical and tabular

Slide #13 Penrose Tiles

6. True or False. A geometric relationship used in approximately modeling quasicrystals, although their original creation wasn't to describe them are Penrose tiles.
   _____

Slide #13

7. Short answer. _____ _____ are small non-identical shapes arranged to fill a space completely.

Quasicrystals - Quiz

Slide #13 Penrose Tiles

8. True or False. Penrose tiles give us a geometric representation of quasicrystal molecules and atoms and are not made up of Phi. _____

Slide #14 Peter Lu's Girih Tiles with Observations of Islamic Tile Design

9. Strong evidence reveals that _____ mathematicians and artists discovered quasicrystalline properties of "Penrose tilings" hundreds of years before Kepler.

a. Israeli b. European C. Islamic

Slide #23 Quasicrystal Uses

10. _____ use includes razor blades, surgical tools and as a frying pan alloy coating.

Answer Key

PowerPoint Interaction Questions & Quiz Answer Key - Quasicrystals

Directions: Using NatureGlo's eScience PowerPoint, *Quasicrystals, Unusual Mosaic of Atoms*, answer the questions below.

Slide #3 What is a Quasiperiodic Crystal, or Quasicrystal?

1. True or False. Quasicrystals have unusual atomic crystal arrangements including 5, 8 and 12-fold symmetries found in aluminum alloys & certain polymers (synthetic plastics & resins). True

Slide #3

2. Multiple choice. Symmetries quasicrystals include are c.

   a. 1, 2, 3, 4, 5 b. 2, 3, 4, 6 c. 5, 8, 10, 12

Slide #5 Usual Symmetry Types found in Crystallography

3. The usual symmetry types found in crystallography include 2-fold as found in equilateral triangles, 4-fold in squares and 6-fold in regular hexagons.

PowerPoint Interaction Questions – Quasicrystals

Slide #8 Quasicrystal's Discovery

4. Fill in the blank. Dan Schectman made electron microscopic observations of quasicrystals and won the **Nobel Peace Prize** in chemistry for his discoveries and work.

Slide #8 The Two Known Quasicrystal Types

5. Multiple choice. The two quasicrystal types are **a**.

   a. Polygonal and icosahedral b. triangular and square

   c. Spherical and tabular

Slide #13 Penrose Tiles

6. True or False. A geometric relationship used in approximately modeling quasicrystals, although their original creation wasn't to describe them are Penrose tiles. **True**

Slide #13

7. Short answer. **Penrose Tiles** are small non-identical shapes arranged to fill a space completely.

PowerPoint Interaction Questions – Quasicrystals

Slide #13 Penrose Tiles

8. True or False. Penrose tiles give us a geometric representation of quasicrystal molecules and atoms and are not made up of Phi. **False**

Slide #14 Peter Lu's Girih Tiles with Observations of Islamic Tile Design

9. Strong evidence reveals that **Islamic** mathematicians and artists discovered quasicrystalline properties of "Penrose tilings" hundreds of years before Kepler.

   a. Israeli b. European C. Islamic

Slide #23 Quasicrystal Uses

10. **Quasicrystal** uses includes razor blades, surgical tools and as a frying pan alloy coating.