

Breathing Underwater

Scuba diving is an increasingly popular activity. But it can be a little expensive, and you need a lot of gear to take part. You also need a qualification, or you need to dive with a qualified instructor.

Snorkelling is a lot more accessible. You might not get the same thrills as with a full scuba dive, but at least you can admire the ocean without stinging your eyes and constantly popping your head out of the water for air.

What you have to do

You've been asked to design a snorkel and face mask - including the mouthpiece - for a new company, set up to try to encourage teenagers to start snorkelling.

The owner of the company has provided you with the following **design brief** ...

*Underwater Breathing Co.
Plymouth
Devon*

Dear Sir/Madam,

Re: Design Brief

We want our customers to be able to pack away their snorkel and face mask into as small a space as possible. It should come with a bag that can be easily carried (perhaps attached to a belt) so users can go for a swim and put it on if they feel like snorkelling.

The snorkels should have a purge valve and some sort of design to stop water splashing into the hole at the top. It should clip easily to the side of the face mask.

Our target age group is 12-16 year-olds - so your design should be fresh, original and affordable.

The snorkels and face masks will be mass-produced.

How to set about it ...

What exactly do they want?

1. Draw a table like the one below (you may need more rows). Use the first column to list the key **design features** from the **design brief**. In the second column, "Initial thoughts", make a few notes about what you'll have to bear in mind as you begin to come up with possible solutions.

Key design feature	Initial thoughts

2. You can now write your **design specification**. This should explain exactly what's required, and the implications of each design feature.

Generating ideas and shortlisting

3. Using the internet, library and/or resource centre, carry out some research into snorkel design (including purge valves) and face masks. Here are a few places you might like to try:

<http://www.nwdivenews.com/MC/index.asp?showcol=Y&ID=68> (this site tells you details of the various bits that make a snorkel - including purge valves and splashguards)

<http://www.aqualung.co.uk/catalog/snorkel.htm> (this company specialises in scuba equipment - this page shows some of its snorkels).

<http://www.apolloportsusa.com/products-mfs.html> (this site shows a range of mask designs - including a foldable snorkel!)
4. Produce a number of **design ideas** using simple freehand sketches to try to visualise them.
5. Shortlist three of your ideas, explaining the decisions behind your choices. Even at this stage you should be pretty sure your design ideas will work. Scientific principles will help, for example, water pressure, density and flotation.

And then there was one ...

6. You must now work out the pros and cons of your three design ideas. There are a number of ways to help you work these out. A few of them are:
 - You could carry out simple tests on models of particular components. For example, you may want to make sure the snorkels are wide enough so someone can breathe easily through them. In some cases you may want to test a scale model of the whole structure.
 - Think about costs. Which of your snorkels and face masks would be most expensive to manufacture?
 - What's the rough life expectancy of your different designs? Is one much more hard-wearing than another?
7. Having weighed up the pros and cons, you've probably got a decent idea which design you think is the best. But the client is the paymaster. So, to help choose a final design solution, you should get feedback from an expert who understands your client's needs. You could also consider feedback from your client's potential customers.
 - Make 2-D and 3-D drawings and/or scale models of your three design ideas. These should be of good enough quality to allow you (and anybody else for that matter) to visualise exactly what your snorkel and face mask will look like.
 - Present your designs to the expert, and write down their comments and suggestions. (but if you're adamant one design is better than another, make sure you can explain why - you have to give the client what they want, but YOU are the designer!).
 - Consider the expert feedback and decide what modifications you need to make, if any, to make sure your designs meet the client's needs.
8. Choose your final design solution and summarise the reasons behind the choice, including how your **design solution** fulfils the **key design features** in your **design specification**, and how you have used expert feedback.

Presenting your solution

9. Decide on a suitable engineering drawing technique to present your final solution. Make 2-D and 3-D engineering design drawings, or use computer aided design (CAD) to produce them. Make sure you stick to engineering standards and conventions.

You've done the design job ...

10. You've successfully produced a **design solution** from a **design brief**. But what now? You've done the job of the designer, so you need to put your engineer's hat on. The design solution has to be turned into a **product specification** - giving the manufacturer the information needed to actually make the product.

A product specification details all the materials needed to make a product; it includes its dimensions, tolerances and details of how the different components will be joined together.

You need to decide which materials will be best to make your snorkel and face mask. To decide which materials are best you should look back at the design brief and your initial research. You should also use databases and other resources to find out properties of materials.

You might also want to try tests for materials, joints and finishes to show how these can vary and influence your choice for the product specification.

COMPARATIVE TESTS