Warm up

Read the sentences and decide which colour can complete all three of the idioms.

1. We boarded the plane and set off into the wild ____ yonder, not knowing what our fate would be.
2. No one even knew that they were in a relationship. When we found out that they were getting married, it was a real bolt from the ____!
3. I’m not very close to my family. We only get together once in a ____ moon.

What do the idioms mean?

Think of three things which are never or very rarely this colour.
Watch for main idea

You are going to watch a video called, "Why You Never See Brilliant Blue Fireworks." Work in A/B pairs. While you watch, listen for the answers to your three questions, A or B. Then share the information with your partner.

Student A

1. Which colours are the easiest to achieve in fireworks? The most difficult?
2. If temperatures are too hot, what effect does this have on the firework colours?
3. Do the experts think that there will be a blue firework in the future?

Student B

1. In what order do these three things interact in a firework: colour, fuel and fuse?
2. If toxic arsenic is used in fireworks, who is in danger?
3. What other new developments in fireworks might we see in the future?

Is any of this information surprising to you?

Watch for detail

Read the sentences from the report and remember/predict the missing words. The words you write will have the same or similar meaning as the words in bold. The first letters of the missing words have been given. Watch the report again to check.

1. P______________ (people who work with fireworks professionally) have tried to produce blue fireworks for centuries, and they have yet to succeed.
2. Why is blue so e______________ (difficult to find or achieve)?
3. You see, to make fireworks, you need four basic components: fuel (usually gunpowder), a c ________________ (a chemical that consists of two or more elements) that produces colour, a fuse, and glue to hold it all together.
4. That explosion heats up those colour-producing compounds, causing them to g______________ (produce a continuous light).
5. But some molecules are h______________ (strong enough to survive or exist in extreme conditions - comparative form) than others.
6. Strontium chloride, the compound used to make red fireworks, can w______________ (be strong enough to resist change under specific difficult conditions) at least 1,500 degrees Fahrenheit.
7. But to make a blue firework, you need copper chloride, which is much more f______________ (easily broken or damaged).
8. As soon as it gets hot enough to b______________ (burn strongly and brightly) blue, at least 1,000 degrees Fahrenheit, it starts to break down.
9. Arsenic, for example, has been used in some old fireworks f______________ (particular combinations of substances, like a recipe)...
10. There's some r______________ (of a good enough standard to be considered acceptable) pale blues that are used more in special effects...
Now answer these questions:

1. Which two words are opposites?
2. Which two words relate to mixing things together to make a product?
3. Which two words relate to fire and light?
4. What other meaning of the word respectable do you know?

Optional extension - language in context

Work out the meanings of these common expressions in bold from the video, using the context to help you.

1. Pyrotechnicians have tried to produce blue fireworks for centuries, and they have yet to succeed.
2. To be fair, we’ve gotten close-ish (to creating blue fireworks).
3. ...there’s still plenty to get excited about on the horizon, like fireworks that burst into different shapes and patterns, even letters.

Comprehension

John Conkling, the pyrotechnics expert from the video, says that achieving a blue firework would be "a delicate balance." Can you explain what he means in 35 words or less?

Final activity

Choose one of these options: a product development task or a discussion about issues related to fireworks.

Activity 1: Discussion

Discuss these questions in pairs or small groups.

1. How would the development of blue fireworks improve people’s experiences of fireworks displays in your country? What about the development of fireworks which form letters or shapes?
2. Do you think it’s better to watch big professional displays of fireworks or to stage small displays at home? Why?
3. Is it worth watching fireworks displays on TV?
4. Do you think it should be illegal for ordinary people to buy fireworks? Why?
5. Some people say that fireworks displays should be banned. What do you think their arguments might be?
Activity 2: Product development

Work in pairs or small groups to develop a new product: a brilliant blue firework. You need to decide:

1. What type of firework is it? Use your dictionary to check these words if you need to - a sparkler, a rocket, a fountain, a Catherine wheel.
2. Is your new firework for domestic use or for large public displays?
3. When and where might it be used?
4. How does the blue colour improve/enhance the firework display? Does it have any special significance or communicate any special meaning?
5. What is the name of the product? Use your imagination - you can see some examples of names in the header image at the beginning of the lesson.

Present your ideas to your classmates.
Introduction: Why You Never See Brilliant Blue Fireworks (Science Insider, 5 July 2019)

Narrator: Fireworks have been around for millennia. They flood the sky with brilliant bursts of scarlet, emerald, and ivory, but never blue. Pyrotechnicians have tried to produce blue fireworks for centuries, and they have yet to succeed. Why is blue so elusive?

John Conkling: The blue has been very, very difficult to achieve at a level comparable to the greens and reds and whites, just because it's a stability issue at high temperatures.

Narrator: That's John Conkling. He's one of the world's leading experts in pyrotechnics, and he says the problem comes down to chemistry. You see, to make fireworks, you need four basic components: fuel (usually gunpowder), a compound that produces colour, a fuse, and glue to hold it all together. You mix this stuff up into what's called a pellet, and then shoot it into the air. When the fuse burns up, it sets off the gunpowder, which explodes. That explosion heats up those colour-producing compounds, causing them to glow. And it turns out...

Conkling: The hotter you can get the molecules in your flame, the more emission you're going to get, so the brighter and more intense the flame colour's going to be.

Narrator: But there's a limit, because temperatures that are too hot will break down those molecules and wash out the colour. But some molecules are harder than others. Strontium chloride, the compound used to make red fireworks, can withstand at least 1,500 degrees Fahrenheit. That's hotter than some lava. But to make a blue firework, you need copper chloride, which is much more fragile. As soon as it gets hot enough to blaze blue, at least 1,000 degrees Fahrenheit, it starts to break down. So pyrotechnicians need to find a mixture that gets hot enough to set off the blue compound but not so hot that it destroys the colour.

Conkling: It's a delicate balance.

Narrator: And even after centuries of searching, we still haven't discovered the right one, nor have we found a more stable replacement for copper chloride. And even if we do, we'd better hope that it's cheap and nontoxic.

Conkling: Arsenic, for example, has been used in some old fireworks formulations, but obviously an arsenic compound is not something you want to put up in the smoke where people are watching the fireworks.

Narrator: To be fair, we've gotten close-ish.

Conkling: There's some respectable pale blues that are used more in special effects, where the audience is a little closer to the action, and usually the colour is more visible. It's been a long search, and we're not there yet.
Narrator: But there's still hope for bright blue.

Conkling: Certainly, it's possible, as there are people working on it, so there could be a breakthrough one of these days.

Narrator: And even if we never find that brilliant blue, there's still plenty to get excited about on the horizon, like fireworks that burst into different shapes and patterns, even letters. So maybe one day we can have an American-flag firework for the Fourth of July. We just need to get that blue.
Key

1. Warm up

5 mins.
Working with the whole class, elicit that the common colour for all three idioms is blue. Students can work in pairs or small groups to define the idioms, and then check answers with the class. Again, working with the whole class, brainstorm three things that are rarely/never blue. Students will probably think of two things that are rarely/never blue fairly quickly: fruit/vegetables or food in general, and animal fur or hair. Elicit or tell students that there are also no fireworks that are truly blue and then elicit some ideas about why this might be. Tell them they are going to find out more about this during the lesson.

1,2,3 - blue
wild blue yonder: a distant and unknown destination
a real bolt from the blue: an unexpected and surprising piece of news
once in a blue moon: very rarely; this refers to occasions when a full moon occurs twice in a calendar month

1. Students’ own answers - see teacher’s notes

2. Watch for main idea

10 mins.
Go over the introduction and explain the instructions. Set up A/B roles and give students a few minutes to look through their three questions and predict any answers they can. Then watch the video (0:00-3:28) so that students can check their ideas and complete their notes. As the video is short, they should focus on watching rather than making extensive notes – give them a minute after the video to finish the task. Students then work in A+B pairs to share information and complete notes about their partner’s answers. Check answers with the class and then pose the follow up question to give students a chance to react to the information.

Student A:
1. The easiest colours are red, green and white. Blue is the most difficult.
2. Very high temperatures make the colour weaker.
3. Yes, possibly, but they seem to think it will be difficult.

Student B:
1. The fuse is lit first, and when it burns down, the fuel catches fire and explodes. The explosion produces heat that activates the colours.
2. The people who are watching the display will be in danger.
3. We might see fireworks that can form different shapes and patterns, like letters.

3. Watch for detail

15 mins.
In this stage, students will listen for detailed information - in this case lexical items that will be a useful addition to the working vocabulary of students at advanced levels. Go over the instructions and perhaps demonstrate the first exercise (without confirming or denying the answer). Then allow students time in pairs to look through the exercise so they can remember or predict the missing words. If they don't recall an item, they should just move on to the next one. Students then watch the video a second time before checking answers in pairs. Often students
can hear all the phonemes of the word but need support in converting this to plausible spellings. You might want to drill any words, phrases or sentences that were problematic for students. Finally, pose the follow-up questions to consolidate (and extend) understanding of these items.

1. Pyrotechnicians  2. elusive  3. compound  4. glow  5. hardier  
6. withstand  7. fragile  8. blaze  9. formulations  10. respectable

Questions:
1. Hardy and fragile
2. Compound and formulations
3. Glow and blaze
4. A person is respectable if they have a high social status, a good character or behave very well.

4. Optional extension - language in context

5 mins.
If you are running short of time, you don’t need to complete this stage; you could also set it for homework. Work with the whole class to consider the items in bold and their meanings.

1. They have not succeeded yet, despite making a strong effort. This structure can also be used with other verbs: they have yet to score (sports), or they have yet to find a cure for cancer (medicine).
2. To be fair is often used to introduce a positive point, after there has been some criticism of someone’s actions; we can also say: In (all) fairness.... -ish is a very useful suffix which introduces a level of uncertainty to an adjective, meaning more or less, or approximately.
3. In the near future; this is a sailing metaphor.

5. Comprehension

5 - 10 mins.
In this stage students demonstrate global comprehension of the main point of the video and practise the academic skill of concise summarising. This could be done in pairs as a speaking exercise, or alone as a writing exercise. Round up some answers at the end and compare how different students handled the task.

Sample answer: to make blue fireworks, we need to find a mixture that can get hot enough to set fire to the blue colour compound without becoming so hot that the colour is lost.

6. Final activity

10 mins.
There are two different activities to choose from to round off the lesson. You could do either or both, depending on time and what your class prefers.

Activity 1
Discussion: this is a straightforward question and answer activity for pairs or small groups. Encourage students to use language from the lesson and give reasons and examples. Monitor and support as necessary, rounding off the activity with some error correction. This option is a good choice for students who are preparing for exams, which often include the topic of festivals and celebrations.

Activity 2
Product development: this is a marketing task. Students can work in pairs or small groups to brainstorm ideas for a blue firework and how it would be used. Students may want to base their product name on one of the idioms from the Warm up. They can present their ideas to the class or even make a poster to display, which the teacher could check later. This could also be done for homework.