

Lesson Plan Phase 1

Lesson Plan – Step 1 Cynllun Gwers – Cam 1

Student-teacher	William Myers	Class:	8H
AoLE or Subject	Science and Technology	Date:	24/1/2020
Lesson Focus:	Light Refraction		
Meaningful links to Curriculum	Developing explanation skills based on scientific knowledge of refraction of light		
Meaningful links to: Cross Curricular Responsibilities	Literacy – Learning the terminology associated with light refraction		
Personal Targets (Linked to QTS and identified in weekly review): Volume/ Other methods of gaining pupils attention. Addressing the needs of ALN pupils.			

Learning Objectives (focus on Learning- use accessible vocabulary):
The pupils will learn to: Analyze how light behaves as it passes through different objects

Success Criteria (clearly linked to each Learning Objective and related to the process and/or product of learning)	Assessment of Pupils' Learning Evidence (What have the learners to say/write/do/produce – to demonstrate learning)
Pupils can explain what happens when light shines through glass at different angles. Pupils can explain the phenomenon of light refraction	Pupils will have to answer 3 question sheets at various points in the lesson on light refraction.

Time	Activities/Methodology/Key Concepts (Teacher's Role – including key teaching points and key questions)	Pupil Tasks (Pupils' role -including differentiation strategies, engagement in formative assessment and homework)	Resources (Including Health and Safety requirement)
Opening phase (with links to prior learning)	Starter; Provide light refraction question sheet 1 to determine initial knowledge on the subject.	Pupils are to fill out the question sheet to see what knowledge they may have of light refraction already.	Light Refraction question sheet 1
Teaching & Core Learning	Main; Provide students with a theoretical explanation of light refraction; Light bends if it moves through solid objects like glass or prisms coming in at an angle. This is due to the light slowing down as it passes through the object. Provide light refraction question sheet 2 to ascertain knowledge gained. Take students outside to model light refraction on the red gra.	Pupils will be given an explanation of how light refraction works. Questions: Do you know what happens when light passes through a glass block? Does anyone have an idea about what light refraction means? Following this they will attempt a question sheet modified from the first one to ascertain understanding gained. Pupils will then accompany teacher outside to the red gra/ field to take part	Light Refraction Question Sheet 2

		in a physical activity demonstrating light refraction: A line will be drawn in the red gra, pupils will hold hands/hold onto a long stick and walk straight towards the line in a line. They will slow down to half speed once they cross the line. The same will be repeated, but this time they will walk at the line at an angle which will cause their path to bend as they slow down one by one when they cross the boundary.	
Plenary	Plenary; Provide light refraction question sheet 3 to determine knowledge gained following physical demonstration	Pupils are to answer a final question sheet, slightly modified from the 2nd sheet to see if any further knowledge was obtained.	Light Refraction Question sheet 3

Lesson Plan – Phase 1
Evaluation of the Learning Experience
(include references to QTS)

Evaluation of Pupil Learning	
Evidence of Learning (including attitude to learning over time))	
Next Steps for Progress	

Reflective Analysis of Teaching and Strategies For Development – including justification/rationale for pedagogical choices	
Evidence of my Effective Practice	
Areas for my Development Personal Targets for Progress	

Interview Questions

- How did you enjoy the lesson?
 - Were there any points in the lesson that you found particularly difficult?
 - How well did you understand _____ after the first explanation?
 - What affect did the second explanation have on your understanding?
 - How useful did you find the physical aspect of the lesson?
 - Imagine you were me; if you were to do the lesson again, would you do something differently? (after the other questions)
-
- Give them a chance to validate their responses

Informal group Interview following Research Lesson.

- Enjoyed the lesson.

4/2/20

- Anything difficult?

- Recalling info from previous lessons → ~~The ones that~~
One finds it okay, the others find the more complicated stuff to remember.

→ Practical aspect aids the understanding of the lower ability

→ They did gain knowledge after theoretical explanation.

→ Practical ^{aspect} seems to be ^{less understandable} ~~not~~ on the higher ability.

→ Taking part in the practical aspect makes understanding better, but viewing it from a distance not as effective.

→ More time on the sheets.

Observation Schedule

Leuven scale of involvement will be used as the criteria for the observation schedule:

Stage in the Lesson:	Pupil:			
	1 boy in corner	2 boy at back	3 Girl in middle	4 Girl on right.
Start Filling in blanks on an A3 revision sheet they had from last lesson.	Handing out sheets. Now working his way through sheet.	Working away on starter	was disengaged briefly but now on task. Easily distracted.	Either trying to help pupil next to her, or trying to remember work. ~~Easily distracted~~
Theory Looking at atoms & electric circuits. Atoms for reference to charge in different particles.	Writing down the explanations for series/Parallel circuits. • Needs reiteration of task & help to know what to do.	Still engaged in the lesson. Working away on question sheet w/ little to no talking.	Reluctant to answer questions, but has the knowledge.	Filling in the sheet whilst he is going through it at front. Hard up straight away. Helping the pupil next to her to answer question sheet.
Practical Rope demonstration of how electricity travels from cell (teacher) to bulb (pupil) via feeling of heat. Demonstrating parallel & series circuits.	Taking part in the demo. • seems to need an individual explanation each time.	Now also taking part in second demo. Constantly engaged throughout whole lesson.	• Friends reenter from test. Looks more engaged in the lesson now. ~~Easily~~ More distracted again, but is also discussing work with pupils either side of her. • Works better surrounded by friends.	Always engaged in the lesson. "Constantly helping pupil beside her (Mko?)

Reflection of the Lesson Study (based on Gibbs 1988):

Name: William Myers

Date: 4/2/20

Class: Yr 9.

Stage	Notes	Prompts
Description	• Explanation of electrical circuits. • Difficulty recalling. • Were mythed about answering same question 3 times. → but this was part of research. • Longer time to fill in sheet.	What happened... ...during the main body of the lesson? ...when learners encountered difficulties? ...during times of transition? How did the learners respond to the different phases of the lesson? What were... ...the main areas for development in today's session?
Feelings	• Practical-hard to engage non-participants. • Lesson went well, got everything done.	What were your thoughts or feelings during the lesson? Giving examples from within the lesson, explain your feelings?
Evaluation	• Everyone engaged most of the time. • Those distracted from practical element didn't get as much from it. • It was a revision lesson, so quite recall based - some had difficulty with this.	Can you list... ...the aspects of the lesson that went well? ...the elements of the learning experience that were disappointing? ...any factors that influenced the learning/experience? What are some of the problems... ...learners encountered? ...you encountered? ...support staff encountered? Explain where the learning could have been more effective.
Analysis	• Effective session as most students seemed engaged for majority of lesson. • Reviewing previous content & using various methods of teaching. → Successful lesson in answering the research question.	Why would someone else think that... ...this was an effective/ ineffective session? What caused... ...the learning to be effective today? ...disruptions and the children being off task? ...the overall success of today's session? What literature could be used to develop your knowledge of how to improve?
Conclusion	• Lower liked practical aspect. • mid-ability enjoyed it as well. • Higher required further written work. • Integrate physical aspect for differentiation between ability groups.	Can you outline... ...how you could move the lower/ mid/ high ability forward? ...the next step for the whole class? ...the next steps for specific individuals? ...Did the physical engagement work?

• Physical engagement worked!

		Summarise ideas on how to improve practice.
Action Plan	• Where appropriate, try to incorporate physical engagement in lesson planning	Describe an incremental plan for the application of the knowledge discovered and how this may impact lessons in the future.

Later reflection (up to 48 hours post-lesson study):

General comments on initial reflection:	~~to test~~ After time spent thinking about it, the comments seem to be accurate, & the research answered the question of whether physically ~~& directly~~ engaging in an activity can improve understanding.
Are there other additional ideas that could improve the effectiveness of the learning taking place?	~~A whole-class involved~~ A physical engagement activity that involved the whole class rather than a few individuals so they all get the benefit of directly taking part.

Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

It refracts

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects?

It slows down

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

It would be slowed

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

It bends

2. What do we call an object that allows all light to pass through it?

Transparent

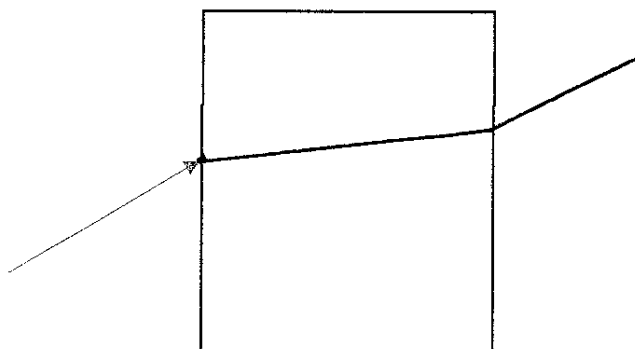
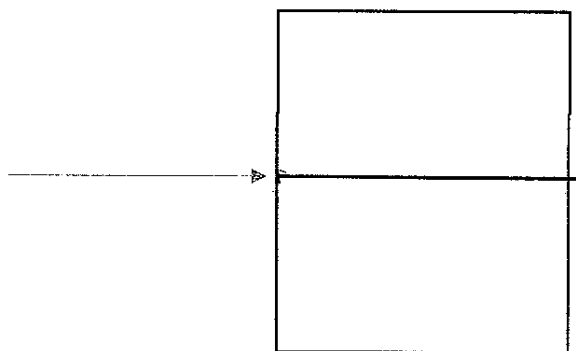
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

It slows down,

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

It slows down

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

Light refraction is when light bends while going through a transparent object

2. What do we call an object that allows all light to pass through it?

transparent

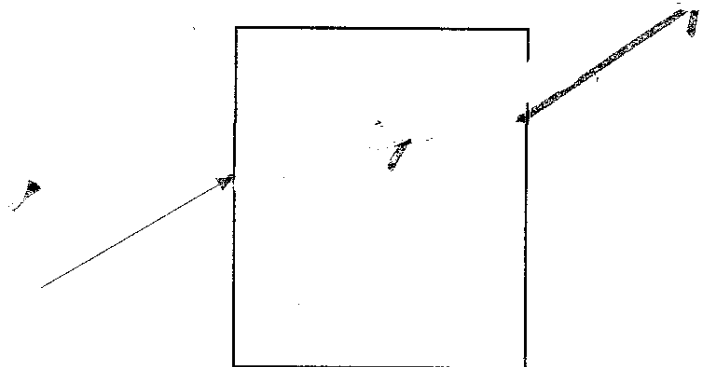
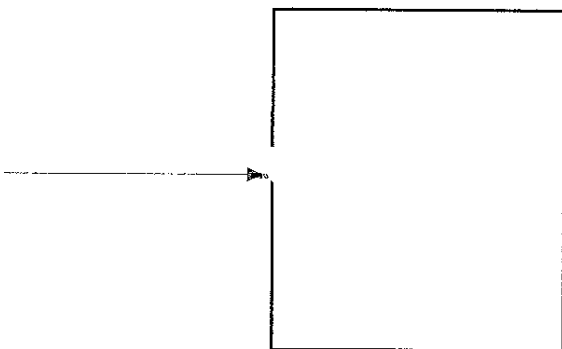
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

at 90° it goes straight through but at a diagonal angle it changes direction slightly.

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

The speed of light slows down when going through transparent objects.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

~~I don't know~~

2. What do we call an object that allows all light to pass through it?

~~Transparent~~

3. What happens to the light as it passes through different see-through objects?



4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

~~Yes, it slows down~~

Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

When light bends

2. What do we call an object that allows all light to pass through it?

Transparent

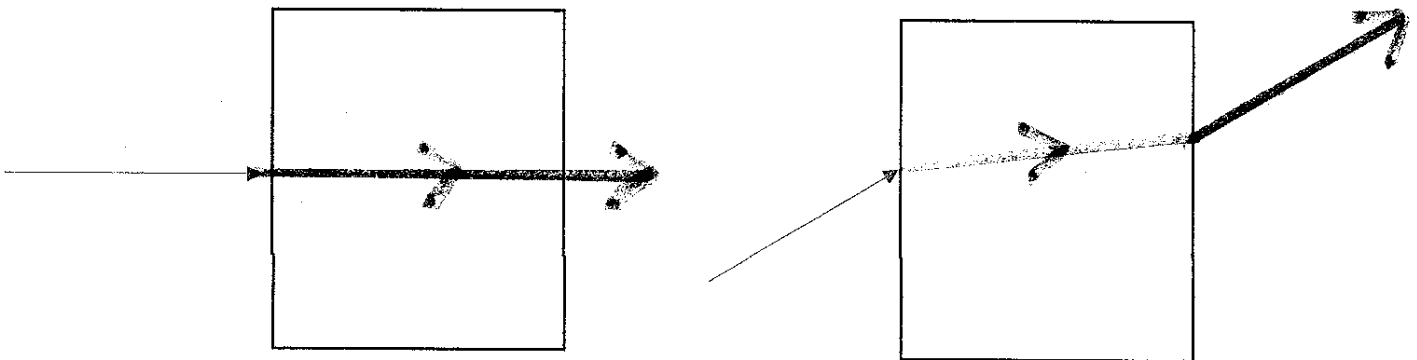
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

90° goes straight, at an angle, changes direction

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

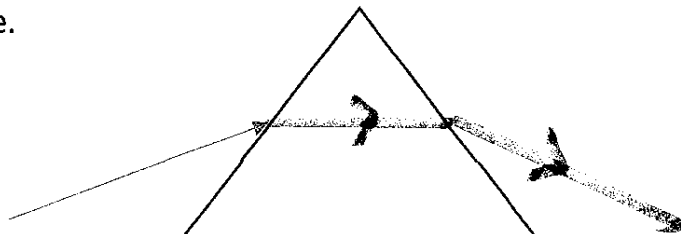
Yes, it goes slower

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

- It is at the same angle as it went in. ← Answer in space above question.
7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

Nope

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects?

It reflects

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

When light bends

2. What do we call an object that allows all light to pass through it?

Transparent

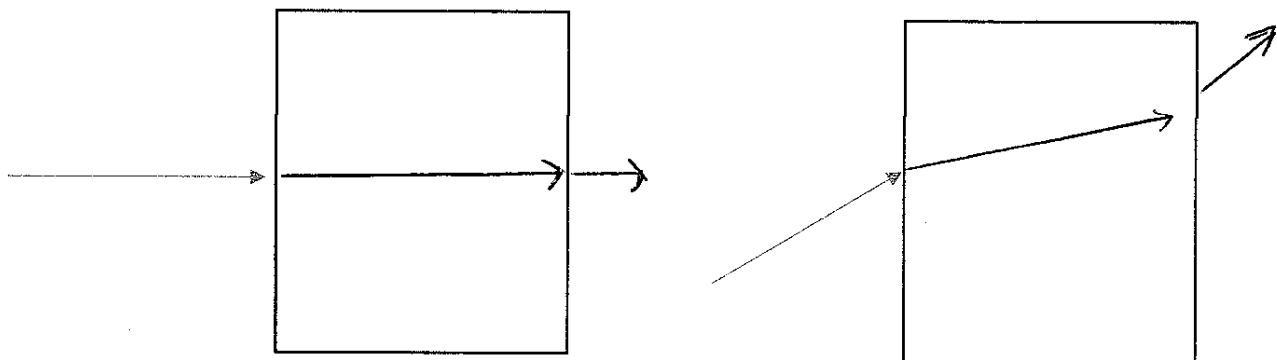
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

90° angle it would go straight any other it would bend.

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Yes, it slows down

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

when light bends

2. What do we call an object that allows all light to pass through it?

Transparent

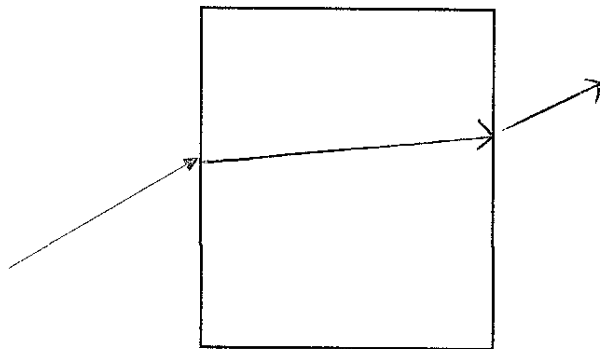
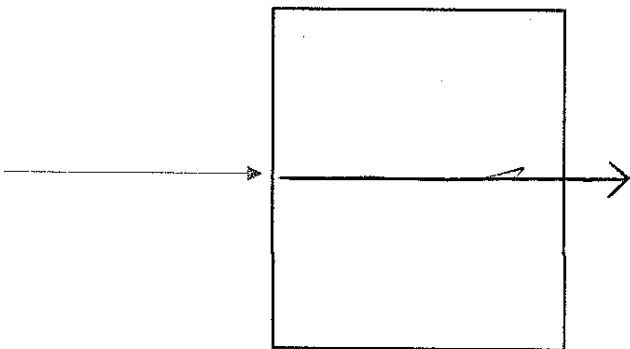
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

90° angle it would go straight any other would bend

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Yes, it would slow down

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:

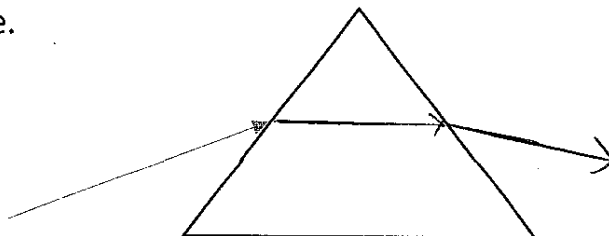


6. Now draw what happens to the ray coming out the other side.

The same as started

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.

Answer in space above question.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

NO

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects?

It reflects

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

I don't know

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

when light bends

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

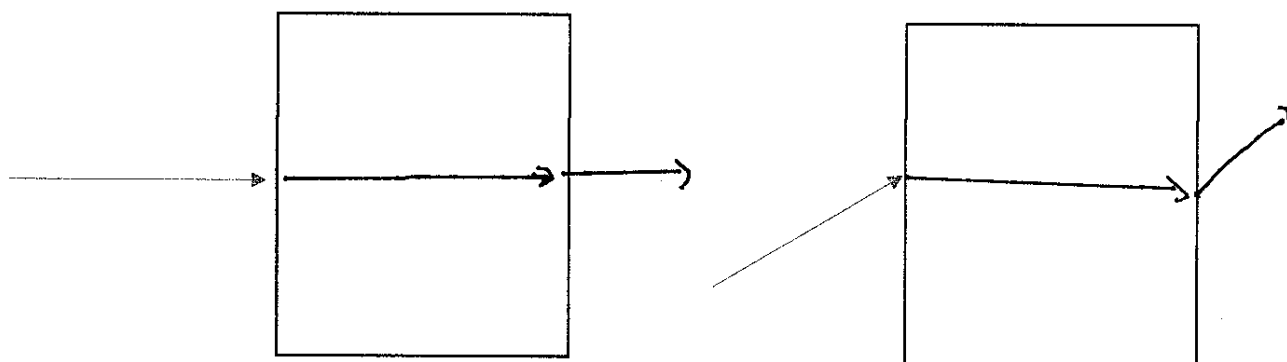
90° = goes straight

all others = bends

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes slows down in transparent

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

When light bends

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

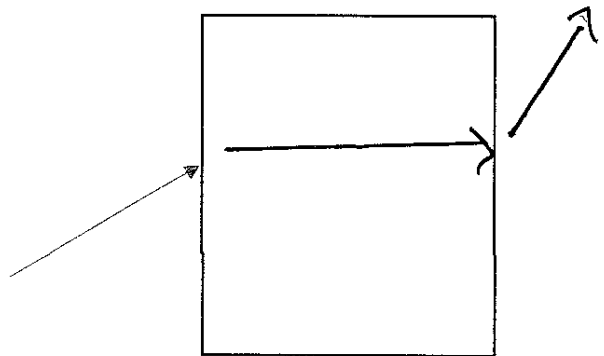
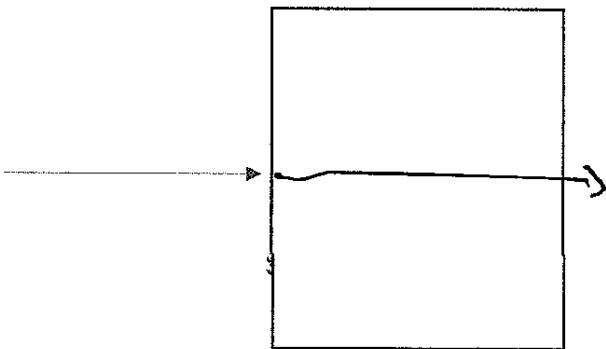
90° = straight

anything else = bends

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes slows down ~~to~~ through objects

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:

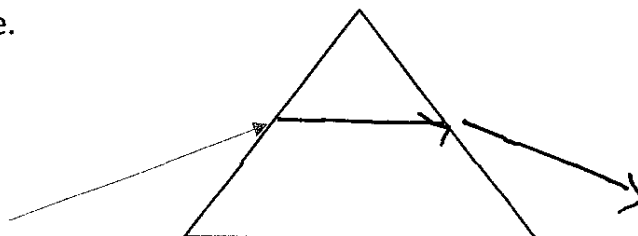


6. Now draw what happens to the ray coming out the other side.

the same as started

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.

Answer in space above question.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

I do not know what it means

2. What do we call an object that allows all light to pass through it?

transparent

3. What happens to the light as it passes through different see-through objects?

It slows down

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

Yes it is it slows down.

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

It is when light passes through an object it bends

2. What do we call an object that allows all light to pass through it?

transparent

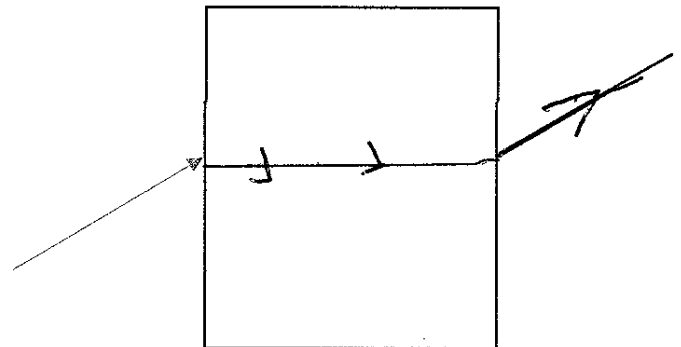
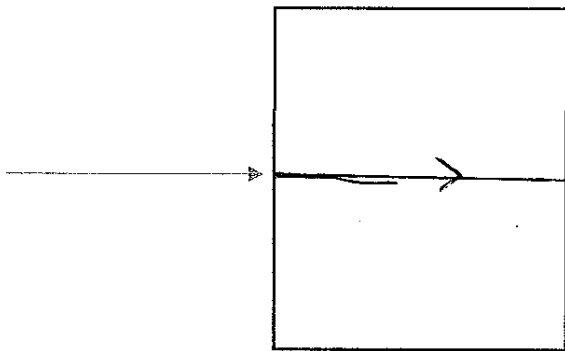
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

It does not bend

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Yes it slows down

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

It means when light passes through an object it bends

2. What do we call an object that allows all light to pass through it?

transparent

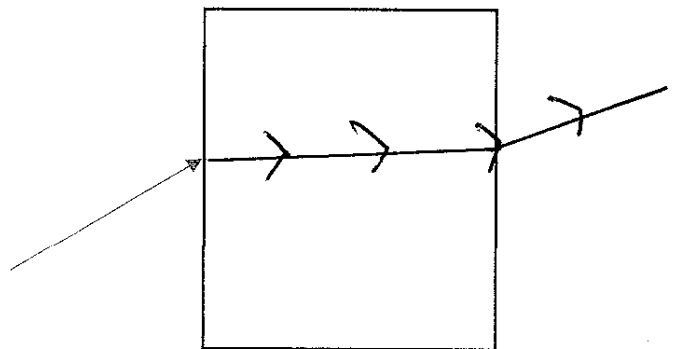
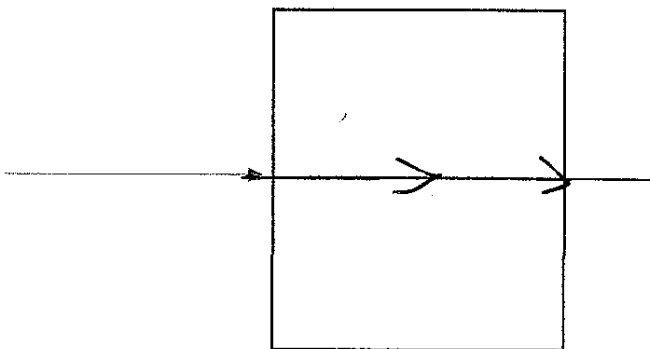
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

With other angles it bends at 90° it doesn't

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

When light passes through objects it slows down

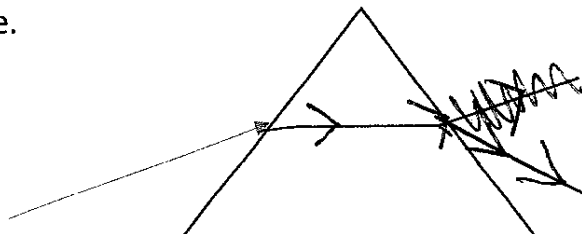
5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.

Answer in space above question.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

I do not know

2. What do we call an object that allows all light to pass through it?

transparent

3. What happens to the light as it passes through different see-through objects?

It reflects

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

I dont know

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

Light refraction when ~~if~~ light bends

2. What do we call an object that allows all light to pass through it?

transparent

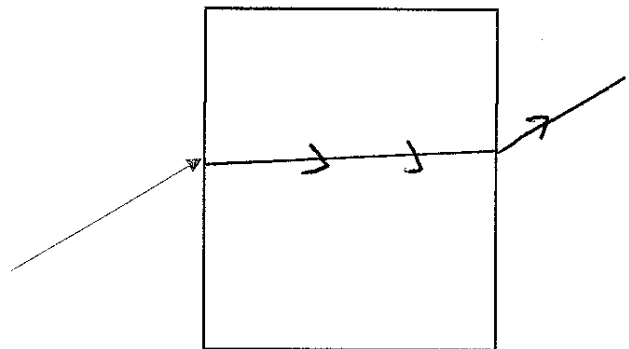
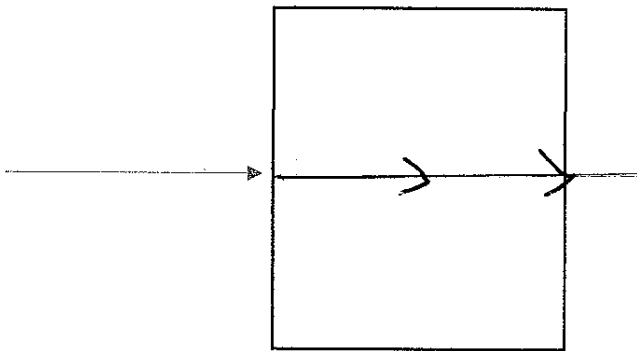
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

it does not bend

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

yes it slows down

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

when light bends

2. What do we call an object that allows all light to pass through it?

transparent

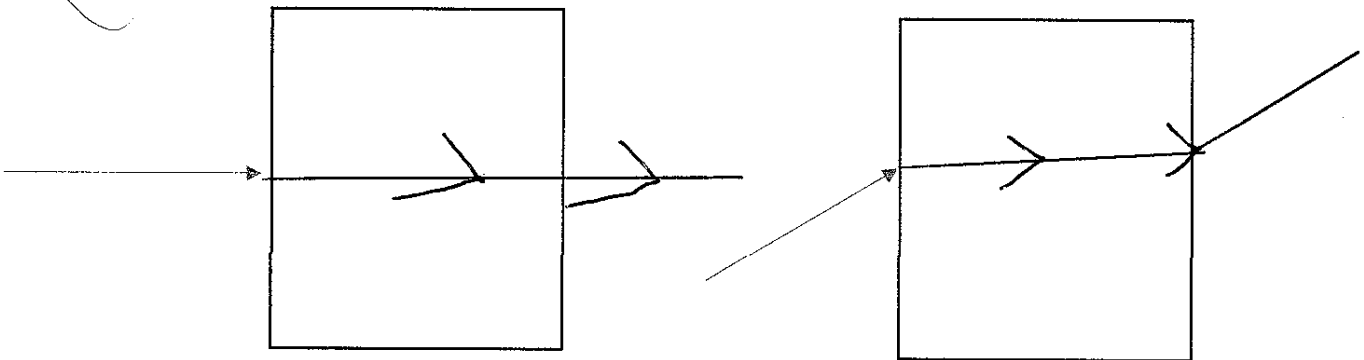
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

it does not bend

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes it slows down

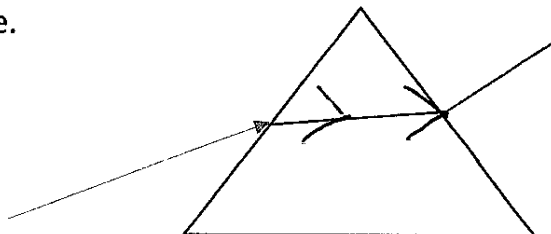
5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

the same as started

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.





Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

AS a light ray goes through a see-through objects it bends slightly

2. What do we call an object that allows all light to pass through it?

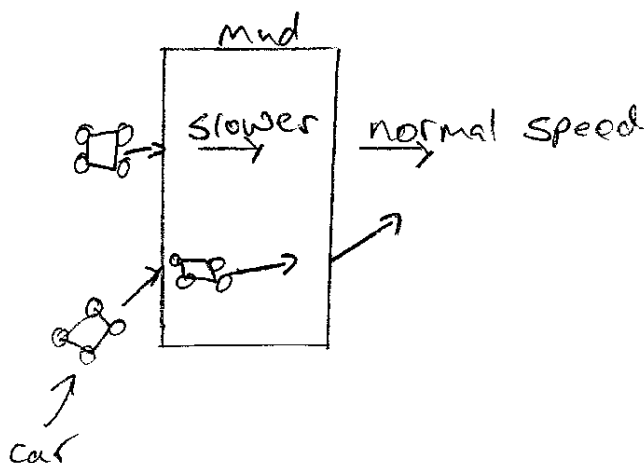
Transparent and translucent

3. What happens to the light as it passes through different see-through objects?

The light ray bends. but only if the see through object is at an angle if it was straight the light wouldn't bend.

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Yes it ~~is~~ does effect the speed as it's sort of like if a car went through mud it would slow down



Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

As a light ray goes through a see-through object it bends slightly (only if the object is wonky)

2. What do we call an object that allows all light to pass through it?

transparent and translucent

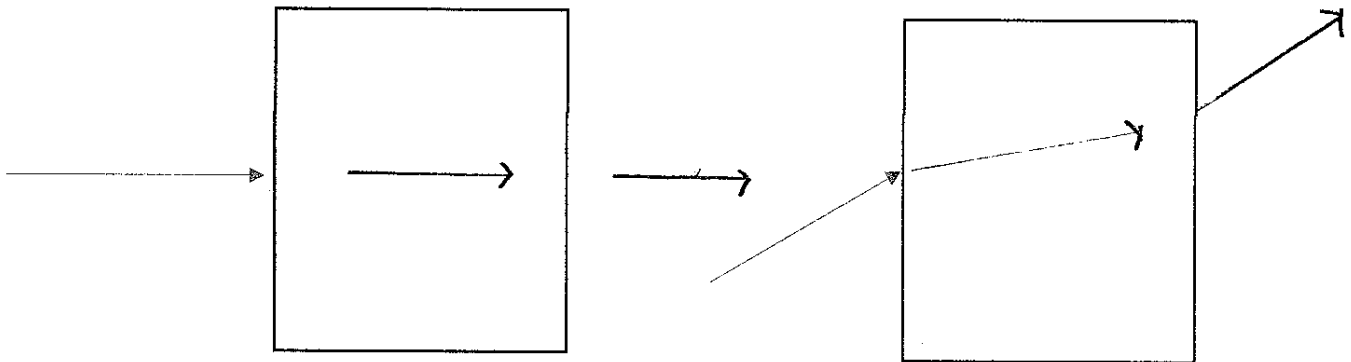
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

If it was at 90° it would go straight through if it was wonky it would ~~come~~ come out bent.

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes it does ^{affect} ~~affect~~ the speed as if it is sort of like a car went through mud it would slow down.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

As a light ray goes through a see-through object it bends slightly (only if the object is wonky)

2. What do we call an object that allows all light to pass through it?

transparent and translucent

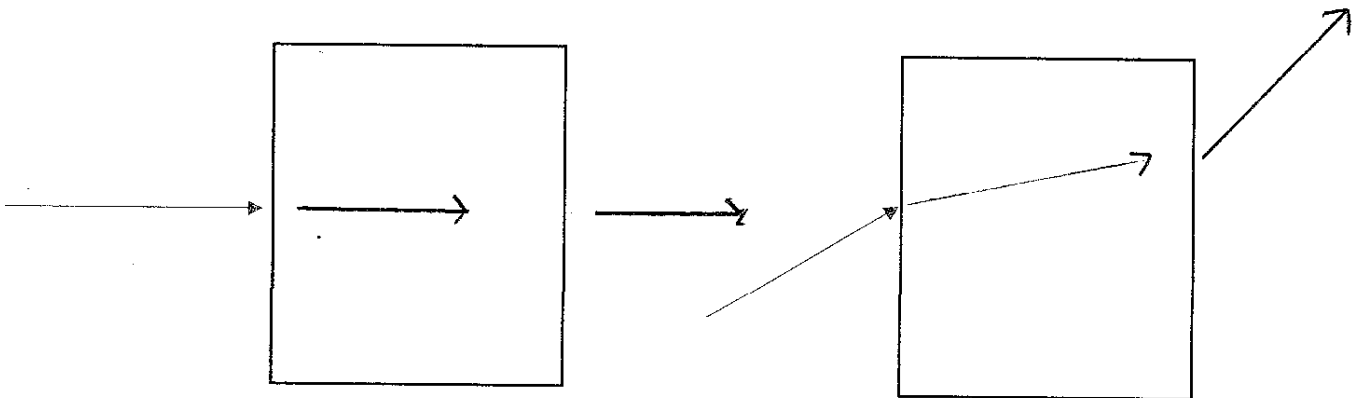
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

If it was at 90° it would go straight through if it was wonky it would come out bent.

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes it is affected the speed as if it was sort of like a car went through the mud it will slow down.

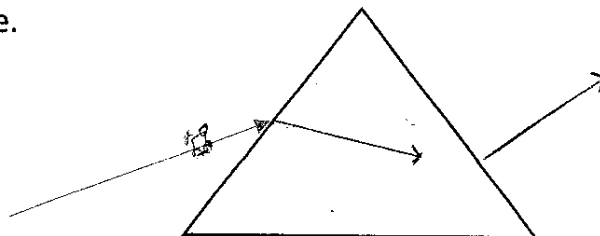
5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

It goes in and comes out at the same sort of angle.

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

As a light ray goes through a see-through object it bends slightly instead of passing straight through

2. What do we call an object that allows all light to pass through it?

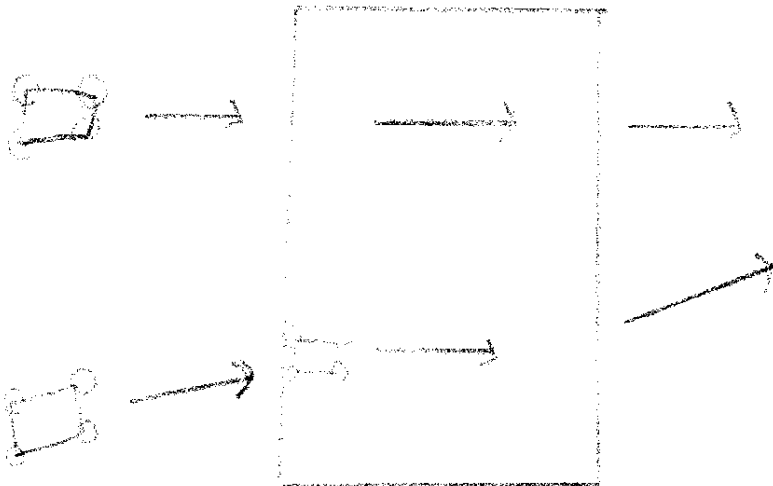
transparent translucent

3. What happens to the light as it passes through different see-through objects?

The light ray bends but only if the transparent object is at an angle if it was straight the light would not bend

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes it does affect the speed as it's slower if a car went through mud ~~then~~ it would slow down.



Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

as a light ray goes through a translucent object it bends slightly

2. What do we call an object that allows all light to pass through it?

transparent and translucent

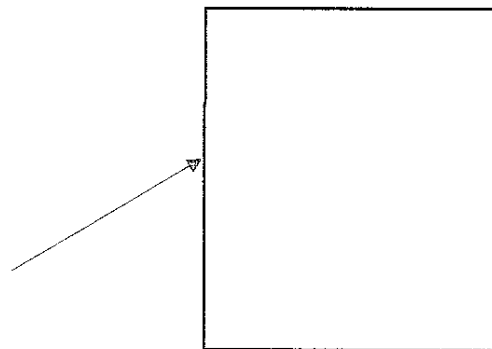
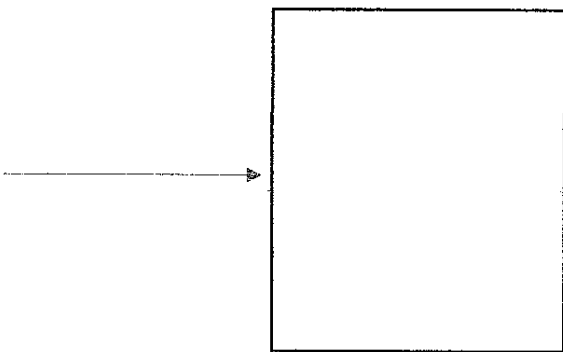
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

if it was at 90° it would go straight through and if it was straight it would turn 90° .

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes it does affect the speed as it is sort of if a car went through mud it would slow down.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

as a light ray goes through a translucent object it bends slightly

2. What do we call an object that allows all light to pass through it?

transparent and translucent

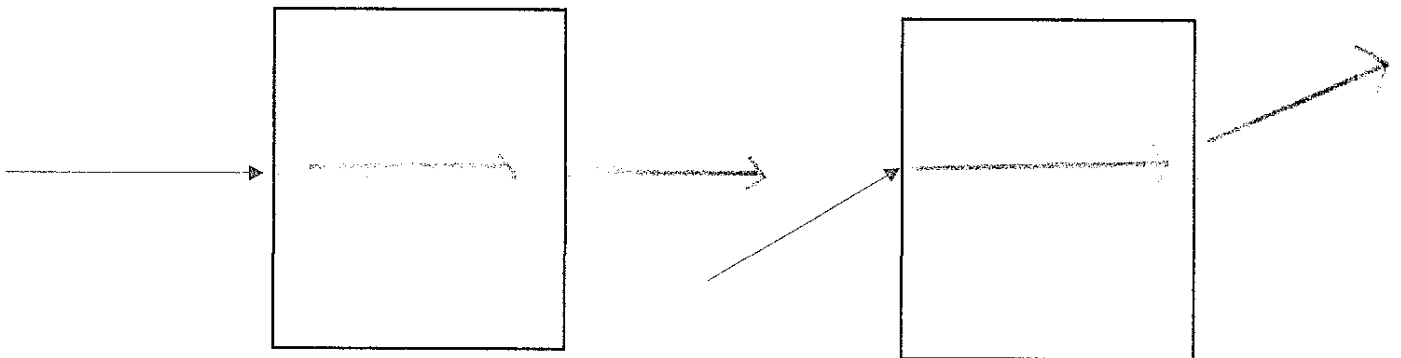
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

if it was at 90° it would go straight through and if it was straight it would turn

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

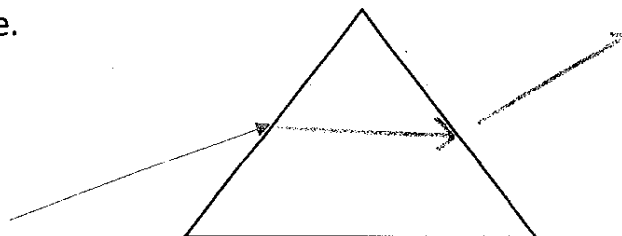
yes if it does affect the speed as it is sort of like a car went through mud it would slow down.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.



Answer in space above question.

Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

As a light ray goes through a see-through object it bends slightly.

2. What do we call an object that allows all light to pass through it?

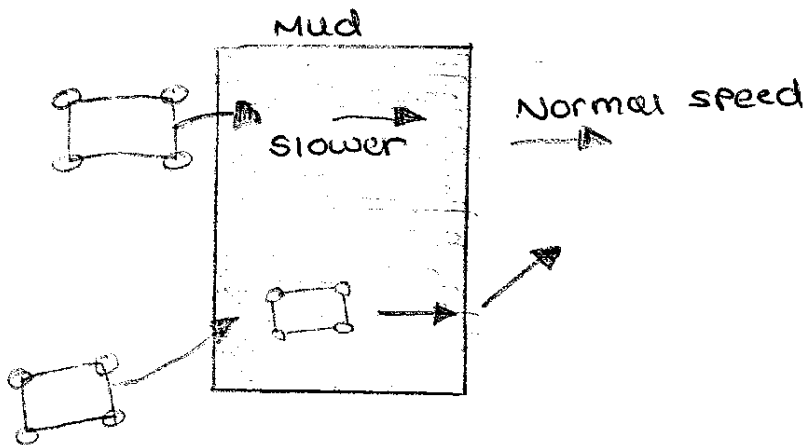
Transparent and Translucent

3. What happens to the light as it passes through different see-through objects?

The light ray bends. But only if the see through object is at an angle if it was straight the light wouldn't bend.

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

yes it is does effect the speed as is sort of like if a car went through mud it would slow down.



Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

As a light ray goes through a see-through object it bends slightly (only if the object is wacky)

2. What do we call an object that allows all light to pass through it?

Transparent and Translucent

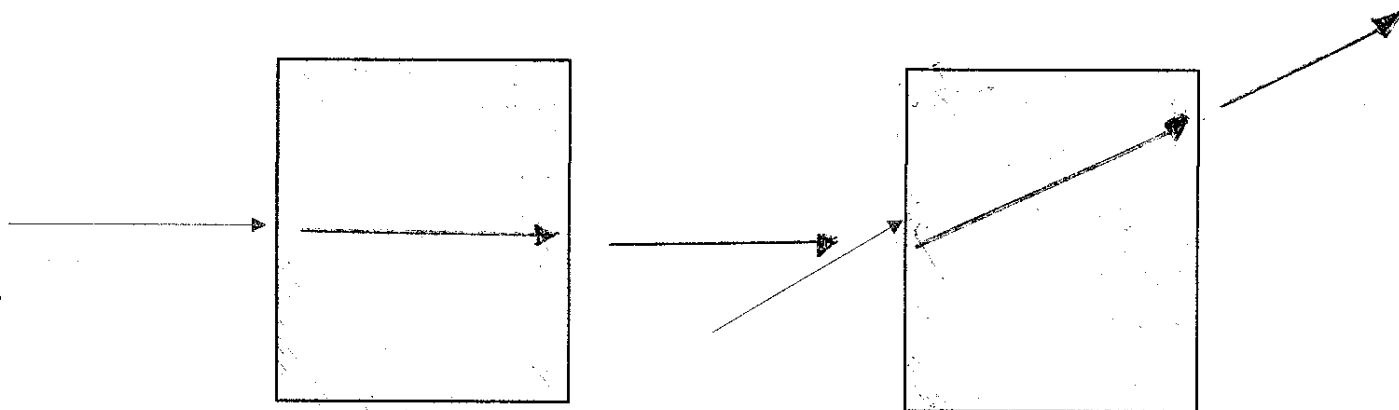
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

If it was at 90° it would go straight through. If it was wacky it would come out bent.

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

yes it does effect the speed as it sort of like if a car went through mud it would slow down.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

As a light ray goes through a see-through object it bends slightly

2. What do we call an object that allows all light to pass through it?

Transparent and Translucent

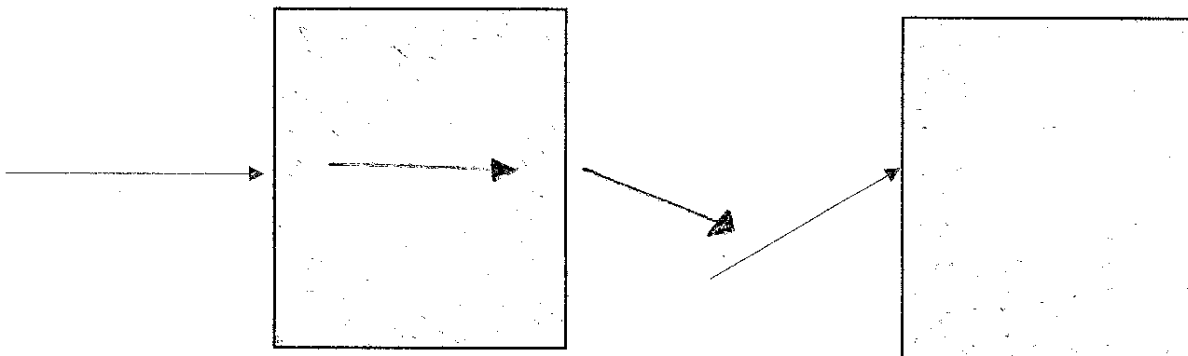
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

If it was at 90° it would go straight through. If it was wendy it would come out bent.

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

yes it does effect the speed as it sort of like if a car went through mud it would slow down.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:

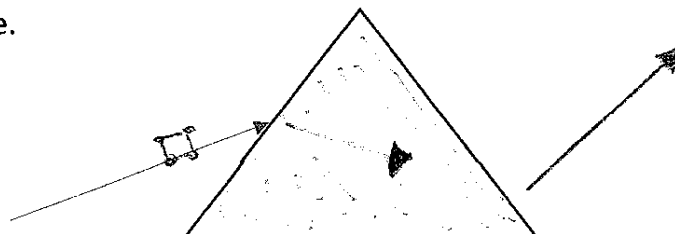


6. Now draw what happens to the ray coming out the other side.

It goes in and comes out at the same sort of angle.

← Answer in space above question.

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

It's when the light passes through a see-through object
& bends the ray slightly. (If it's on an angle that is.)

2. What do we call an object that allows all light to pass through it?

Transparent / Luminous

3. What happens to the light as it passes through different see-through objects?

It bends a bit. The speed of light slows down. & bends
as it passes through the object. Only happens when the light
comes in at an angle.

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

I think so! The speed of light slows down as it passes
through the object.

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

Light refraction is when a ray of light passes through a clear object & bends, then continues the same as before.
(only happens if the light comes in at an angle)

2. What do we call an object that allows all light to pass through it?

Transparent

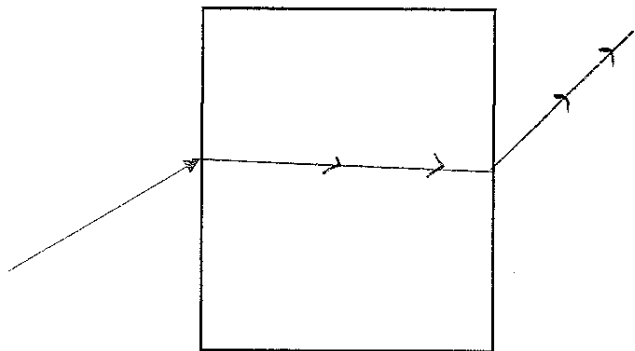
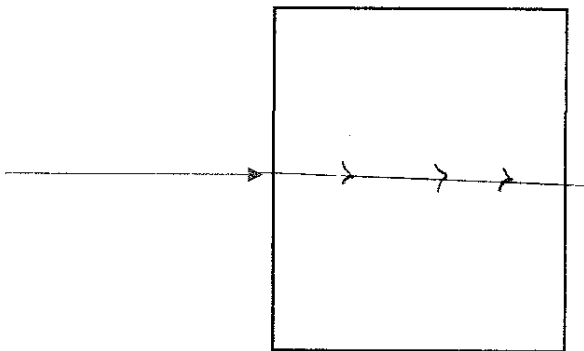
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

The light does pass through the object, but doesn't bend. (Ray of light passes through a clear object & bends, then continues the same as before)

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

The speed of light slows down as light passes through it.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Doesn't refract when ^{the light comes in} as object is at a 90° angle or when it's transparent.

Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

Light Refraction is when a ray of light passes through a clear object & bends, then continues the same as before. (only happens if light comes in at an angle.)

2. What do we call an object that allows all light to pass through it?

Transparent

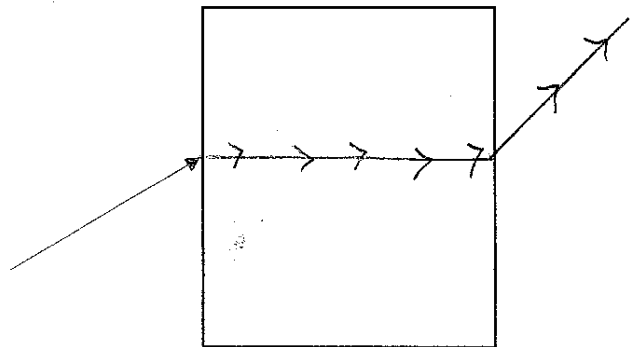
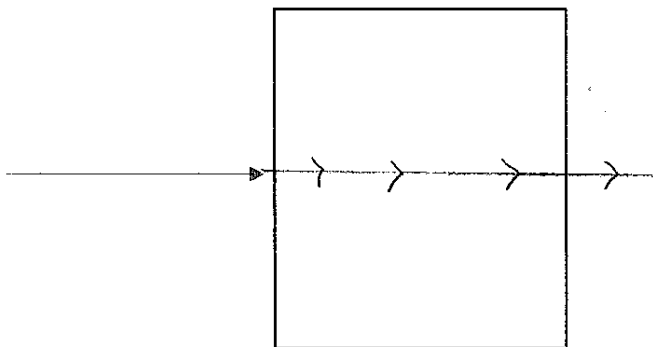
3. What happens to the light as it passes through different see-through objects at different angles, including 90°?

The light passes through the object, but doesn't bend! (ray of light passes through a clear object & bends, then continues the same way as before)

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

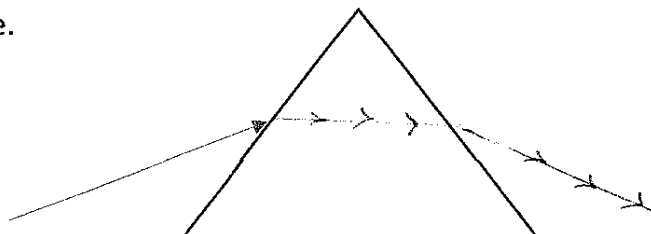
The speed of light slows down as the light ray passes through the clear object.

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

7. What can you say about the angle it comes out at? Extension: Try ^{Answer in space above} drawing how the next light ray is affected; think about what happened outside. _{question.}



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

It Refracts

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects?

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

When light bends

2. What do we call an object that allows all light to pass through it?

transparent

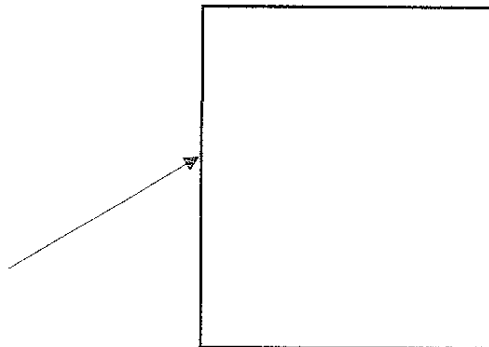
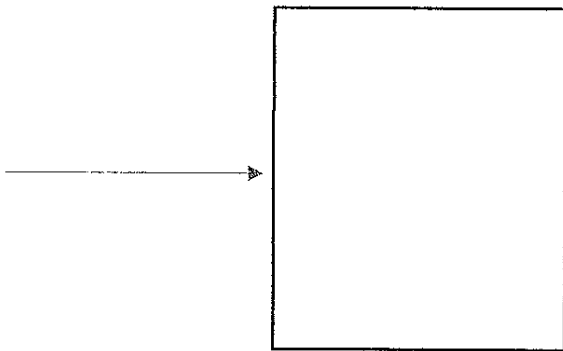
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

it comes in at a 90° angle

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

the speed of light-

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

Light bends

2. What do we call an object that allows all light to pass through it?

transparent

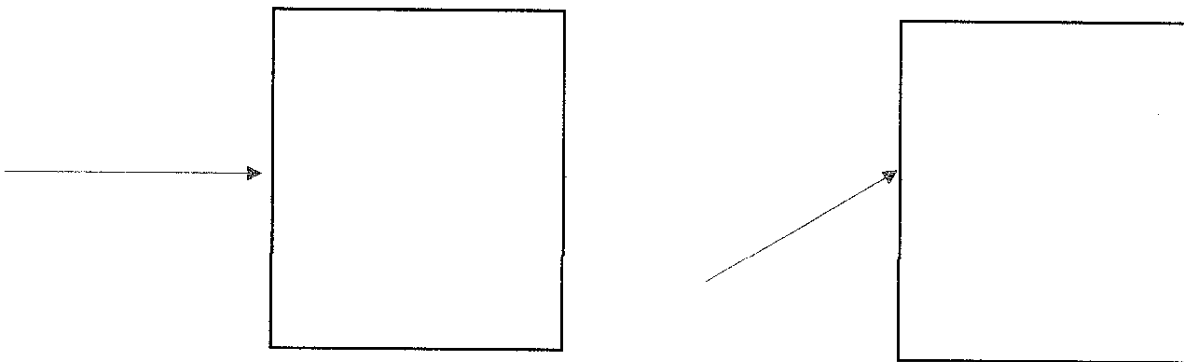
3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

Slows down when passing

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

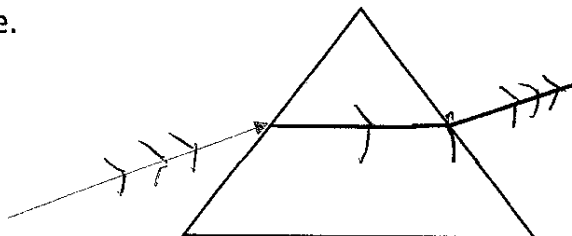
yes it bends

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

7. What can you say about the angle it comes out at? Extension: Try ^{✓ Answer in space above question.} drawing how the next light ray is affected; think about what happened outside.



Light Refraction Worksheet 1:

1. Do you know what Light Refraction means? Write your answer in the space below:

I don't

2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects?

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

Light Refraction worksheet 2:

1. Do you know what Light Refraction means? Write your answer in the space below:

Is when light bends.

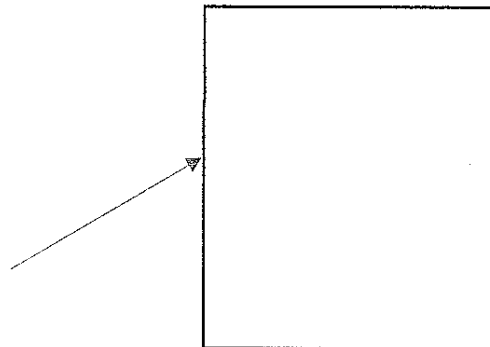
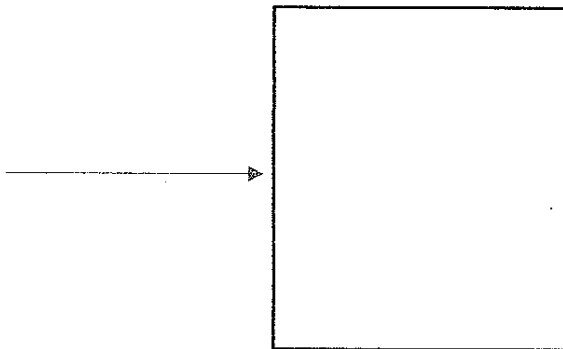
2. What do we call an object that allows all light to pass through it?

Transparent

3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

4. Is the speed of light affected as it passes through different see-through objects? If so, In what way?

5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



Light Refraction worksheet 3:

1. Do you know what Light Refraction means? Write your answer in the space below:

2. What do we call an object that allows all light to pass through it?

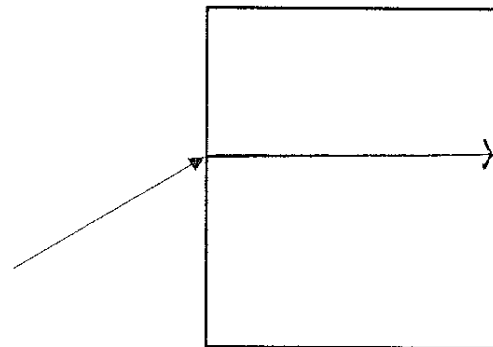
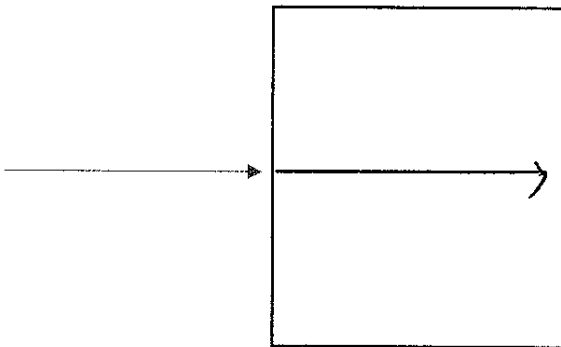
Transparent

3. What happens to the light as it passes through different see-through objects at different angles, including 90° ?

It doesn't bend at all when on an angle of 90° when not

4. Is the speed of light affected as it passes through different see-through objects? If so, in what way?

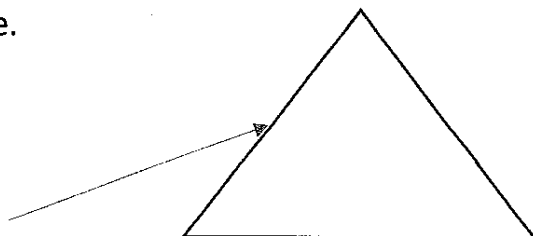
5. Draw what will happen to the light ray as it passes through the glass blocks that follow:



6. Now draw what happens to the ray coming out the other side.

7. What can you say about the angle it comes out at? Extension: Try drawing how the next light ray is affected; think about what happened outside.

↖ Answer in space above question.



SAMPLE CONSENT FORM (PARENTS)

PROJECT TITLE: How does physical engagement aid students' development of conceptual modelling in Physics?

Name of Researcher: Mr William Myers

Please initial box

1. I confirm that I have read and understand the information sheet dated 3/2/20 – 4/2/20 for the above study.

☐

2. I understand that my child's participation is voluntary and that I am free to withdraw my child from the study at any time, without giving any reason.

☐

3. I understand that my child can choose to withdraw at any time, without giving a reason.

☐

4. I understand that the information given by my child will be used in a university assignment.

☐

5. I understand that my child's name will not appear at any time.

☐

6. I agree for my child to take part in the above study.

☐

Child's name

Parent signature

Date

When completed, please return in the envelope provided to
..... by the of (date)

Thank you.

INFORMATION SHEET (PARENT)

PROJECT TITLE: How does physical engagement aid students' development of conceptual modelling in Physics?

Dear Parent / Guardian,

My name is **Mr William Myers** and I am studying for a PGCE qualification at Yr Athrofa, University of Wales Trinity Saint David. I am currently a student teacher within **Ysgol Dyffryn Taf** and am teaching in your child's class.

I would like to invite your child to participate in my research project. The title of the project is 'How does physical engagement aid students' development of conceptual modelling in Physics?' and I aim to investigate whether the use of physical participation within lessons helps with the learning of some concepts in physics. Through your child's participation, I hope to ascertain how this can be developed for use with a range of classrooms teaching physics.

The lesson shall occur largely as per usual, with small additions of question sheets to ascertain understanding at different stages of the lesson. Throughout the lesson a research partner shall be present to observe the class and how pupils interact with activities. Following this, your child may be part of a group interview to allow for discussion regarding their opinions about the different stages.

All names will be kept strictly confidential and will only be known by myself and my research partner. Your child's participation in this study is completely voluntary so you or your child can withdraw from the study at any stage. Your child will also be asked to give their assent before the beginning of the study.

After careful and precise analysis of the data obtained from the lesson observation and group interview, I would be happy to provide you with a copy of the findings at your request. The results of the research will be discussed in a university assignment that will contribute to my PGCE course. The results of this study will be stored on **a firewalled drive belonging to the University** and all raw data will be destroyed once the assessment has been marked.

I thank you in advance for your time. If any questions do arise, feel free to contact me at your convenience.

Yours sincerely,

Mr William Myers

INFORMATION SHEET (PUPIL)

PROJECT TITLE: How does physical engagement aid students' development of conceptual modelling in Physics?

Dear Pupil,

My name is **Mr William Myers** and I am studying for a PGCE qualification at Yr Athrofa, University of Wales Trinity Saint David.

I would like to invite you to participate in my research project. The title of the project is '**How does physical engagement aid students' development of conceptual modelling in Physics?**' and I aim to **investigate whether the use of physical participation within lessons helps with the learning of some concepts in physics.**

The lesson shall occur largely as per usual, with small additions of question sheets to ascertain understanding at different stages of the lesson. Throughout the lesson a research partner shall be present to observe the class and how pupils interact with activities. Following this, you may be asked to be part of a group interview to allow for discussion regarding your opinions about the different stages.

All names will be kept strictly confidential and will only be known by myself and my research partner. Your participation in this study is completely voluntary and you will be asked to confirm that you're willing to be a participant at the start of the lesson, but you can withdraw from the study at any stage.

After careful and precise analysis of the data obtained from the lesson observation and group interview, I would be happy to provide you with a copy of the findings at your request. The results of the research will be discussed in a university assignment that will contribute to my PGCE course. The results of this study will be stored on **a firewalled drive belonging to the University** and all raw data will be destroyed once the assessment has been marked.

I thank you in advance for your time. If any questions do arise, feel free to contact me at your convenience.

Yours sincerely,

Mr William Myers

Observation Schedule

Leuven scale of involvement will be used as the criteria for the observation schedule:

Stage in the Lesson:	Pupil:		
	1 <i>4.1</i>	2 <i>5.4</i>	3 <i>2.1</i>
Start	<i>3 - Questioning, but off topic</i>	<i>3 - Focused on trying to answer question that</i>	<i>2 - looking around and talking</i>
Theory	<i>2 - some distraction, limited focus on task</i>	<i>3 - listening, but not engaging</i>	<i>2 - 1 - actively talking</i>
Practical	<i>4 - Focused on task</i> <i>2 - A little attention paid while writing</i>	<i>3 - Participated without focusing</i> <i>1 - no focus while writing</i>	<i>3 - Takes part with some tugging</i> <i>2 - Distracted whilst writing</i>

<i>Post</i>	<i>3 - some distraction but largely focused</i>	<i>4 - settled back into activity quickly</i>	<i>3 - began work, but left coat on</i>
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4.1

5.4

2.1

• Enjoy

• Too loud

• Enjoyed

• Some questions
hard

• Found it easier
after outside

• Content on
the board helped

• Some people doing it
wrong outside

• Could have had
a demonstration

• Found it
easier after outside

Stage in the lesson:		Pupil:
Start		
Theory		
Practical		

3-4 min	3-4 min	3-4 min	3-4 min
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Reflection of the Lesson Study (based on Gibbs 1988):

Name: Bill Myers

Date: 3/2/20

Class: 8

Stage	Notes	Prompts
Description	• Enjoyed going outside • Difficulties with ray diagrams • More work done when coming back in	What happened... ...during the main body of the lesson? ...when learners encountered difficulties? ...during times of transition? How did the learners respond to the different phases of the lesson? What were... ...the main areas for development in today's session?
Feelings	• All students progressed and answered some questions	What were your thoughts or feelings during the lesson? Giving examples from within the lesson, explain your feelings?
Evaluation	~~well:~~ • Understanding of refraction • Ray diagrams not well understood • Outside could be more effective - Explain inside - Model with teacher	Can you list... ...the aspects of the lesson that went well? ...the elements of the learning experience that were disappointing? ...any factors that influenced the learning/experience? What are some of the problems... ...learners encountered? ...you encountered? ...support staff encountered? Explain where the learning could have been more effective.
Analysis	• Reinforcing concepts through repetition	Why would someone else think that... ...this was an effective/ ineffective session? What caused... ...the learning to be effective today? ...disruptions and the children being off task? ...the overall success of today's session? What literature could be used to develop your knowledge of how to improve?
Conclusion	• Practical experiment on refraction • Worked well with lower ability	Can you outline... ...how you could move the lower/ mid/ high ability forward? ...the next step for the whole class? ...the next steps for specific individuals? ...Did the physical engagement work?

		Summarise ideas on how to improve practice.
Action Plan	<i>Where appropriate, use physical engagement wherever possible</i>	Describe an incremental plan for the application of the knowledge discovered and how this may impact lessons in the future.

Later reflection (up to 48 hours post-lesson study):

General comments on initial reflection:	
Are there other additional ideas that could improve the effectiveness of the learning taking place?	