The Great *Exhibition* AT HOME

ROYAL COMMISSION EXHIBITION OF 1851

BIG IDEAS

ROYAL ACADEMY OF ENGINEERING

THIS IS ENGINEERING

The Royal Academy of Engineering

As the UK's national academy for engineering and technology, the Royal Academy of Engineering brings together the most talented and successful engineers to advance and promote excellence in engineering for the benefit of society.

We have three strategic priorities:

- Make the UK the leading nation for engineering innovation and businesses
- Address the engineering skills crisis
- position engineering at the heart of society.

We bring together engineers, policy makers, entrepreneurs, business leaders, academics, educators and the public in pursuit of these goals.

This is Engineering

This is Engineering is a campaign to encourage more young people, from all backgrounds, to consider careers in engineering. Engineering is an exciting, varied, and rewarding career, and yet the UK has a shortage of young people applying for engineering courses and jobs. One of the reasons for this shortage is that many people hold outdated views of what engineering is, and what engineers do.

This is Engineering challenges these misconceptions by telling the story of real young engineers from a variety of backgrounds who are making a difference through engineering in a variety of ways. The campaign films and images bring engineering to life for young people across social media, and are free for anyone to use online, in the classroom and at events.

For more information about the campaign and to learn what engineering really looks like, visit the website and watch our short films at **www.thisisengineering.org.uk**

This is Engineering is led by the Royal Academy of Engineering in collaboration with Engineering UK and with the generous support of our partners.

Royal Commission for the Exhibition of 1851

The Royal Commission for the Exhibition of 1851 awards some 35 postgraduate Fellowships and Scholarships a year, for advanced study and research in science, engineering, the built environment and design. It also makes a small number of Special Awards to support projects consistent with its overall aims. Many of these are focused on raising the awareness of the young to the opportunities presented by science and engineering.

Big Ideas

Big Ideas creates programmes that encourage community participation, inclusion and cohesion across the arts, heritage, science and sport. We specialise in projects which bring groups together and create new experiences and relationships on a local, national and international scale. Change the way you see the world with Big Ideas.

Illustrations by Nick Hayes

Foreword

The Great Exhibition of 1851 was an international celebration of innovation. To Prince Albert and his team of commissioners it was the ultimate demonstration of a modern world – fast moving and dynamic.

The Great Exhibition at Home Challenge is inspired by the wonder of such a momentous undertaking and the ambition of those involved. It provides an opportunity to connect schools and communities today in the spirit of the Exhibition of 1851, to look to the future and engineer a better world.

I'm looking forward to seeing what young people today make of Albert's story and the wonderful ways in which it will inspire them to create new inventions for 2020. We urgently need curious minds to address the challenges which we face today, none more urgent than the negative impact we are having on the environment.

Join us – and our friends at the Royal Academy of Engineering and Big Ideas – in activating and inspiring students across the country to get involved, and become a part of the legacy of the Great Exhibition of 1851.

Nigel Williams
Secretary, The Royal Commission for the Exhibition of 1851

The Great Exhibition at Home partnership

The Royal Commission for the Exhibition of 1851 and The Royal Academy of Engineering have partnered to deliver The Great Exhibition at Home project with Big Ideas.

We would like to thank everybody who has been generous with their time and ideas during the development of this pack. We would particularly like to thank the fantastic engineers, who have allowed their work and research to be featured, and volunteered their time as part of a star prize for the competition winners.

Image: Interior view of Crystal Palace in South London. 1854. Delamotte, Philip Henry. © Victoria and Albert Museum, London.

Contents

Find out more at
big-ideas.org/join1851

The Great Exhibition at Home Challenge

Inspired by Prince Albert's original Great Exhibition, which showcased the most exciting technology and inventions from 1851, students across the country are invited to create a Great Exhibition in their own home! This year's challenge will address one of society's most pressing issues...

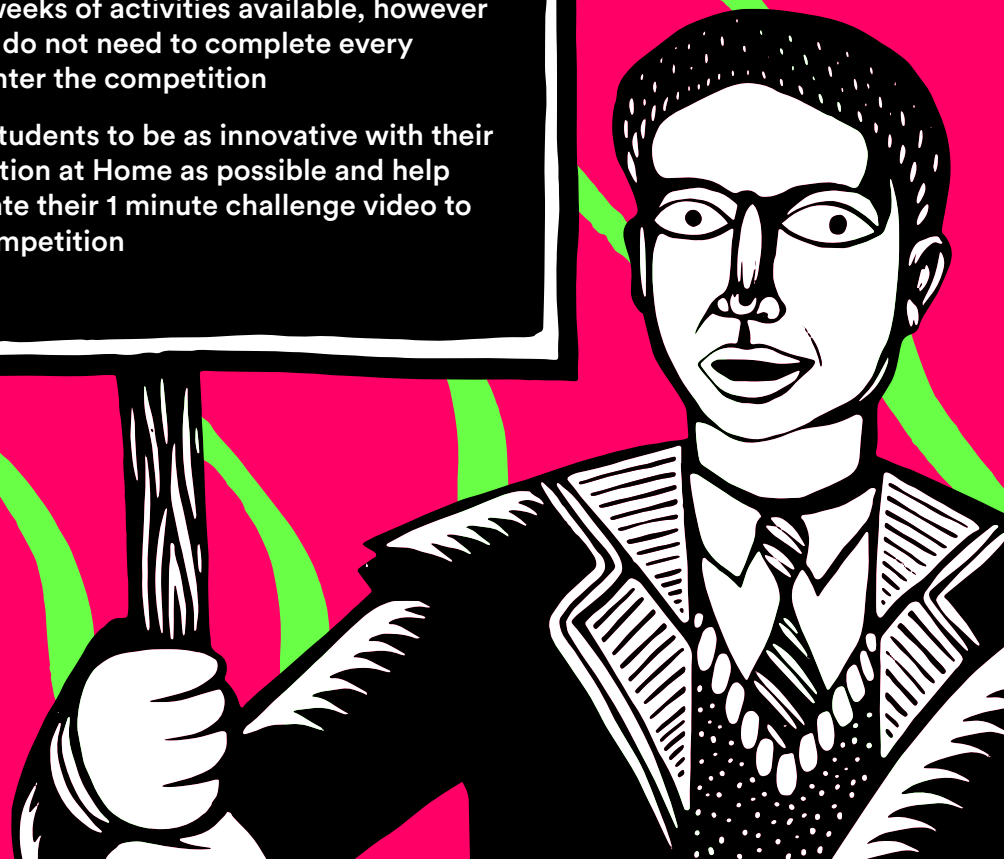
How can engineering help protect the planet?

All UK primary and secondary students and schools are welcome to take part in The Great Exhibition at Home Challenge. The challenge is aimed at students aged 9 – 14, although younger and older children can be involved, the challenge is suitable for wherever your classroom may be at this time, students can work alone or with friends. All participants who submit a 1-minute challenge video will be in with a chance of winning fantastic prizes!

The pack refers to 'educators and students': this includes all teachers, parents, carers who are currently acting as educators and all learners taking part in the challenge.

HOW TO TAKE PART

- Use this resource pack to gain an overview of the project and it's content to facilitate students' learning
- Download the additional worksheets from big-ideas.org/1851. Use them to guide your students through the challenge and help them to create exhibits for their own 'Great Exhibition' – there are 7 weeks of activities available, however participants do not need to complete every activity to enter the competition
- Encourage students to be as innovative with their Great Exhibition at Home as possible and help them to create their 1 minute challenge video to enter the competition



What was the original Great Exhibition all about?

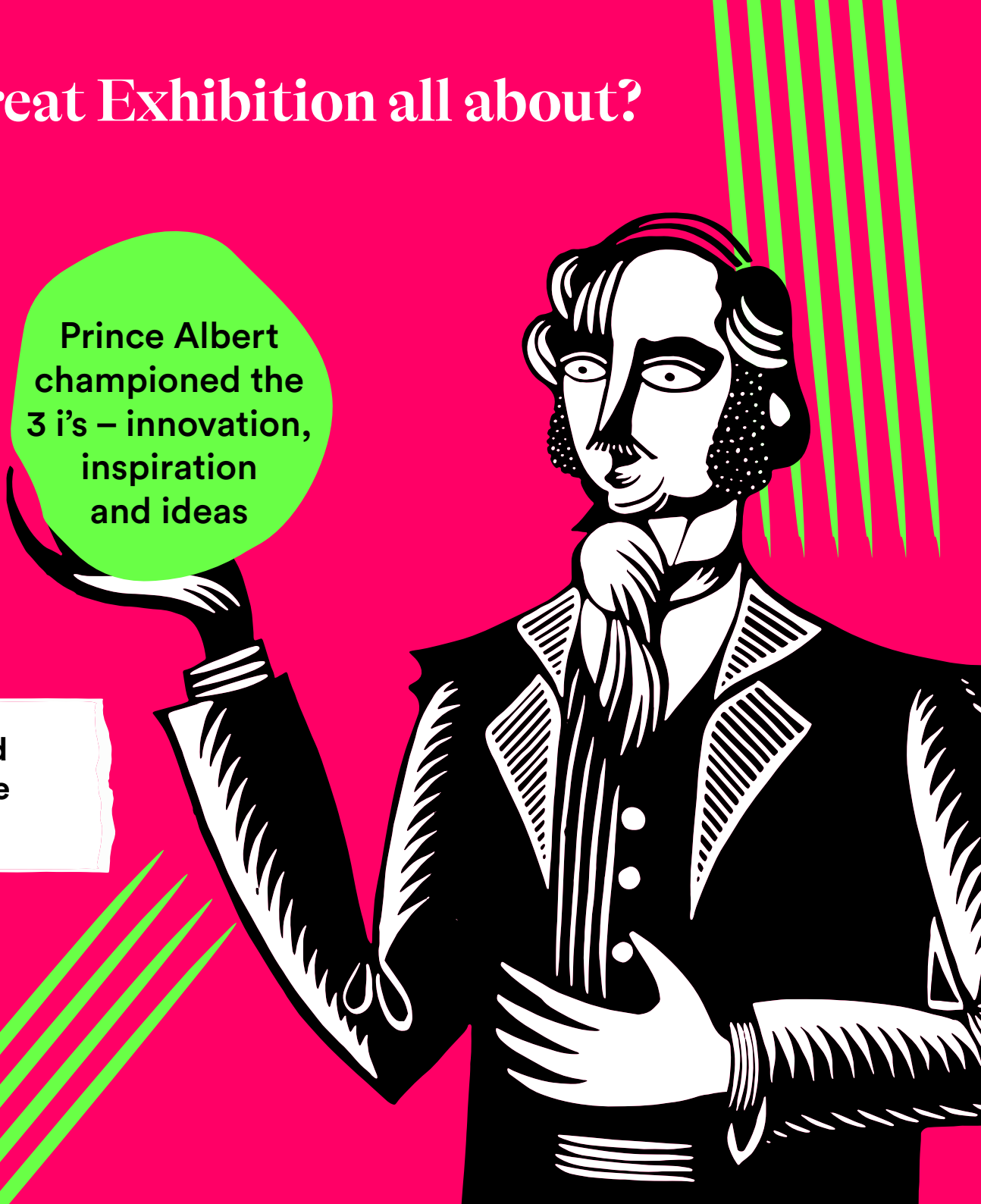
In 1851, Prince Albert and his team wanted to celebrate the advances in technology, science and design all around the world – they especially wanted to show that Britain had some of the best and brightest inventors and engineers around!

They decided to organise a huge showcase of modern technology from all over the globe to be judged as part of a huge competition – The Great Exhibition.

Not only did they hope that such an exhibition would show that Britain had some of the leading engineers and innovators in the world, but also that the international exhibits would inspire and educate British manufacturers and the British public.

As the original World Trade Fair, The Great Exhibition is now considered one of the most memorable and influential cultural events of the 19th century.

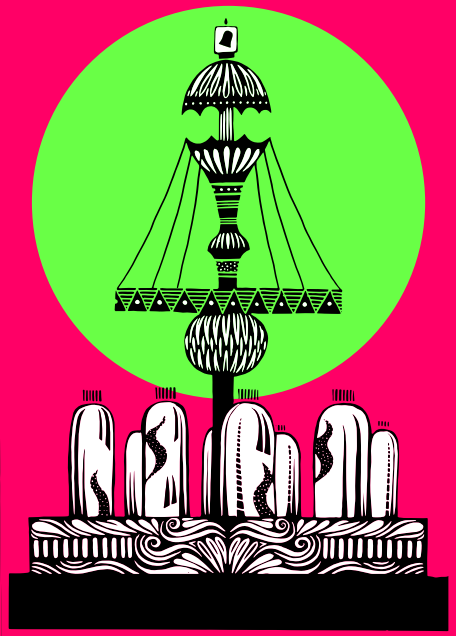
On the following pages, you will find summaries of content featured in the student worksheets



Step inside the Crystal Palace

There were all manner of inventions, exhibits and curiosities shown inside the Crystal Palace. We have selected seven '1851ders' from more than 100,000 exhibits displayed at the original exhibition.

These inventions were cutting edge for their time and would have sought to tackle issues facing the Victorians. Take a look at the following exhibits and see examples of how participants can use these inventions from 1851 to think about one of the big challenges we face in 2020 – environmental concerns. These can act as a springboard for discussion, and a way to start thinking about the kinds of climate issues we are facing and how engineering can help.



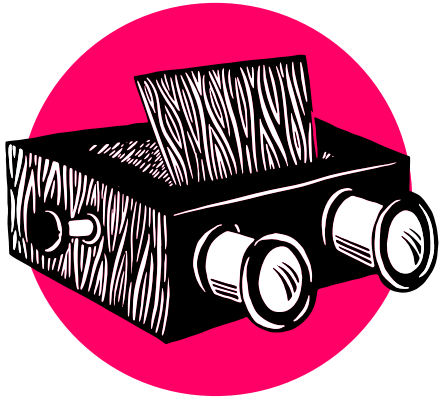
TEMPEST PROGNOSTICATOR OR LEECH BAROMETER

by George Merryweather

Invention which used live leeches to predict the weather.

How can predicting the weather be helpful?

Think about natural disasters and how we might engineer solutions for flooding.



STEREOSCOPE

by Jules Duboscq

Transformed two dimensional pairs of images into three dimensional images before the viewer's eyes. The 'original' Virtual Reality.

How can we use technology to help educate people about the environment?

Think about social media, VR and spreading the word!

THE YACHT PIANO

by William Jenkins

A folding piano complete with collapsible keyboard to squeeze into tight spaces such as a yacht, saloon or ladies parlour.

How can we be more environmentally conscious with the way we travel?

Think electric cars, fast trains and city bike initiatives.

THE COMICAL CREATURES

by Hermann Ploucquet

A display of stuffed animals doing distinctly human things, such as a frog carrying an umbrella and a pair of sword fighting mice.

Why are animals finding it increasingly hard to survive on the planet and what can engineers do to help?

Think about rising sea levels, deforestation and fires.

PERFUME FOUNTAIN

by Eugene Rimmel

A beautiful exhibit which allowed ladies to try 'Great Exhibition Bouquet' perfume by spritzing their handkerchief in the fountain.

How can fashion and cosmetic brands be more sustainable?

Think about engineering new fabrics and using natural cosmetic ingredients.

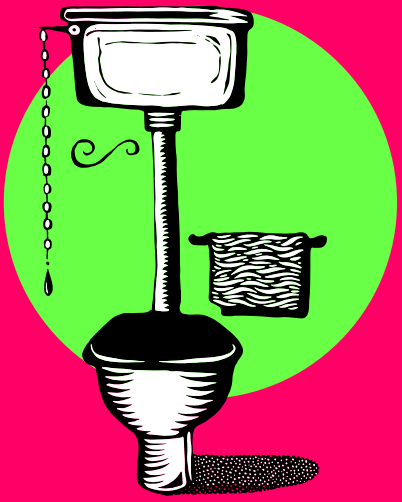
ALARM BED

by R.W. Savage

A silent alarm bed which would tip a sleeping person out of bed at a time of their choosing.

How can technology and gadgets help us be more eco friendly in our day to day lives?

Think about keep cups and public transport.



PAID FOR PUBLIC TOILETS

by George Jennings

For the first time ever, Great Exhibition visitors could pay one penny to gain access to individual cubicles with flushing toilets.

Why is waste an issue in 2020 and how can engineers help?

Think about recycling and different types of biodegradable plastic alternatives.

Engineering a better world

In the following table you can familiarise yourself with some inspiring engineers. Each of them is using engineering to address environmental issues. The table includes a summary of their work and their reasons for becoming engineers. In the additional student weekly worksheets you will find profiles for each engineer. These will help participants learn about the engineers in more detail and provide activities to get them thinking.

Find out more about our engineering trailblazers at **thisisengineering.org.uk**

ENGINEER	PROBLEM THEY HAVE TACKLED	SOLUTION THEY HAVE FOUND
Lucy Hughes	Plastic waste	Created a new plastic substitute from fish waste
Laurence Kemball-Cook	Non-renewable energy sources	Created a device to harness kinetic power from footfall
Dr Enass Abo-Hamed	Lack of power to countries without an electrical grid	Developing a hydrogen battery that would be able to store clean and renewable energy
Ben Crowther	Farming uses too much land and water	Created a new way to farm which uses less water and pesticides
Milly Hennayake	Flooding damaging homes and communities	Developing environmentally friendly drainage system to keep people safe from flooding
Halvard Grimstad	Lack of food for a growing population	Helps to build agricultural robots for growing food

What will we be looking for?

To enter the challenge, students must create a 1 minute video presenting their Great Exhibition at Home which answers the question *'How can engineering help protect the planet?'*. A teacher, parent or guardian must submit the video, either by email to 1851@big-ideas.org or online at big-ideas.org/athome/.

Entries will be judged against the following criteria:

UNDERSTANDING

(Scored out of 25)

How much have you learnt about the original Great Exhibition and the Great Exhibition at Home 2020 engineers? How well can you demonstrate this learning through your own work?

CREATIVITY

(Scored out of 25)

How are your ideas and your Great Exhibition original? We want to see creative ideas, enthusiasm and energy.

SIGNIFICANCE

(Scored out of 25)

Why is it important to use science and engineering to protect the environment?

ENGAGEMENT

(Scored out of 25)

How is your video engaging your audience? Is it accessible and exciting?

DOCUMENTING YOUR EXHIBITION

Participants will need to create a video, no more than 1 minute in length. The video should showcase their Great Exhibition at Home and explain how they think it will tackle this year's challenge question: 'how can engineering help protect the planet?'. Send this to 1851@big-ideas.org or submit online at big-ideas.org/athome.

For further guidance on how to create, edit and submit your video visit big-ideas.org/teacher-support. If you are experiencing technical difficulties please feel free to get in touch.

PRIZES

Three winning schools will receive:

- £500, £300 or £100 worth of equipment to supersize STEM subjects in your school
- A 30 minute meeting or video chat with one of the inspiring engineers featured in this pack for your school

Three runners up will receive:

- A 30 minute meeting or video chat with one of the inspiring engineers featured in this pack for your school

Plus thirty prizes for individual participants!

EXHIBITION INSPIRATION

When thinking about what a Great Exhibition in your Home might look like, always remember Albert's 3 i's - innovation, inspiration and ideas! A Great Exhibition can be whatever you want it to be, but here are a few ideas to get you started...

- Hold an Exhibition in your bedroom, your garden, even a shoebox!
- Create a display about one of our engineers
- Design or make your own own invention
- Conduct an experiment and display the results
- Create an animation about engineering and the environment
- Run a campaign to reduce plastic in your household
- Display posters in your window for the rest of your street

GETTING STARTED

Now you have an overview of the project and its content, it is time to set your students off on the challenge. There are 7 sets of sheets for students to work through. These introduce one Victorian invention and one contemporary engineer to participants each week, as well as providing practical engineering and design challenges. These challenges can be used to build up exhibits for students to display at their Great Exhibition at Home, which is the final video challenge in week 7.

Students are not required to complete all the worksheets to enter into the challenge, however these helpful educational resources can guide participants. Any student who enters their 1 minute challenge video will be in with a chance of winning prizes.

Additional support

If you need any additional support, or would like to share your learner's progress throughout the project, please get in contact by emailing 1851@big-ideas.org.

A special welcome to all RAEng Teacher Coordinators taking part in the project – we would love to hear from you! Please get in touch using the email above with any questions, concerns, or for support with the project.

Those facilitating The Great Exhibition at Home challenge are also invited to join our Facebook Community group to connect with other educators and share ideas, tips, and pictures of students' progress. Further support, including weekly Q&As, will also be available on this group.

Take this further...

Stay Connected

The Royal Academy of Engineering's Connecting STEM Teachers programme aims to create a national network of support for teachers across all STEM subjects, ensuring they have the knowledge and confidence to engage a greater number and wider spectrum of school students with STEM. Central to the success of the programme is the work of the Academy's Teacher Coordinators (TCs) who lead support networks for local STEM teachers across the UK.

To find out more about the benefits of joining the network and the location of your closest TC visit tinyurl.com/STEM-Teachers

STEM Project resources

Our resources have been developed by teachers and engineers to be used in schools for pupils aged 9-14. The resources provide thematic learning activities to support and add context to the national curriculum. They can also be used in STEM clubs or school challenge days. An important aim of each resource is to enable teachers and STEM leads to engage their students with STEM through hands-on activity and stimulating engineering content. You can download these at stemresources.raeng.org.uk

To join the network and receive free training and resource boxes contact education@raeng.org.uk

Big Ideas

To get involved with more exciting educational projects visit big-ideas.org

The Engineers

Listen to interviews with three of the world's greatest engineers recorded with public audiences. Search "The Engineers The World Debate BBC" to find links to programmes exploring civil engineering, robotics, genetic engineering and engineering space flight. The Engineers is a partnership between the BBC World Service and The Royal Commission for the Exhibition of 1851.

The Royal Commission for the Exhibition of 1851

To learn more about the history of the Great Exhibition and its legacy today visit royalcommission1851.org

This is Engineering

Join the campaign and share *This is Engineering* films and case studies with pupils in your school. Watch the films and visit the wesbite at thisisengineering.org.uk

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