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Picture perfect: making the most of images when creating and sharing teaching resources

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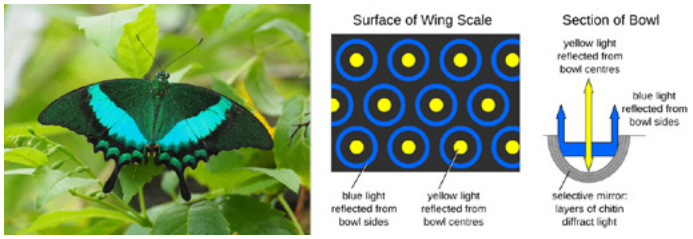
Not sure how best to source and create images for sharing your teaching materials? It's a snap if you follow these simple tips!

Worth a thousand words?

One of the joys of acting as Executive Editor for *Science in School* has been meeting all the fantastically engaged STEM teachers who are continually coming up with novel and creative teaching ideas for inspiring their students. It's been a privilege to help some of them share these ideas with the wider STEM teaching community through publication in *Science in School*, but there are of course other avenues for sharing teaching ideas, from conferences and festivals to blogs and websites to social media and video platforms. Whatever the platform used, in STEM teaching, as in STEM research, images can be invaluable in communicating and explaining ideas; as the adage goes, "a picture is worth a thousand words". In this article, I'd like to share some tips and lessons learned from the editorial process to help teachers make the most of images in posts, articles, presentations, and posters.

The whys and wherefores

Before considering where or how to obtain images, it's important to first ask why. What are we trying to communicate? There are many possible functions for an image in an article, poster, or presentation, and these may come with different priorities. Images may be used to capture the audience's interest or to provide an engaging visual example, and in this case, they need to be really visually appealing. Conversely, clarity is key for images intended to convey information, such as a scientific concept or experimental setup. Determining the purpose of the image will allow you to choose the most appropriate image type and source.



An example of the different types of information that can be conveyed by photographs and diagrams. Here, the photograph shows the effect in the real world and evokes wonder, whereas the scheme explains the science behind it.

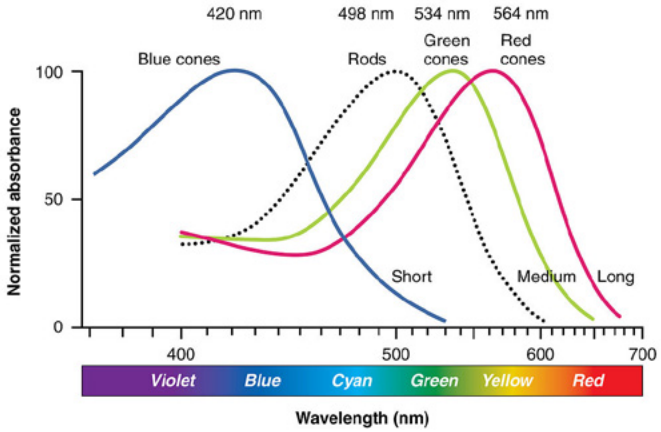
Images: Butterfly: Nosferattus/Wikipedia, Public Domain. Structural colour: Chiswick Chap/Wikipedia, CC BY-SA 4.0.

Alt texts

Remember that not everyone can process visual information easily, so consider making your online images accessible to those using screen readers by including an appropriate alt text.[1,2]

Copy with care

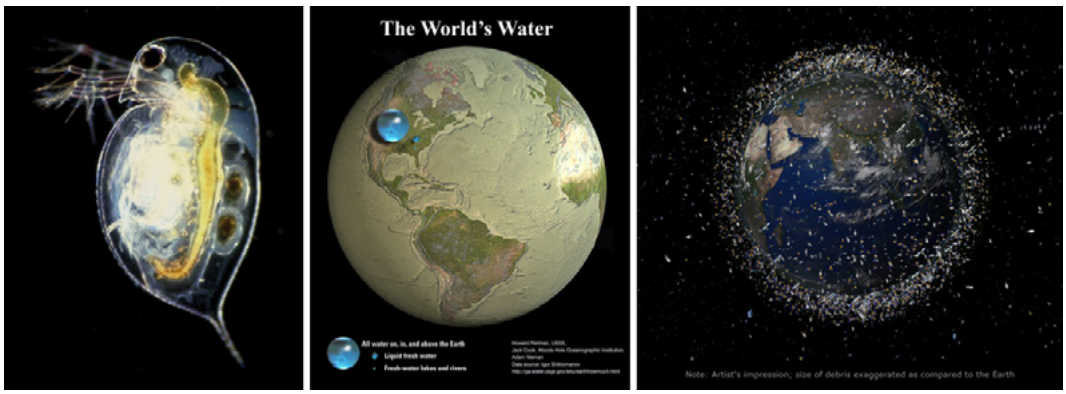
When looking for images to illustrate a teaching concept, many people first think to look for images online. The internet is indeed a source of very useful images, especially technical schemes, artists' impressions to illustrate relationships or scale, and beautiful photographs. However, some care is required to avoid falling foul of copyright law.



Useful technical schemes, like this one showing the activation wavelengths of different receptors in the eye, can also often be found online.

Image: Anatomy & Physiology, 2023, OpenStax

The first thing to know is that an image doesn't need a copyright symbol on it to be protected by copyright. Creative works are automatically protected and copyright belongs to the creator unless otherwise stated. This means that you can't just run an image search and use any image you find in your own articles, presentations, or posters. Images without any licence information listed are typically copyrighted and



Examples of how online images can be useful in teaching resources: an incredible microscopy image showing the common classroom model organism *Daphnia pulex*, an infographic showing the world's fresh water against the earth for scale, and an artist's impression (not to scale) of space debris around the earth. Images like this would be more difficult to produce yourself.

Images: Daphnia pulex: Paul Hebert/ PLOS Biology, 2025, 3, CC BY 4.0. World's water infographic: Howard Perlman/USGS, Jack Cook/Woods Hole Oceanographic Institution Adam Nieman, Igor Shiklamonov, Public Domain. Space debris: © ESA.

Public domain

Images in the public domain can be used without restrictions. They include images where copyright has expired and are typically indicated by the note "public domain" or the following symbols:

Images: Creative Commons

A variation is the "no rights reserved" or CCO licence, which indicates that a copyright owner has chosen to waive their copyright and related rights. Note that the length of time that copyright holds for different types of work varies by country,[3] so it is possible for a work to be in the public domain in one country but under copyright in another.

Creative Commons

Works published under Creative Commons Attribution (CC-BY) licences[4] can be used and adapted for any purpose with attribution, that is you must clearly acknowledge the creator and/or owner. These may also be indicated with the following symbols:

Images: Creative Commons

There are also variations of Creative Commons licences,[5] like NoDerivatives (CC BY-ND), ShareAlike (CC BY-SA), and NonCommercial (CC BY-NC), which place additional restrictions on how you can use the work. However, "commercial" for CC BY-NC is not well defined; for example, you don't necessarily need to be selling anything or making a profit to be seen as falling under commercial use.[6-7] For this reason, I prefer to stay on the safe side and avoid CC BY-NC licences if possible.

What about fair use?

There is a concept of 'fair use' for educational purposes, but this is not the blanket permission to use copyrighted work in education that many people think. Fair-use laws and educational exceptions are actually quite complex, often poorly defined, and can vary from country to country, even within the EU.[8-10] To be safe, I'd recommend just not using copyrighted images (without permission).

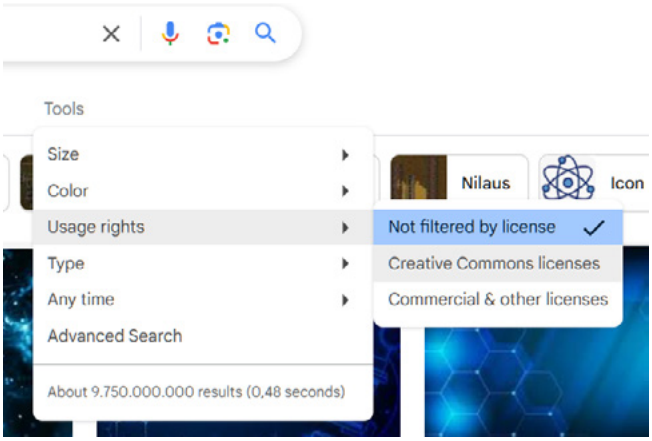
may not be used without permission from the owner or purchasing a licence for their use. So, what images can legally be used for free?

There are two main categories of images that can be legally used: those in the public domain and those under a Creative Commons licence. I will briefly explain these and the rules for their use below, but copyright law can be quite complex and the following does not constitute legal advice; please check if you aren't sure!

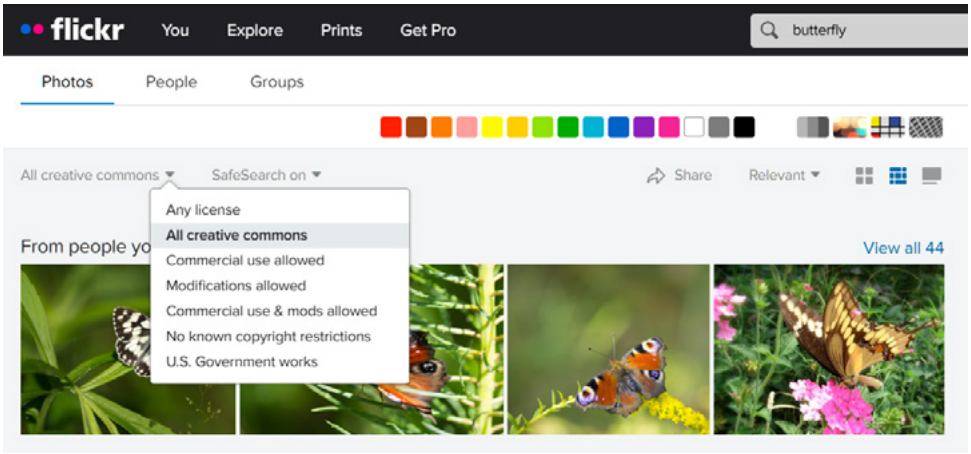
Where do I find images to use?

There are a number of places where you can conveniently find Creative Commons images. These include:

- **Search engine filters:** many search engines include options to filter for images under Creative Commons licences. Images from the following points on this list will generally also turn up in this kind of search. For Google, when doing an image search, click on Tools→Usage rights→Creative Commons licences:



- **Wikimedia commons:** Wikimedia Commons is a repository of public-domain or freely licenced images. Most (but not all) images in Wikipedia articles also meet these criteria; you can always click on the image to get more information on the source and copyright.
- **Flickr:** this is an image-hosting service where people can upload and share their images. Some (but definitely not all!) creators make their images available under Creative Commons licences. You can filter for these images while searching.
- **Stock image sites:** there are stock image sites that offer images that are free to use. Not all of these sites properly check ownership for uploaded images, so they are not risk free, but are very commonly used.[11,12] Always check the licence: some images require attribution and others



A screenshot from flickr, showing how search results can be filtered by licence.

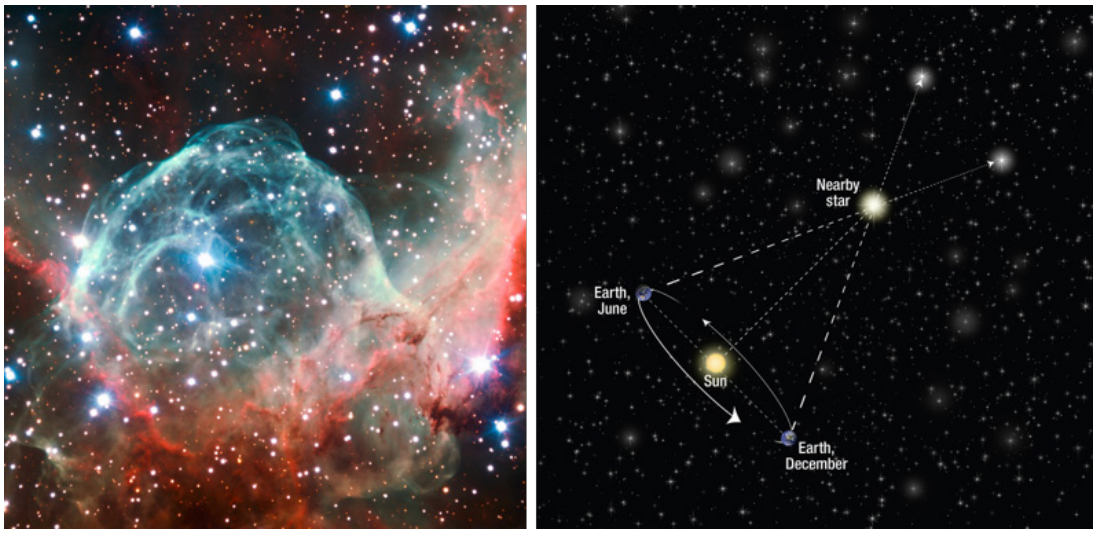
don't. Even when no attribution is required, it's still good manners to credit the creator if you can.

- **Open-access articles:** many people are surprised that you can't just use images from scientific papers; the copyright for these is owned by the publisher. However, open-access articles are typically published under some kind of CC BY licence; you can check this on the article page. Note: this only covers images created for that article. Authors will often also use images from other sources (with permission/attribution) and for these, the copyright conditions of the original source apply.
- **Other sources:** government departments, national institutions, and research organizations often also make images available for use. Since there are so many potential sources, the easiest way to find these images is through a filtered search (see first point). ESO and ESA have particularly nice collections of space images that can be used for educational purposes; make sure you read the conditions of use.[13,14]

A final word of caution: with images as with text, just because something is online does not mean that it is accurate and correct. Check all images, especially scientific images, before using them.

Do it yourself

Another way of obtaining images is, of course, to create them yourself. This is often more effort but has the advantage that you can create images that show exactly what you need to communicate. This is particularly important when sharing teaching resources, where you will need to illustrate your exact experimental setup or results.

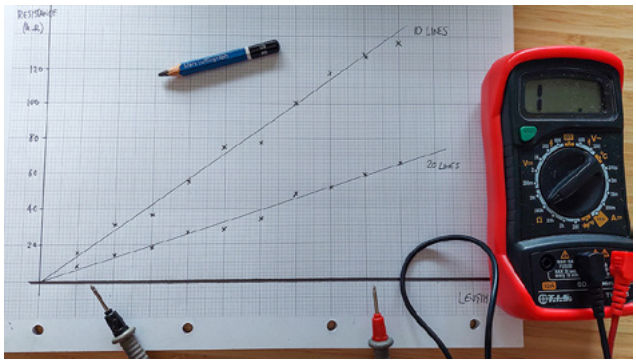


A beautiful image of the Thor's Helmet nebula, from ESO's image library, and a nice diagram explaining parallax from the Hubble Space Telescope project.

Images: Thor's Helmet nebula: B. Bailleul/ESO. Parallax diagram: NASA, ESA, and A. Feild (STScI)

Snap happy

An obvious way to create images is to take photographs with a digital camera or smartphone. This can be especially useful to illustrate experimental setups and results.



A nice illustration of an experimental setup: everything is in focus, there is good contrast, the setup is well lit, and there is no distracting 'junk' in the background.

Image: Science in School, 2022, 56

However, getting good-quality images can be challenging, especially with complex experimental setups. Here are a simple few tips for non-experts that can help:

- Ensure good lighting! This is essential to getting sharp photographs. Diffuse natural light is ideal but if artificial light is used, make sure it is bright enough, that you are not holding the camera in front of it and casting shadows, and that the key parts of the subject are well lit and not in shadow.

I haven't chosen a very good angle for photographing this lichen; I'm between the sun and the subject, casting deep shadows onto it.

Image courtesy of Mary Wray

- Avoid taking photographs against/in front of a window or bright light source, where the subject will be in silhouette and details won't be visible.
- Try to take photographs against a clean background so that your subject is clearly visible: either clear away distracting objects in the background, assemble your subject in front of a wall, or place a large piece of paper/card/fabric behind it.

Two examples of photographs that are sharp, well lit, and taken against a simple background without distractions: a DNA model and a microscale crucible and spirit burner setup.

Images: DNA model: Science in School, 2024, 70.

Microscale crucible: Science in School, 2024, 69.

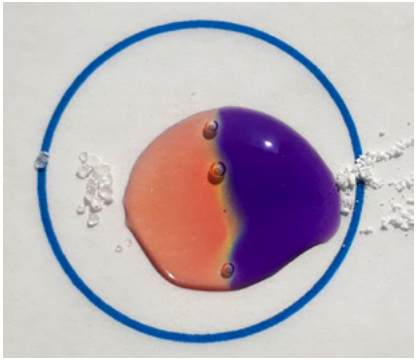
- Think about the background colour. Try to ensure good contrast with what you're photographing, for example, a light background is better for darker subjects and a dark background will be better for lighter subjects

Two examples of effective use of contrast with the background: a squid dissection and a petri dish showing the preference of a yellow slime mould for unsalted oats.

Images: Squid dissection: Science in School, 2023, 62.

Petri dish: Science in School, 2023, 62.

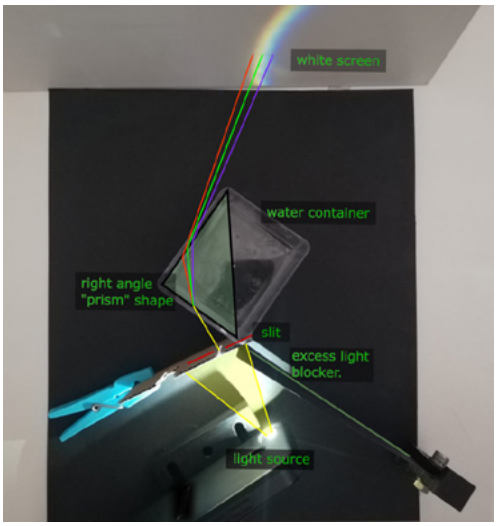
- Take a step back: if your image (or a part of it) is not sharp, you might be too close to the subject. As long as the photographs are of good quality, you can crop them afterwards to focus in on certain areas.



This close-up image of a microscale reaction between citric acid and sodium carbonate in a drop of water containing an indicator is in good focus because the image was originally taken from a little further back and then cropped.

Image: Science in School, 2021, 54

- If any students' faces are shown in the image, make sure you get written permission from both the students and their parents to use them online.
- Even if you don't have a photo editor, like Photoshop, images can often be improved by using the simple editing tools in your phone or your computer's photo viewer to crop out distracting background and adjust the brightness, contrast, or colour balance if necessary.
- Adding annotations or lines/arrows for emphasis can help to clarify the key details.



For this setup demonstrating light diffraction, it's not easy to identify all the elements from just the photograph, so the author has added some lines and notes to make things clearer.
Image: Science in School, 2024, 66

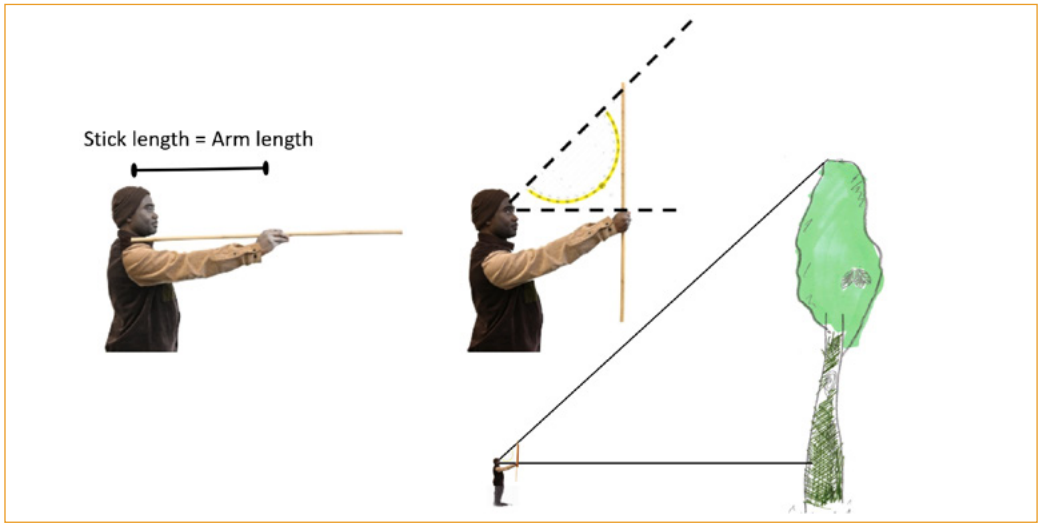
Finally, if you're struggling, consider getting your students involved; older students are often very accomplished at taking (and editing) excellent photographs with their phones!

Draw the line

For complex experimental setups, setups with tricky-to-photograph elements like glassware or water, or complex scientific concepts, a scheme or diagram might be clearer than a photograph. These may be drawn from scratch by using a digital drawing tool or a graphic design tool like Canva, for example. Alternatively, diagrams may be assembled from other images, or photographs can be annotated to highlight the key features. If using other images that are not your own, make sure you have permission to use these and that they are all credited in the final image.

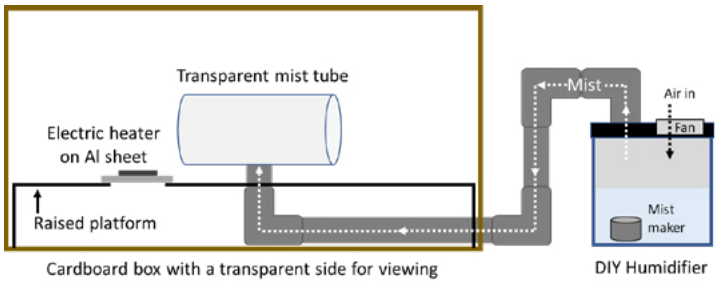
Some additional things to bear in mind are:

- For diagrams containing edges and lines, including text, the commonly used raster file types (e.g., JPEG, PNG, TIFF) may appear fuzzy when uploaded to a website, especially if they are resized. To avoid this, export your diagrams as vector files (e.g., SVG) if possible.[15]
- There is nothing wrong with hand-drawing diagrams and schemes and then scanning or taking photographs of them. Make sure they are well lit and use simple editing tools to adjust things like framing, angle, brightness, contrast, and colour.
- When colour carries important information, try to use accessible colour schemes.[16]
- Use colour mindfully; thoughtless use of colour can actually make diagrams harder to understand. For example, if you use red to indicate positive charges, then no other text or image elements that aren't related to positive charges should be red.
- Try to avoid overly busy diagrams: include only those elements that are essential to the meaning. Likewise, avoid placing too much text on diagrams, although exceptions can be made for large infographics.



Since it's difficult to take a photograph that clearly shows both a person and the full height of a tree, the author has combined photographs with drawings to illustrate the use of a forester's triangle.
Image: Science in School, 2024, 67.

- Ensure any text is large enough to be read at the size the diagram will be shown.



An example of a clear, simple scheme for a rather complex experimental setup to show convection currents, which would be very difficult to illustrate clearly with a photograph.
Image: Science in School, 2023, 64.

It's also becoming increasingly common to use generative-AI tools to create educational diagrams.[17] If you do this, make sure you carefully check the output for accuracy and always declare the use of generative AI in the image credits.

Yes, you can!

All this information might give the impression that a lot can go wrong when using images, but it's really not as scary as it may seem! Images can be a powerful addition to your resources, and hopefully these tips will help you make the most of them. «

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Resources

- Try some simple experiments to illustrate temporal additive colour mixing: Anta A, Goiri E (2024) Colour magic: additive mixing and coloured shadows. *Science in School* **70**.
- Explore the science behind anamorphosis: Liang Y (2024) Exploring anamorphosis: revealing hidden images with mirrors. *Science in School* **68**.
- Explore the concepts of speed and acceleration using supplied digital images or smartphones: Tarrant J (2023) Moving pictures: teach speed, acceleration, and scale with photograph sequences. *Science in School* **65**.
- Learn how to make convection currents visible using mist: Lim ZH, Shu A, Ng YH (2023) A misty way to see

convection currents. *Science in School* **64**.

- Explore structure–function relationships with this photo-microscopy art project: Varga JP (2023) It's a small world: using microscopy to link science, technology, and art. *Science in School* **61**.
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- Enhance your students' understanding of electrolysis using microscale chemistry techniques: Worley B, Allan A (2022) Elegant electrolysis – the microscale way. *Science in School* **60**.
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- Learn how to run effective demonstrations in science lessons: Walsh E (2021) The art of science demonstration. *Science in School* **55**.
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