

Organic Chemistry | (7th Edition)

Chapter 5, Problem 4E

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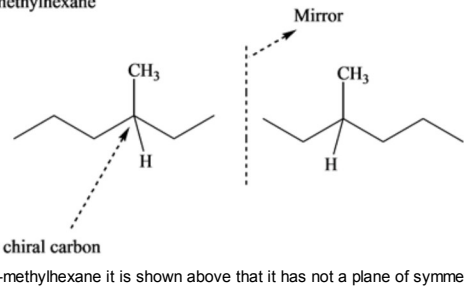
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Step-by-step solution

Step 1 of 15

Chiral: It is the objects or molecules having non-superimposable mirror images and it is due to asymmetric carbon atom present in this kind of molecule means four different groups attached with this carbon atom.

Example: 3-methylhexane
3-methylhexane



chiral carbon

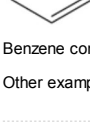
In 3-methylhexane it is shown above that it has not a plane of symmetry but having non-superimposable mirror image

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Step 2 of 15

Achiral: Compounds or molecules which have no chiral center but have center or plane of symmetry and superimposable mirror images are called achiral compounds.

Example: Benzene
Benzene



Benzene contains lots of plane of symmetry that's why it is an achiral compound.

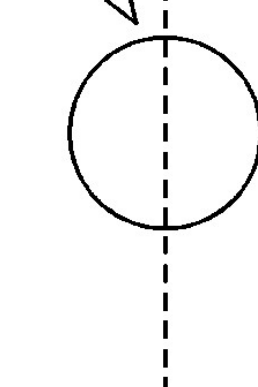
Other examples of achiral are discussed below:

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Step 3 of 15

Pictures of a ball which is achiral objects with the plane of symmetry drawn as follows:

Plane of symmetry

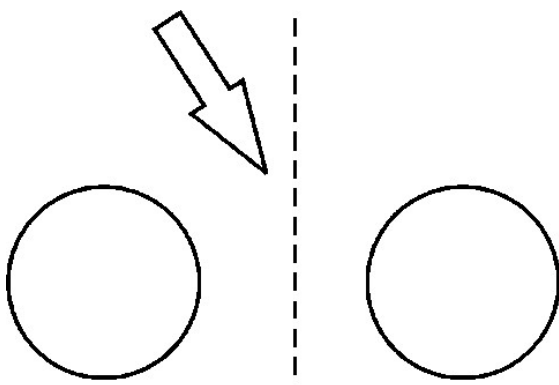


Ball

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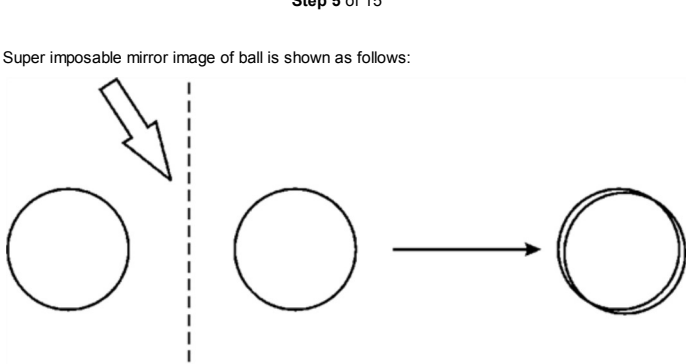
Step 4 of 15

Mirror image of ball is shown as follows:

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Step 5 of 15

Super imposable mirror image of ball is shown as follows:



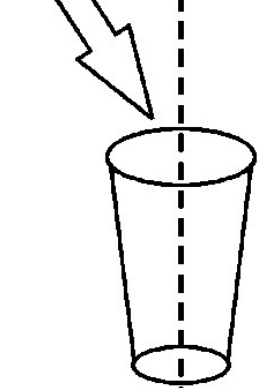
As shown above that ball having plane of symmetry means half part of ball is exact mirror image of other half part of ball and having interior superimposable mirror image, so it is achiral object.

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Step 6 of 15

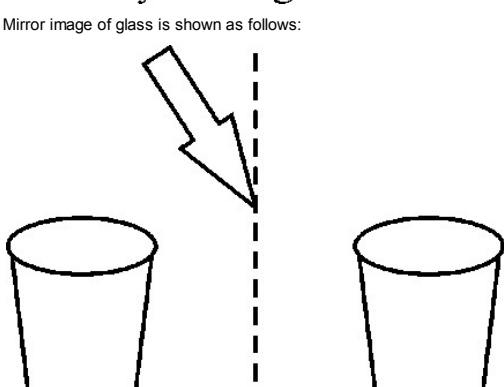
The picture of an ordinary water glass is shown as follows:

Plane of symmetry



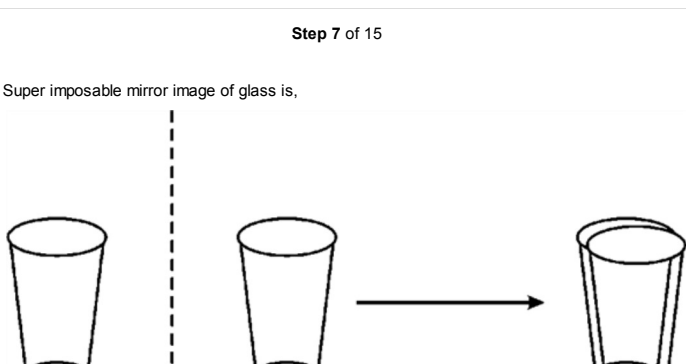
Ordinary water glass

Mirror image of glass is shown as follows:

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Step 7 of 15

Super imposable mirror image of glass is,



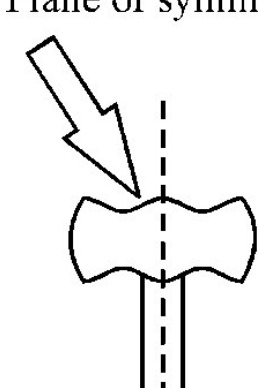
As shown above that glass having plane of symmetry and having interior superimposable mirror image, so it is achiral object.

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Step 8 of 15

The picture of a hammer is shown as follows:

Plane of symmetry

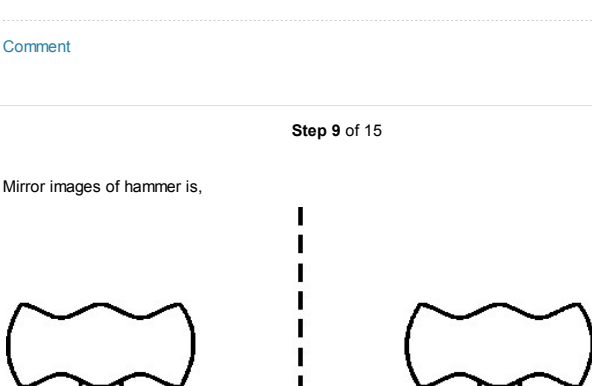


hammer

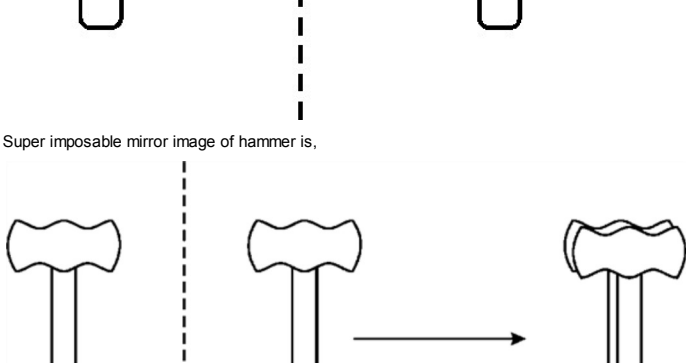
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Step 9 of 15

Mirror images of hammer is,

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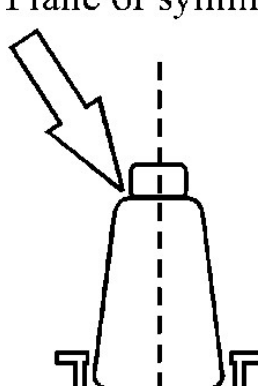
Super imposable mirror image of hammer is,



As shown above that hammer having plane of symmetry and having interior superimposable mirror image, so it is achiral object.

The picture of a chair is shown as follows:

Plane of symmetry

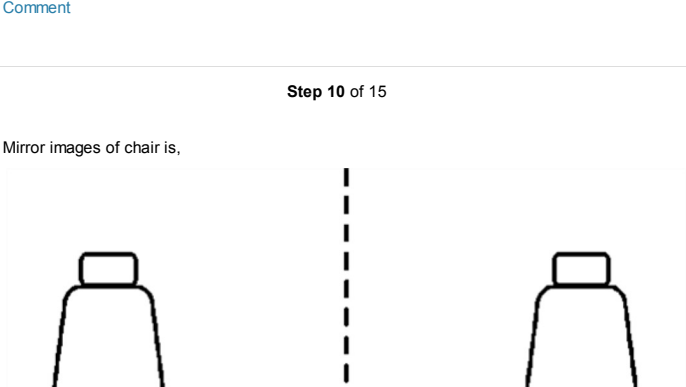


chair

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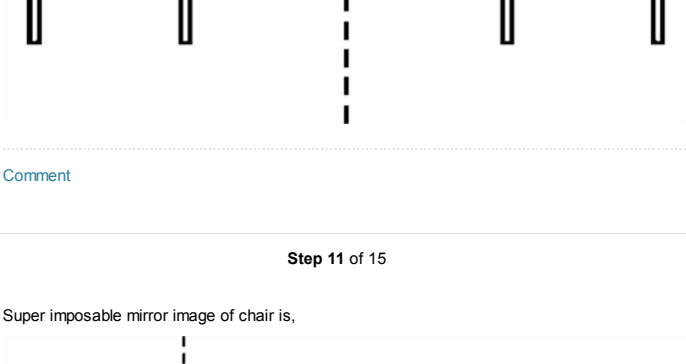
Step 10 of 15

Mirror images of chair is,

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Step 11 of 15

Super imposable mirror image of chair is,



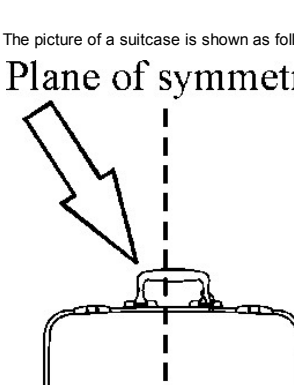
As shown above that chair having plane of symmetry and having interior superimposable mirror image, so it is achiral object.

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Step 12 of 15

The picture of a suitcase is shown as follows:

Plane of symmetry



suitcase

Mirror images of suitcase is,

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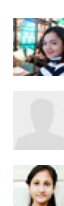
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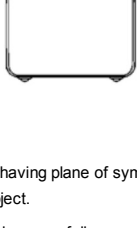
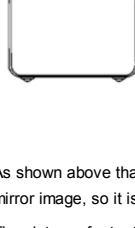
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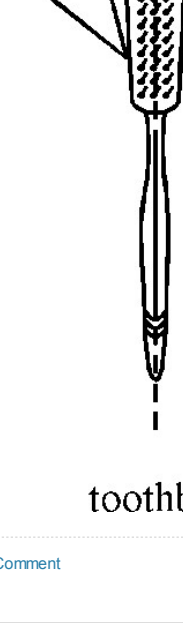
[Comment](#)**Step 13 of 15**

Super imposable mirror image of suitcase is,



As shown above that suitcase having plane of symmetry and having interior superimposable mirror image, so it is achiral object.

The picture of a toothbrush is shown as follows:

Plane of symmetry**toothbrush**[Comment](#)**Step 14 of 15**

Mirror images of toothbrush is,

[Comment](#)**Step 15 of 15**

Super imposable mirror image of toothbrush is,



As shown above that toothbrush having plane of symmetry and having interior superimposable mirror image, so it is achiral object.

Hence all the above objects are achiral because they can be superimposed on their mirror images and they have a plane of symmetry. Both the images are identical.

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Recommended solutions for you in Chapter 5

