

# IT in Education Subject-related Series:

Using 3D-Printing Technology and e-Learning  
Tools to Enhance Learning, Teaching and  
Assessment of Science (S1-3) Curriculum

Session 1

# Objectives

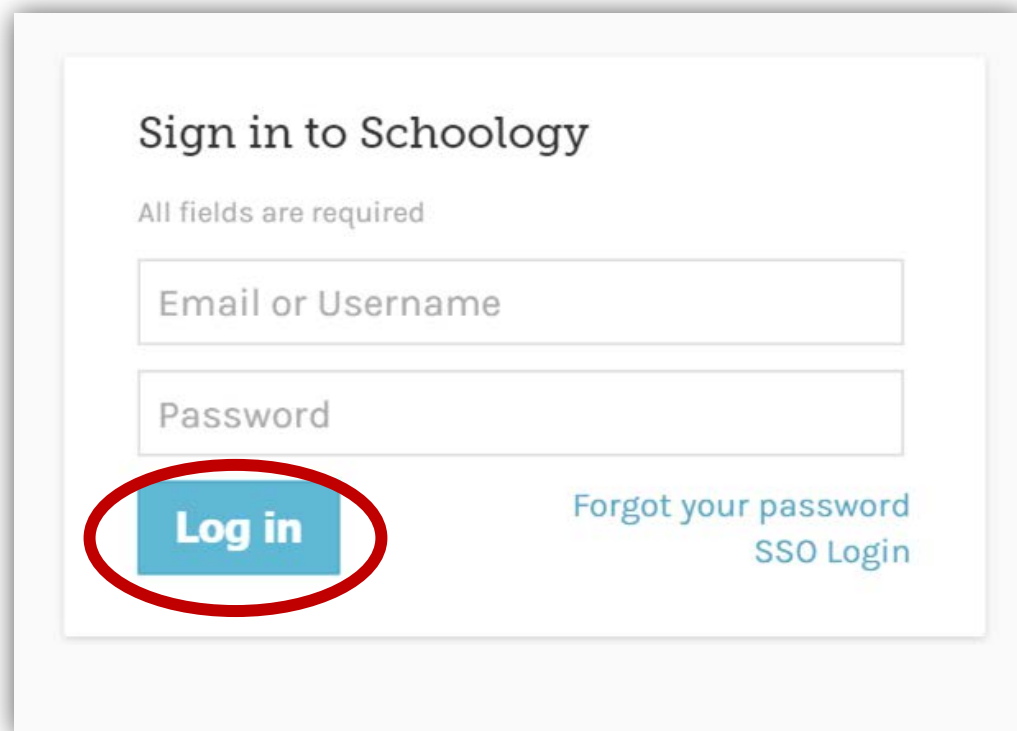
## Session 1

### Using 3D-Printing technology for conducting scientific investigation

- ▶ Use of e-Learning platform (e.g. Schoology)
- ▶ Overview of the strategy for using 3D-Printing technology and digital tools in scientific investigation
  - ▶ Use of e-Learning tool (e.g. AnswerGarden)
  - ▶ Use of PhET simulations tool (e.g. energy forms and changes)
- ▶ Introduction of 3D-Printing technology
- ▶ Design 3D objects for scientific investigation (each participant is required to choose a 3D design task)
- ▶ Discussion on the assignment

# Login the e-Learning Platform

- ▶ <http://www.schoolology.com>
- ▶ Log In: using your own schoolology account
- ▶ Course Code: KJ38Z-WNBWP



Sign in to Schoolology

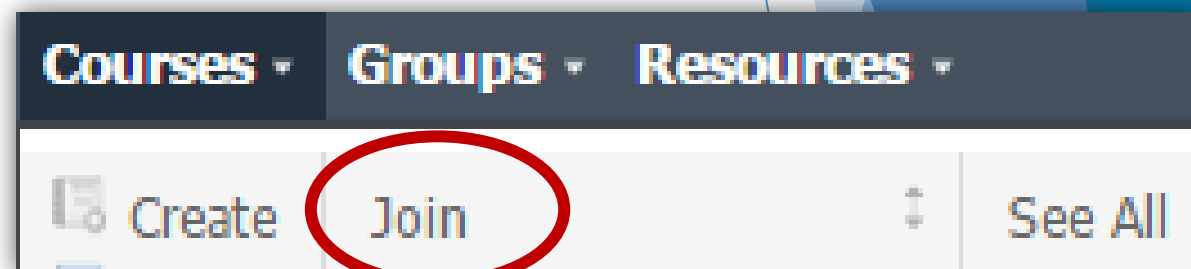
All fields are required

Email or Username

Password

**Log in**

[Forgot your password](#)  
[SSO Login](#)

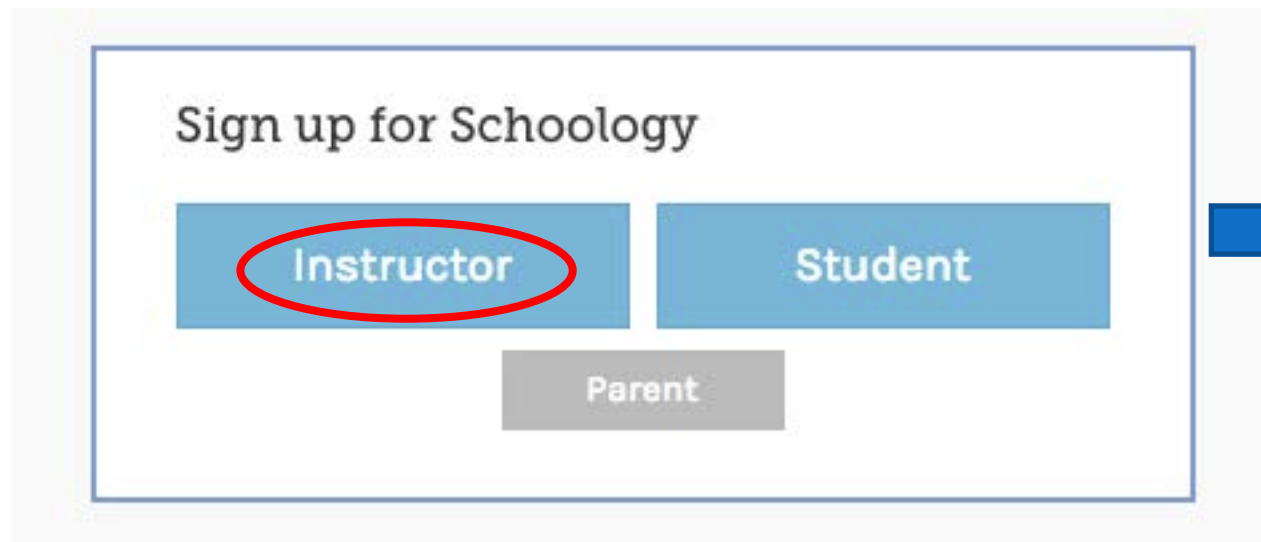


**Courses** ▾ **Groups** ▾ **Resources** ▾

Create **Join** See All

## Sign up as an instructor

- Sign Up: using your personal email to sign up as an instructor

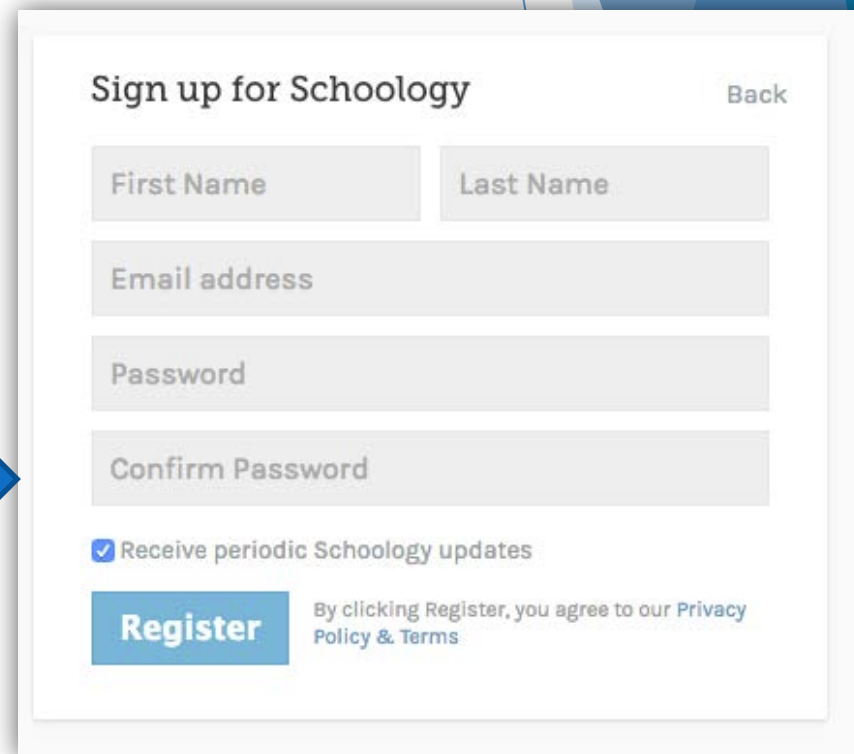


Sign up for Schoolology

**Instructor** Student

Parent

A blue arrow points from the 'Instructor' button to the registration form on the right.



Sign up for Schoolology [Back](#)

First Name Last Name

Email address

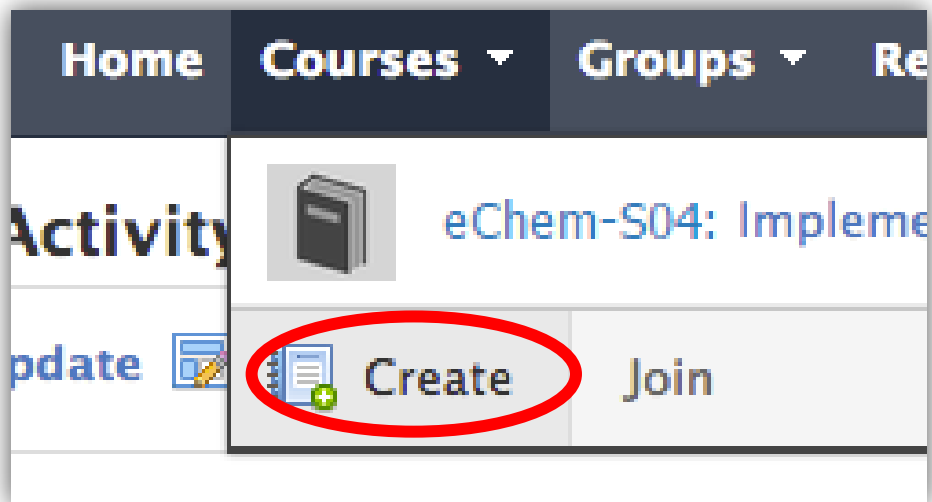
Password

Confirm Password

☒ Receive periodic Schoolology updates

**Register** By clicking Register, you agree to our [Privacy Policy & Terms](#)

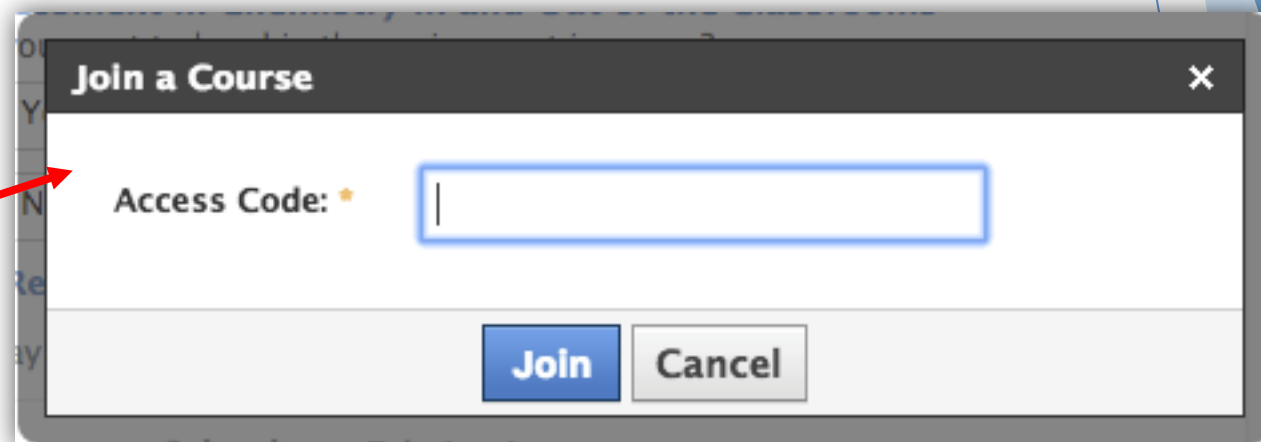
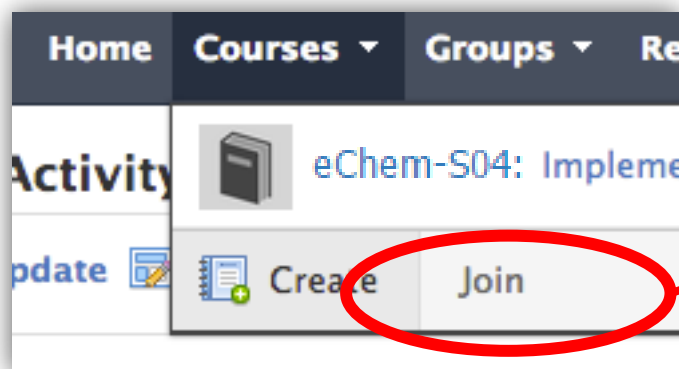
## Create course



Mark down your course code

- ▶ Create your own content and resources

- Use a test account to join the course you created



# schoolology® Ask Questions

The screenshot shows the schoolology interface. At the top, there is a navigation bar with the schoolology logo, a 'Basic' tab, and links for Home, Courses, Groups, and Resources. The main content area displays the course title 'eScience-AE: Using 3D-Printing Technology and e-Learning Tools to Enhance Learning, Teaching and Assessment of Science (S1-3) Curriculum' and the provider 'Institute of Professional Education And Knowledge (PEAK) Vocational Training Council'. Below the title, there are buttons for 'Add Materials' and 'Options'. A list of materials is shown, including 'Session 1', 'Session 2', and 'Questions about the course'. The 'Questions about the course' item is circled in red. On the left side, there is a sidebar with a 'Course Options' section and a 'Materials' section containing links for Updates, Gradebook, Badges, and Attendance.

schoolology® Basic

Home Courses Groups Resources

**eScience-AE: Using 3D-Printing Technology and e-Learning Tools to Enhance Learning, Teaching and Assessment of Science (S1-3) Curriculum**

Institute of Professional Education And Knowledge (PEAK) Vocational Training Council

Add Materials Options

All Materials

Session 1

Session 2

Questions about the course

Course Options

Materials

Updates

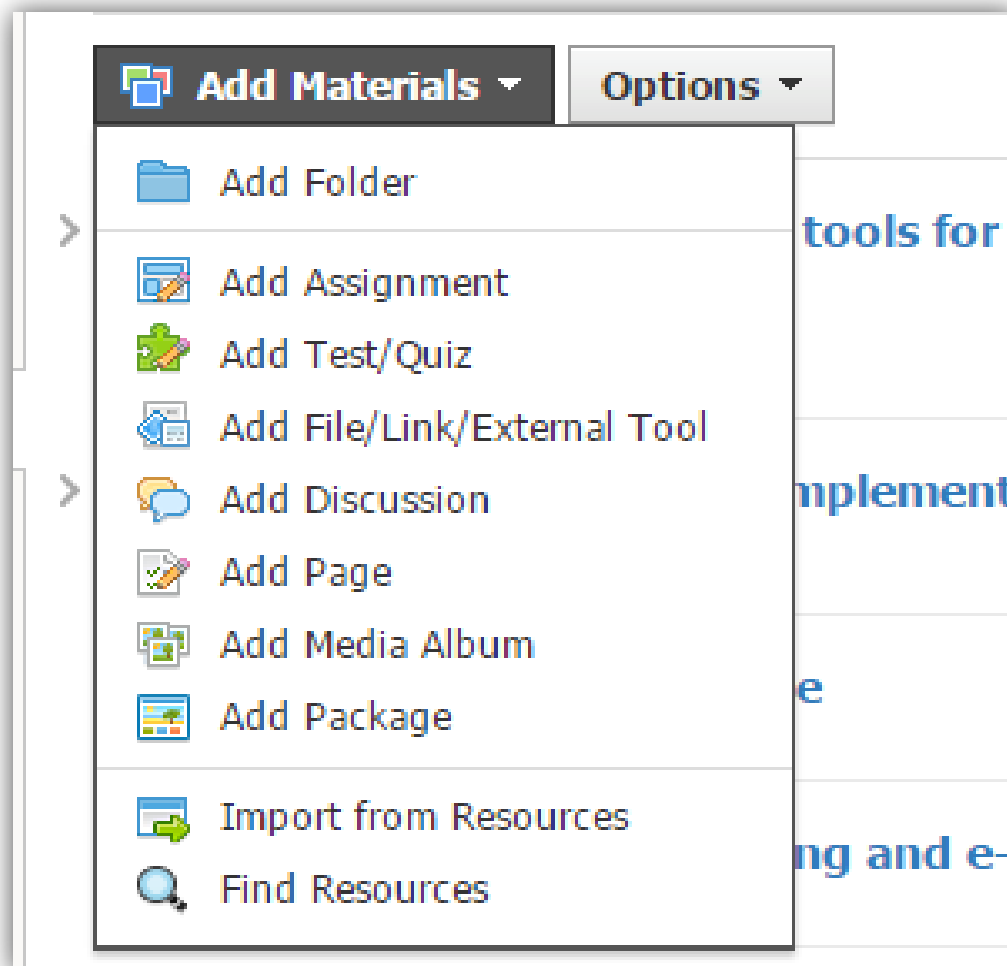
Gradebook

Badges

Attendance

# e-Learning Platform

## Overview of features





# schoolology e-Learning Platform

## Setting Test / Quiz

Institute of Professional Education And Knowledge

**Add Materials** Options

- Add Folder
- Add Assignment
- Add Test/Quiz**
- Add File/Link/External Tool
- Add Discussion
- Add Page
- Add Media Album
- Add Package
- Import from Resources
- Find Resources

**Create Test/Quiz**

Name: \*

Due date: [Calendar icon] [Date field] 100 pts

Category: (Ungraded) Grading options

Scale: \* Numeric

Advanced: [Icons]

**Create** Cancel

Questions Settings Preview Results

**+ Add Question**

- True/False
- Multiple Choice
- Ordering
- Short-Answer/Essay Question
- Fill in the Blank
- Matching
- From Question Banks
- Import Test/Quiz
- Page Break
- Text

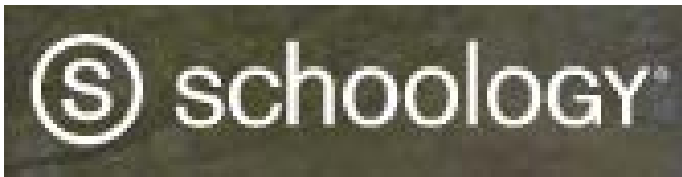
Remember to publish your test/quiz to students

**Revision Test**

Privacy Policy & Terms of Use




11:59 pm

- Edit
- Unpublish**
- Move
- Copy to Course
- Delete
- Save to Resources





# e-Learning Platform

## Setting Test / Quiz

Misconceptions Available   

Questions Settings Preview Results Comments

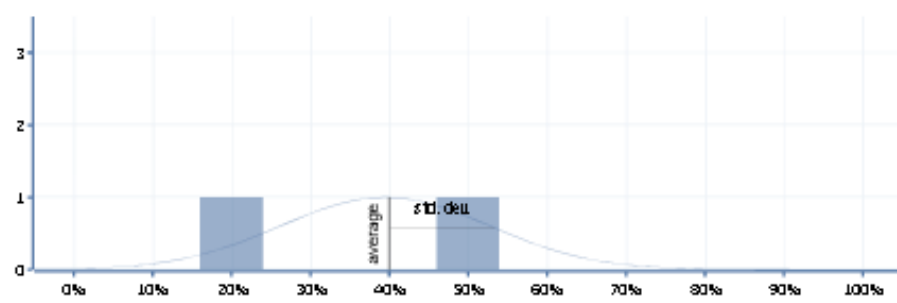
View by Student · View by Question




Name	Submissions/ Attempts	Latest Attempt	Final Score Gradebook Grade	
	1/1	6/05/16 4:35pm	10/38 26.32/100	View Attempts
	1/1	6/05/16 4:35pm	20/38 52.63/100	View Attempts

Statistics

These statistics are currently hidden from student view. You can enable this v by **editing** this assignment.

# of Grades	2	Average	39.47 (39.47%)
Max Points	100	Standard Deviation	13.16 (13.16%)
Highest Grade	52.63 (52.63%)	Median	39.47 (39.47%)
Lowest Grade	26.32 (26.32%)	Mode	N/A (N/A)



Misconceptions Available   

Questions Settings Preview Results Comments

View by Student · View by Question

8 Questions

1 Page

2 Submissions

Most submissions

Least submissions

Avg submissions

1

1

1

Question Answer stats

Question 1: A sodium atom can only form one ionic bond, because it only has one electron in its outer shell to donate.

True: 2 (100%)  
False: 0 (0%)  
(No answer): 0 (0%)

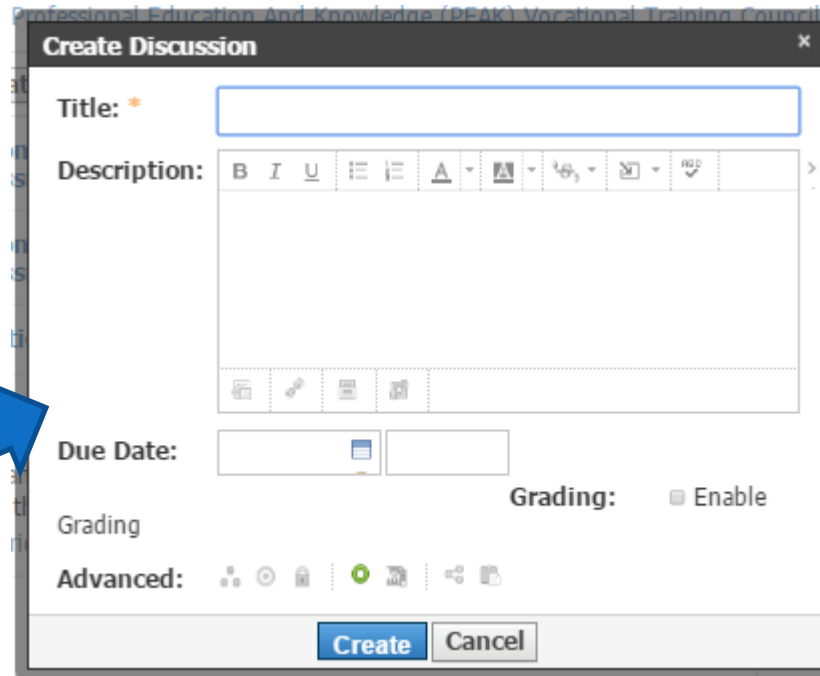
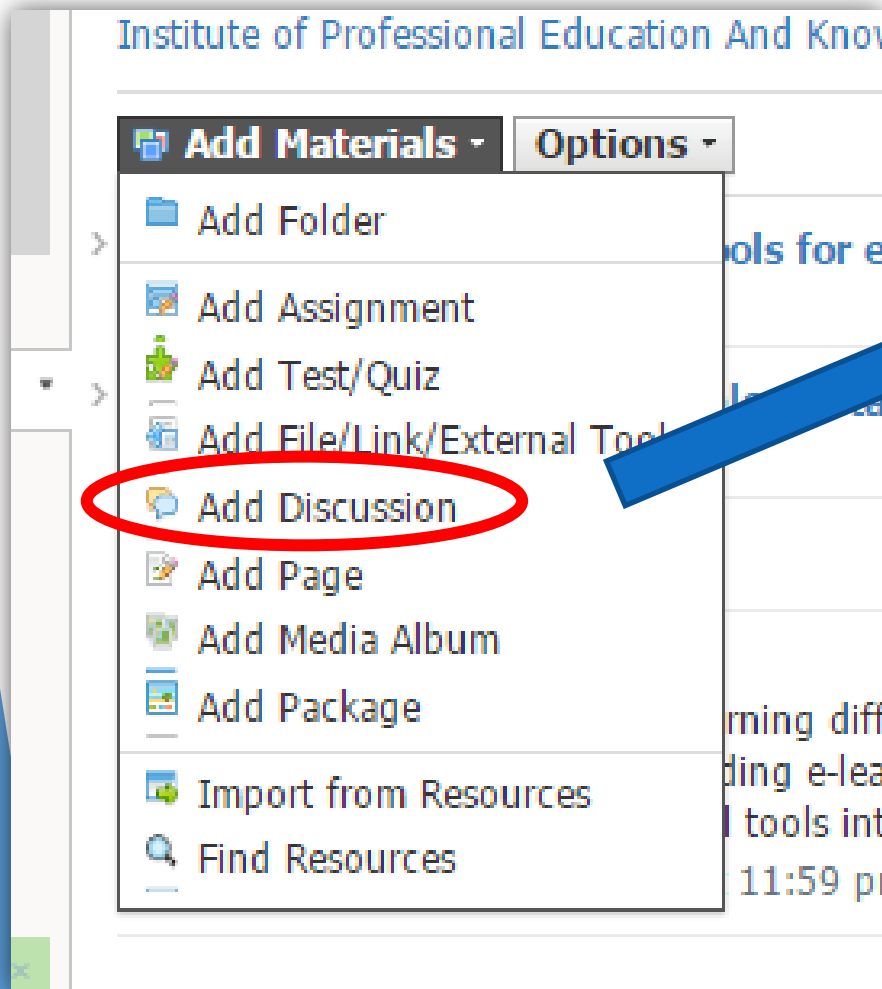
True/False - 1 point  
Points Earned - Most: 0 · Least: 0 · Avg: 0

See stats

View Responses

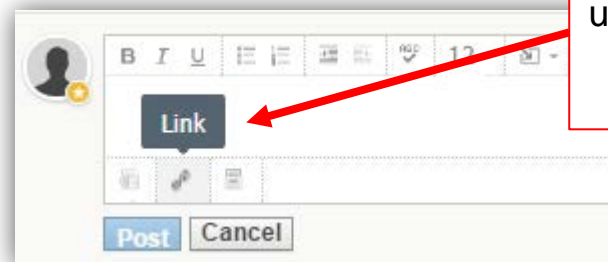
# schoolology® e-Learning Platform

## Setting Discussion




A screenshot of the 'Create Discussion' dialog box. It contains the following fields and options:

- Title:** A text input field.
- Description:** A rich text editor with a toolbar containing icons for bold, italic, underline, list, link, unlink, image, video, and other formatting options.
- Due Date:** A date picker.
- Grading:** A checkbox labeled 'Enable'.
- Advanced:** A row of icons for additional settings.
- Buttons:** 'Create' and 'Cancel' buttons at the bottom.



Can search and attach link to comment when using computer, but not mobile phone

## Giving badges



Course Options

Materials

Updates

Gradebook


**Badges**

eChem-S01: Implementation of e-Learning a ...


Badges

Add Badges


- Create New Badge
- Import from Resources
- Schoolology Badges**




Pod Liste...




Homework




Leadership




Most Impr...



Participation




Positive At...



Problem So...

Student, Sample



Currently there are no members in this course



Why using 3D printing in scientific investigation?

What can 3D printing do?

eScience-AE: Using 3D-Printing Technology ...  
Session 1

Add Materials ▾

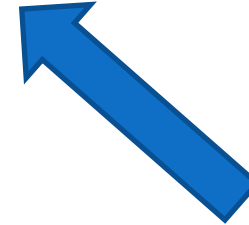
Options ▾



Scientific investigation



E-learning  
tools



3D printing  
technology

# Stages of scientific investigation

Setting a question

What are we investigating and why?

Proposing a hypothesis

What do we know about the topic?

Designing a fair test

How can we test it? Any reference?

-----  
Carrying out the experiment

What do we need? How can we collect data?

Analyzing results

How do we analyze the data?

Drawing conclusion

-----  
Presenting the findings

How is a better way to present the findings?



# How do we usually start a scientific investigation?



# AnswerGarden

<https://answergarden.ch/>

- ▶ Real time brainstorming tool
- ✓ No need to sign up
- ✓ Answers can be exported as image in PNG format (the answers can only be stored for a short period of time in the platform)

1. Click the + sign to open a new AnswerGarden

**AnswerGarden**

## AnswerGarden Mode

Brainstorm **Classroom** Moderator Locked

In Classroom Mode respondents can submit answers, but may only submit each answer once.

### Add Local Discoverability

You can make this AnswerGarden easily discoverable by setting a duration. [\[Learn more\]](#)

1 hour **1 day** 1 week Hidden

**Create**

## Create a new AnswerGarden

### Topic (required)

Type the topic of your new AnswerGarden. This can be a question or a topic, such as:  
"What makes you happy?"

Enter your question or topic here...

### More options (optional)

3. Set how long you want the AnswerGarden to be kept

4. Click 'Create' to start

What to do in summer?

Type your answer here...

Submit

20 characters remaining

reading sunbath  
cycling  
go grad trip eat ice-cream sleep do nothing  
work coz no money dinner tgt interview science vol. prog.

Share

Export

About

QR

Local

Admin

Refresh

## Share

Share this AnswerGarden on various social networks using the following buttons.



## Embed

Use this link to refer to your AnswerGarden.

<https://answergarden.ch/304015>

Embed your AnswerGarden on your website or blog (640x400):

```
<iframe src="https://answergarden.ch/embed/304015" v
```

5. Share this link with others



<https://goformative.com/>

- ▶ Collect students' live responses
- ✓ Give feedback to and grade students' answers
- ✓ Elaborated answers and drawing allowed
- ✓ Easy to set



## ► Sign up an account as instructor

Formative accounts are **FREE** for teachers and students!

If you are interested in school PD or a district implementation, please [contact us!](#)

Sign up as a: **TEACHER** **STUDENT**

[Sign up with Google](#)

[Sign up with Clever](#)

OR

First Name  Last Name

Email

Password

By clicking "Sign up", you agree to our [Terms of Service](#) and [Privacy Policy](#).

[Create Free Account](#)

<https://goformative.com/>

## ➡ Login

Username or Email

Password

[LOG IN](#)

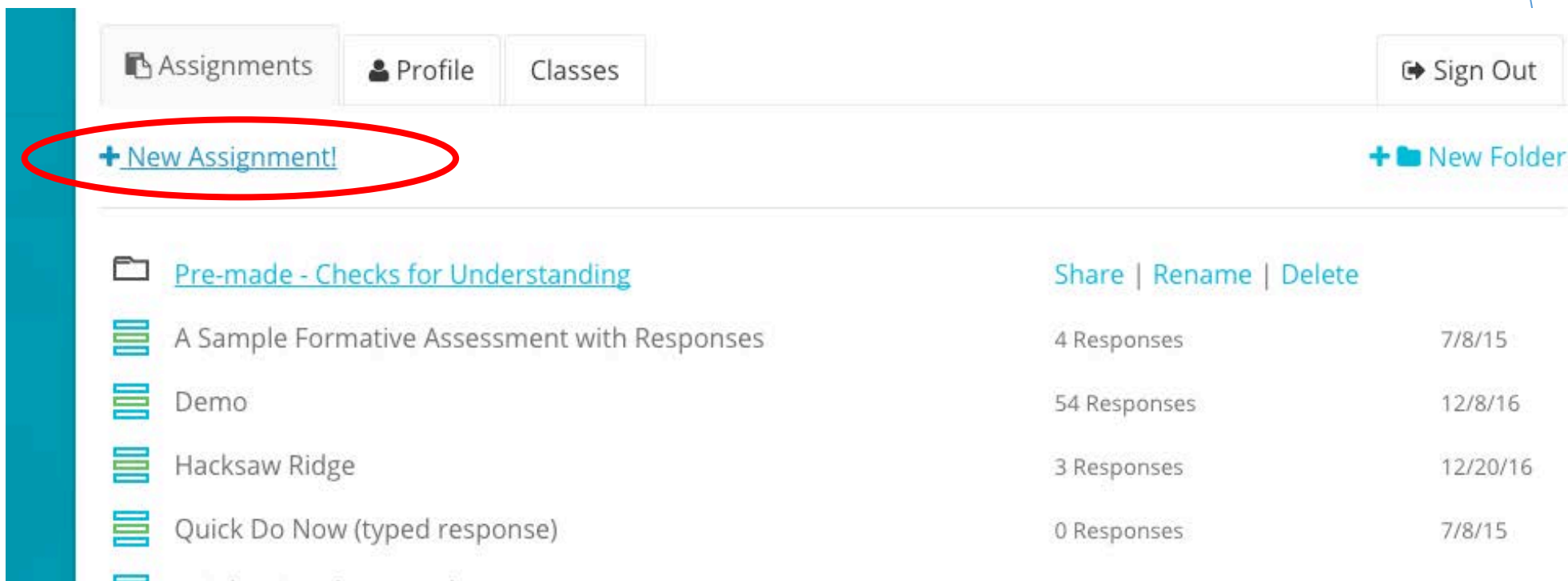
[SIGN IN WITH GOOGLE +](#)

[SIGN IN WITH CLEVER](#)

[Forgot Your Password?](#)

# formative <https://goformative.com/>

- Create questions to collect responses



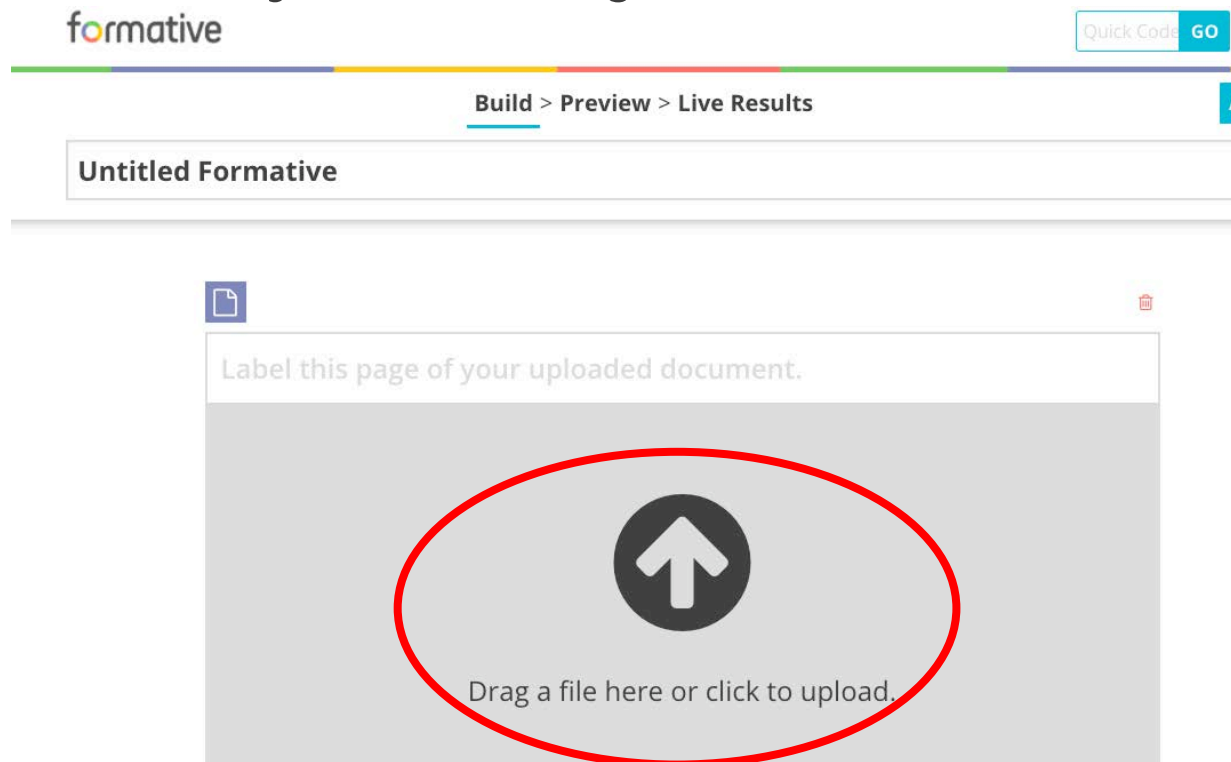
The screenshot shows the goformative.com web interface. At the top, there are navigation tabs: 'Assignments', 'Profile', and 'Classes'. A 'Sign Out' button is located on the right. Below the tabs, there is a '+ New Assignment!' link, which is circled in red, and a '+ New Folder' link. The main content area displays a list of assignments under the heading 'Pre-made - Checks for Understanding'. Each assignment entry includes a folder icon, the assignment name, a 'Share | Rename | Delete' action menu, the number of responses, and the date.

Assignment Name	Responses	Date
A Sample Formative Assessment with Responses	4 Responses	7/8/15
Demo	54 Responses	12/8/16
Hacksaw Ridge	3 Responses	12/20/16
Quick Do Now (typed response)	0 Responses	7/8/15

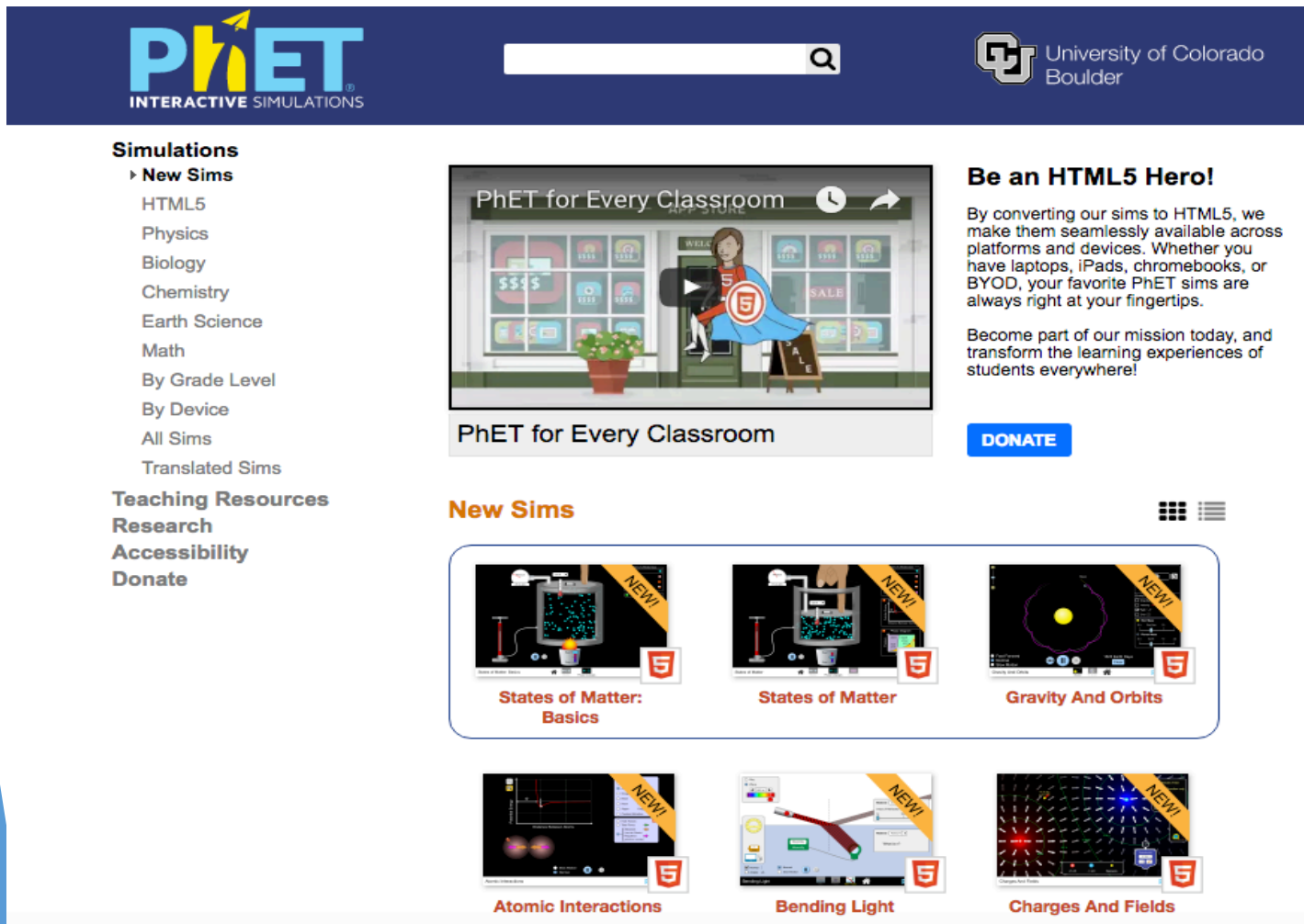


<https://goformative.com/>

- Base on your existing worksheets to create questions



## Simulation on varies concepts



The screenshot shows the PhET website homepage. At the top is the PhET logo and a search bar. Below the logo is a navigation menu with categories like Simulations, Teaching Resources, Research, Accessibility, and Donate. The main content area features a large banner for 'PhET for Every Classroom' with a 'DONATE' button. Below this is a 'New Sims' section displaying six simulation thumbnails: States of Matter: Basics, States of Matter, Gravity And Orbits, Atomic Interactions, Bending Light, and Charges And Fields. Each thumbnail has a 'NEW!' badge and a PhET logo.

**Simulations**

- New Sims
- HTML5
- Physics
- Biology
- Chemistry
- Earth Science
- Math
- By Grade Level
- By Device
- All Sims
- Translated Sims

**Teaching Resources**

**Research**

**Accessibility**

**Donate**

**PhET for Every Classroom**

**Be an HTML5 Hero!**

By converting our sims to HTML5, we make them seamlessly available across platforms and devices. Whether you have laptops, iPads, chromebooks, or BYOD, your favorite PhET sims are always right at your fingertips.

Become part of our mission today, and transform the learning experiences of students everywhere!

**DONATE**

**New Sims**

- States of Matter: Basics
- States of Matter
- Gravity And Orbits
- Atomic Interactions
- Bending Light
- Charges And Fields

✓ Illustrative

✓ Interactive

✓ Convenient






<https://www.youtube.com/>

YouTube HK

water saving nozzle

Filters ▾ About 8,010 results




**Buzz-inn.in**

**This water saving nozzle can save 98% of the water you use**

Buzz-inn.in  
3 months ago • 175 views

this water saving nozzle can save 98% of the water you use 1:00



**Kohler Water Saving Tips - How to Install a Faucet Aerator**

KOHLER  
6 years ago • 9,261 views

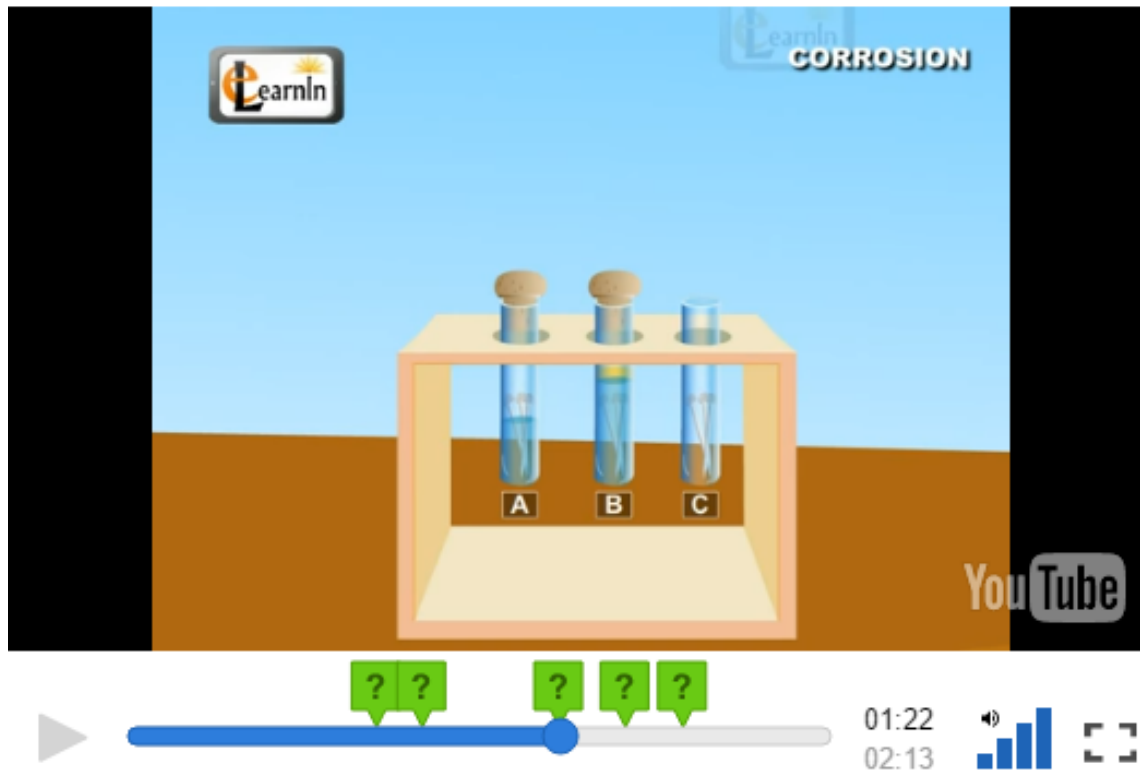
Master plumber Ed Del Grande demonstrates how easy it is to install a low-flow faucet aerator. 1:21

✓resourceful

- ❖Check content before use
- ❖Pop-up advertisement

<https://edpuzzle.com/>

Corrosion and rust- Science



✓Interactive video

❖Analysis of students' responses

❖Free of charge and easy to use

What is the difference between tap water and distilled water?

Why is the difference between distilled water and boiled distilled water?

## 2 Examples of scientific investigation

### Topic 1:

Turbine design  
&  
Hydroelectricity

### Topic 2:

Water Tap design  
&  
conservation of water



# Scientific investigation 1:

## Turbine design & Hydroelectricity

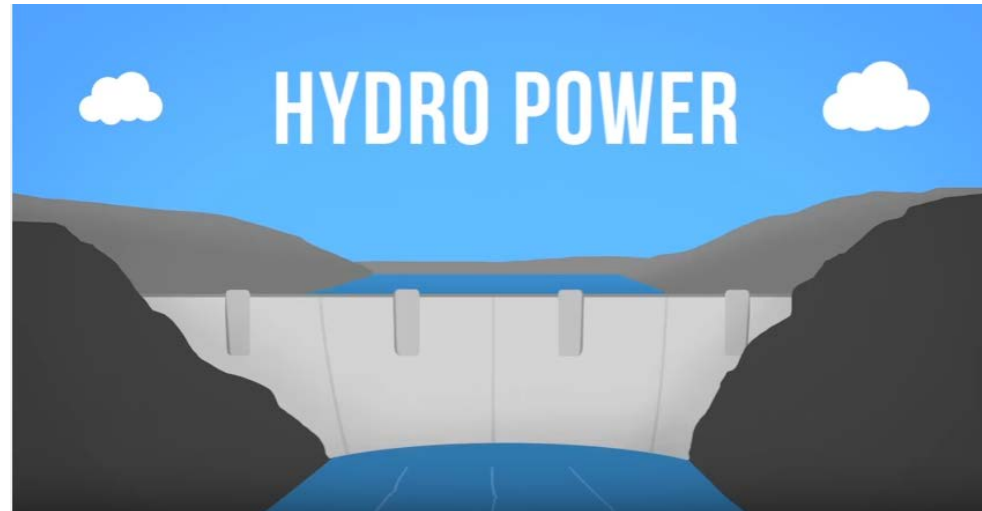
# Turbine design & Hydroelectricity

## Unit 2 Energy

Topics	Key points	Content		Suggested Activities
		Core	Extension	
<b>4.4 Generating electricity</b>	Generation of electricity <i>Hydro-electric power</i> <i>Wind power</i> <i>Nuclear power</i>	Electricity is the most common energy source used at home Electricity is generated in power stations from coal, oil or natural gas in HK; pollution problems arising from the generation of electricity		T Generate electricity using a steam engine model
			<i>Other ways to generate electricity: e.g. hydro-electric power, wind power, nuclear power, chemical cell and solar cell</i>	<i>T. Generate electricity using a hydro-electric power model</i>  <i>S. Generate electricity with a solar cell or home made chemical cells</i>

# Introduction

- ▶ Generate Electricity from water current:
- ▶ WHY ?  
Hydro Power is an alternative energy source  
(Our Daily Need)



## Background knowledge

Pelton Wheel like turbine is chosen as reference...

Working Principle :



Example :



Low speed water Current + Water tight chamber  
= feasible in Classroom

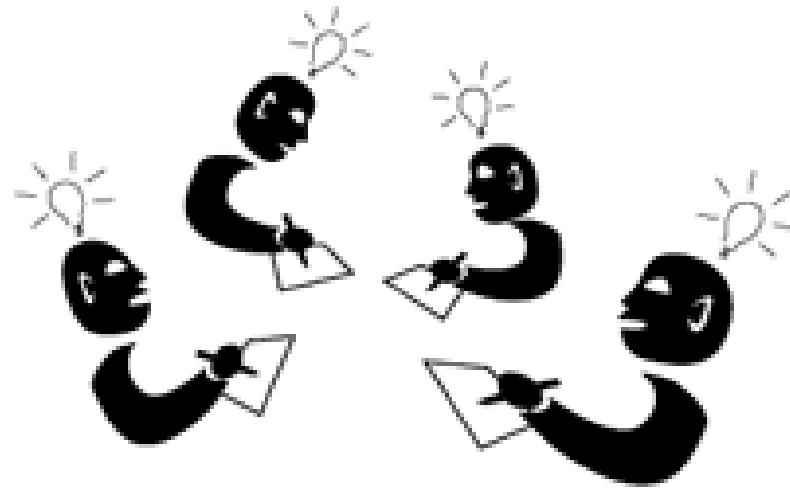




## Design of investigation

What factors are affecting the efficiency of this type of turbine ?

Let's brainstorm ...





# Design of investigation

**AnswerGarden** 

## **Brainstorm Tool :**

identification of students' prior knowledge and interested topics

- ▶ Let students answer the question: "What factors affect the speed of a turbine?"
- ▶ Then summarize students' ideas in the form of a concept map.

# Design of investigation

Factors affecting the efficiency of this turbine :

- No. of flips



(0:00-0:20)

(4:00-4:20)

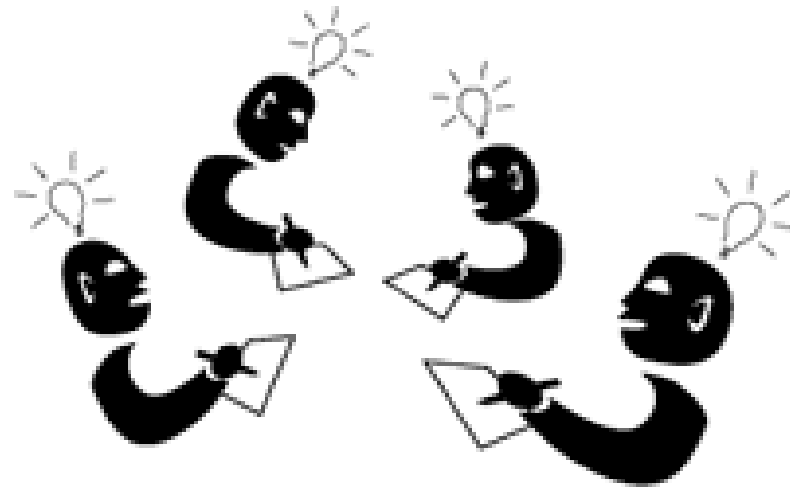
- Size of flips



## Design of investigation

How to measure the efficiency of energy conversion of a Pelton Wheel ?

Let's brainstorm ...



# Design of investigation

## Related Simulations : PhET simulations

e.g. Unit 2 Energy:

- ▶ Energy forms and changes  
(<https://goo.gl/4QUr9N>)
- ▶ Generator :  
(<https://phet.colorado.edu/en/simulation/legacy/generator>)

# Design of investigation

## Exemplars / Reference



Practicability

Originality

Fun

Creativity

# Design of investigation

Investigations on the energy-generating efficiency of a turbine:

Investigation	Independent Variable	Dependent Variable
1	Number of paddles	Average voltage generated
2	Size of paddle	Average voltage generated



Concept of fair test



# Scientific investigation 2:

## Water saving faucet

# Water saving faucet

## Unit 2 Water

Students should learn	Students should be able to	Suggested Learning and Teaching Activities
<b>2.5 Water conservation and pollution</b> <ul style="list-style-type: none"><li>Conservation of water</li></ul>	<ul style="list-style-type: none"><li>Recognise the importance of water conservation and the ways to conserve water</li></ul>	<ul style="list-style-type: none"><li>Perform a survey in class to find out the daily water consumption at home and suggest ways to reduce the wastage of water</li><li>Design and make a device to be fixed on water tap to conserve water in daily use</li></ul>



# Introduction

- ▶ Water saving tips:
  - ▶ Fix dripping water taps ← Not to waste water
  - ▶ Close the water tap when brushing teeth ← Reduce the use of water
  - ▶ **Use of water saving faucet ← Use water more efficiently**



# Introduction

Water saving faucets available in the market:



How much water can be saved by using these?

# Background knowledge

## How much water can a Eco365 water saving faucet save?



Up to 75% Less Water with  
**'Shower Type Aerator'**

On Taps/Faucets our Water Saving Eco365days **'Shower Type Aerator'** with flow of **2 to 4 LPM** (Liters Per Minute) uses up to 75% less water and energy than a standard flow of 10 - 15 LPM aerator. That's saving of 58400 Liters of water annually for a family of 4..

www.neosystemek.com



Shower Type Aerator

Retrofit existing faucet with Water Saving Aerator and you save water without sacrificing on performance Shower Type Aerator available at flow rate of 1.5, 2, 3 & 4 LPM



Easy To Install  
(Do It Yourself)



Instant Water Flow Reduction





## Background knowledge

How much water can a YOCOS water saving faucet save?



## Design of investigation

Does the design of the filter affect its water saving performance?



## Design of investigation

What measurement can we make to show the water saving performance of a faucet?

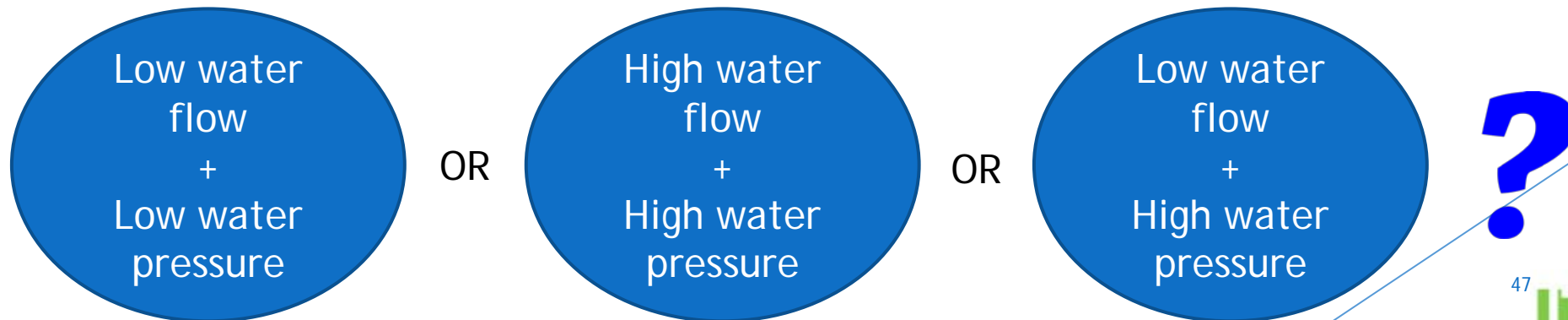
- Measure the water flow, i.e. litre of water per minute, of the water saving faucet



## Design of investigation

What else would you consider when deciding whether or not to use a water saving faucet?

- ▶ Water flow
- ▶ Water pressure



## Design of investigation

How can we compare the water pressure of different water saving faucets?

Let's brainstorm ...





## Design of investigation

How can we compare the water pressure of different water saving faucets?

Let's brainstorm ...

Will the design of filter affect the water pressure?



## Design of investigation

Investigations on the effect of design of filters on the performance of a water-saving faucet:

Investigation	Independent Variable	Dependent Variable
1	Design of filter	Water flow
2	Design of filter	Water pressure



## Extension: Water saving shower head

- How does it work?
- How can we test its water saving performance?



# Extension: Water saving shower head

## - Water flow + water pressure

How to save water properly  
Is total water usage really reduced?



15 minutes to wash body and hair



30 minutes to get things done because water pressure is too low to rinse off



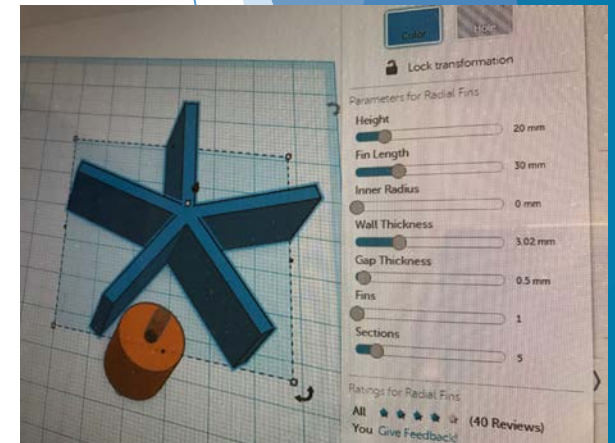
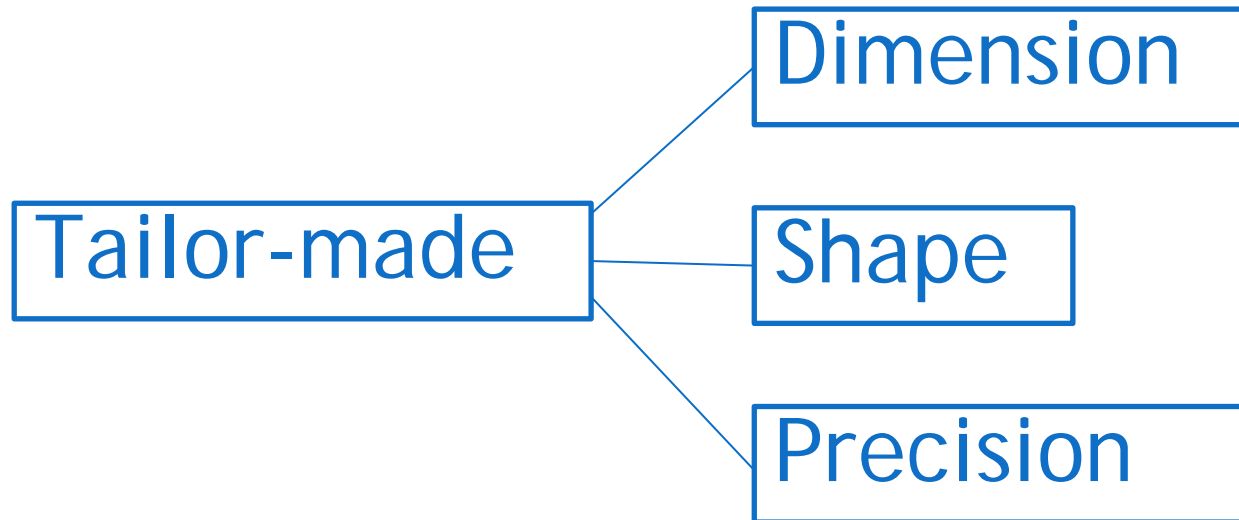
15 minutes to get things done since the pressure is not reduced.



We take shower with a purpose of washing and rinsing body and hair. How long does it take to get the things done properly ? It all depends on water pressure. Water pressure always influence times required to get things done. Of course, the longer time on showering , the larger water consumption. Less water flow is likely to lower water pressure. But E-shower has been manufactured by water saving specilaists. We have know-how of keeping water pressure with less water flow. E-shower is the best choice fo you to save showering water.

# Preparation for investigation

We need the objects for testing and here is where 3D printing technology comes in place.





# Conducting the investigation

- ▶ Let's look at a video showing our trial of the investigation



- ▶ Pre-printed 3D models will be provided to each group so that you can preliminarily experience the effects of alterations on 3D models.

