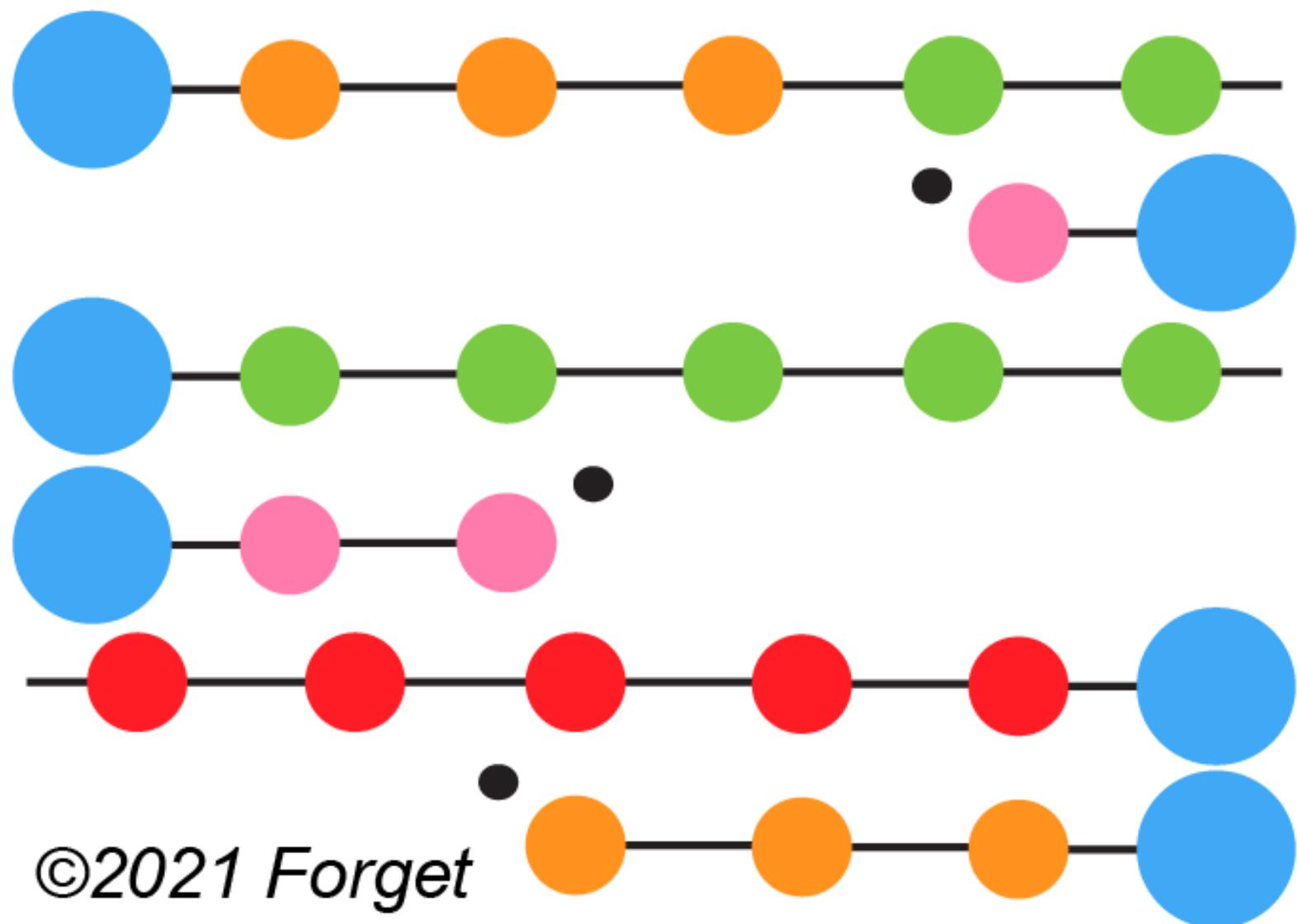


TEACHING ACTIVITY



GOAL

Teaching key concepts of Free Radical Polymerization using a fun and interactive card game. The activity is design to increase student engagement, improve participation and peer interaction. The session is design for 45 minutes but can be extended to 55 minutes depending on the class schedule.

MATERIALS

The classroom should be organized in group tables that can host four people.

For each group table a set of the rules can be printout and provided for the students. Thus they can check the rules during the play.

For each group table a card desk containing 110 cards is provided.

Four set of pen, paper, and calculator so that each student can calculate the Mn, Mw and PDI at the end of the game.

A ranking table as a PowerPoint or on the blackboard to show the score of each student and make a class ranking of PDI. The lower PDI wins. (Winner prizes can be purchase on our website)

FLOW

<i>Step #</i>	<i>Action</i>	<i>Time (min)</i>	<i>Time (min)</i>
1	Presentation of the activity: A card game to understand free radical polymerization. The class is organized in group of four students	2	2
2	Pre-game multiple choice questions. The students answer the six questions of the MCQ. This will help the educator to evaluate the success of the activity	8	8
3	Present the game rules using the provided PDF document and website link. A copy of the rules can be provided on each group table. The rules can have been sent to the student before the class activity	5	5
4	Play the game	20	25
5	Calculate the results	2	2
6	Winner of each group can be determined. Alternatively, an overall ranking can be presented by presenting on the board the results of each individual		5
7	Post-game multiple choice questions. The students answer the six questions of the MCQ. This will help the educator comparing the knowledge before and after the game.	8	8
Total		45	55

FLOW

Solution to the multiple-choice questions is provided here to facilitate the correction which can be done by a class tutor or teaching assistant.

Pre-game answer: 1A, 2B, 3A, 4D, 5B, 6C

Post-game answer: 1A, 2A, 3B, 4C, 5A, 6D

MCQ Evaluation Polymer game

To answer before the game

1 Which of the following is an initiator molecule in the free radical polymerisation?

- Benzoyl peroxide
- Sulphuric acid
- Potassium permanganate
- Chromium oxide

2 How many termination mechanisms can occur during a free radical polymerization?

- Only one
- Two mechanisms
- Three mechanisms
- The chain can grow indefinitely

3 Which one of these statements best describes a chain transfer agent (CTA)?

- CTAs stop growing chains and initiate new chain
- CTAs only terminate polymer chains
- CTAs always have a thiol functional group
- CTAs react with CTAs

4 What is (2,2,6,6-Tetramethylpiperidin-1-yl)oxyl TEMPO?

- An initiator
- A chain transfer agent
- A terminating agent
- A reversible terminating agent

5 What are copolymers?

- Polymer composed of only one monomer
- Polymer chain composed of two or more monomers
- Polymer chain composed by assembling two other chains
- Polymer mixtures of two or more polymers

6 Which combination of chemical characteristic would you choose to obtain a polymer with high mechanical performance?

- Low molecular weight, high PDI
- Low molecular weight, low PDI
- High molecular weight, high PDI
- High molecular weight, low PDI

MCQ Evaluation Polymer game

To answer after the game

1 What is the very first step of the free radical polymerization process?

- Decomposition of initiator
- Addition of free radical to monomer
- Disproportionation
- Chain transfer

2 Which one of the following mechanisms can lead to a termination step?

- Combination of two growing chains into one polymer chain
- Using up all the monomer
- Decomposition of a chain transfer agent
- Quenching of the reaction by cooling

3 What is the role of chain transfer agents (CTA) and how to use them?

- CTAs are used to increase the molecular weight of polymer and increase the polydispersity index
- CTAs are used to limit the polymer molecular weight and obtain a low polydispersity index
- CTAs are used to generate copolymers
- CTAs create living polymers chains

4 What is the role of (2,2,6,6-Tetramethylpiperidin-1-yl)oxyl?

- Initiate polymer chain
- Limits the growth of the polymer chain
- Avoid irreversible chain termination
- Catalyse polymerization

5 Which of the following monomer A and monomer B arrangement best depicts a block copolymer (A and B are monomers)?

- AAAAAABBBBBB
- ABAABAABBBA
- ABABABABABA
- ABBA ABBA

6 What is the best strategy to get high molecular weight and low PDI?

- Avoid chain termination
- Create copolymers
- Initiate a maximum number of chains
- Limit the number of living chains