North East Ambition

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Health and life sciences sector toolkit teacher briefing guide
Pharmaceutical manufacturing

Introduction

The resources have been designed to be used as starter/plenary sessions for subject lessons, connecting to relevant topics within the scheme of work or related subject specific skills. There are links to additional resources or optional extension activities which could support a full careers lesson if desired.

Learning objectives

- Learn about the health and life sciences sector and why it is important to the North East economy.
- Gain an awareness of the different job roles available in different industries within the North East health and life sciences sector and how these may be appealing as a future career.
- Gain an understanding of the relevance of the curriculum to careers in the North East labour market and what skills and academic subjects are required for these roles.

Pharmaceutical manufacturing in the North East – background information

Health and life sciences is a sector of strategic importance to the North East economy, due to our exceptional health and life science assets, and strengths in pharmaceutical manufacturing.

North East England is a major centre for pharmaceutical manufacturing with companies across our region making a vital contribution to the supply of essential medicines across the world and responding in the global effort to diagnose, treat and prevent COVID 19.

In 2020 over 3000 people were employed in pharmaceutical manufacturing across Northumberland, Tyne and Wear and County Durham and this number is continuing to grow.

Within their strategy for economic growth in health and life sciences, the North East Local Enterprise Partnership have outlined an ambition to double the number of jobs and businesses within the sector by 2030.

You can access research on skills for key employment sectors in our region and the most recent ONS statistics on enterprises and employment in the North East health and life sciences sector via the North East Evidence Hub.

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THE CAREERS & ENTERPRISE COMPANY

Video activities

Students answer questions using information provided in the videos.

Careers in pharmaceutical manufacturing in the North East (3:06)
https://www.youtube.com/watch?v=wH2O2d28a7c
Overview of why the health and life sciences sector is so important to the North East economy, with insights from Sterling Pharma Solutions, a pharmaceutical manufacturer based in Northumberland.

The following videos show people working in the sector and highlight some of the skills and qualifications which could help with a career. You do not need to show all the video clips but can select those which are most relevant to your students.

Centre for Process and Innovation (CPI)-interview with a Chemical Engineer - (2:01)
https://www.youtube.com/watch?v=i_nBSkR64Z4
Graduate Chemical Engineer talking about what they enjoy about their job and routes into this career.

High Force Research – interview with a Manufacturing Chemist (2:45)
https://www.youtube.com/watch?v=1qQKHGvWq8s
Graduate Manufacturing Chemist explains what they enjoy about their work and routes into this career.

Centre for Process and Innovation (CPI) - interview with an apprentice process operator (2:08)
https://www.youtube.com/watch?v=aZ3GPD_9Iq4&t=60s
Apprentice process operator at CPI talking about the benefits of the apprenticeship route, what the role involves and skills which are important in the workplace.

Centre for Process and Innovation (CPI) - interview with an apprentice maintenance technician (1:58)
https://www.youtube.com/watch?v=G0GaehIP23M
Apprentice maintenance technician at CPI explaining why they chose an apprenticeship route, the skills they are learning and what they enjoy about their job.

Apprenticeships at GSK (3:24)
https://vimeo.com/517149158
Apprentices and leaders from GSK at Barnard Castle explain the different career routes available in pharmaceutical manufacturing, the benefits of apprenticeships and how to access these opportunities.

Curriculum links

These toolkit resources could be used to introduce a new topic, subject content or to make general links between your subject and how the skills and knowledge acquired can support a future career.

Select the links relevant to your subject from the table below and insert into slide 7 of the lesson PowerPoint template, to highlight the connections between the subject/topic taught and careers in the North East labour market.

Maths curriculum links		
Key stage and subject	**Curriculum link**	**These skills and knowledge are important to this industry because**
KS3	**Ratio, proportion and rates of change**	Calculating and expressing the ratio between the raw materials required to manufacture pharmaceuticals ensures the quality and consistency of the finished product.
	Statistics	The collection and interpretation of data across all stages of the pharmaceutical manufacturing process is becoming increasingly important. As manufacturing is digitalised then more data is captured and an understanding of how this can be interpreted, compared and presented will ensure continuous improvement and consistency across the manufacturing processes.
	Algebra	Algebra is used to model and analyse systems and manufacturing processes.
KS4	**Ratio, proportion and rates of change**	Calculating and expressing the ratio between the raw materials required to manufacture pharmaceuticals ensures the quality and consistency of the finished product.
	Statistics	The collection and interpretation of data across all stages of the pharmaceutical manufacturing process is becoming increasingly important. As manufacturing is digitalised then more data is captured and an understanding of how this can be interpreted, compared and presented will ensure continuous improvement and consistency across the manufacturing processes.
	Probability	Probability is important when evaluating the safety of manufacturing processes. Health, safety, and environmental (HSE) considerations underpin all working practices in industry.
	Algebra	Algebra is used to model and analyse systems and manufacturing processes.
Additional subject related skills	Critical thinking, problem solving, analytical thinking and quantitative reasoning are skills used daily by those working in the development and manufacture of pharmaceuticals. This enables processes to be continually improved and the safe, effective and efficient manufacture of the medicines.	

Science curriculum links

Key stage and subject	Curriculum link	These skills and knowledge are important to this industry because
KS3 Science	**Chemical reactions**	The active ingredients in pharmaceuticals are produced through chemical reactions and accurate representation of these reactions using formulae and equations enables these reactions to be duplicated in factories around the globe.
	Pure and impure substances	Analysing the purity and stability of both the raw materials and finished products is a critical part of the pharmaceutical manufacturing process. Chemists use techniques such as chromatography (e.g. HPLC) to analyse samples at every stage of manufacture.
	Matter	Understanding how changes in temperature and pressure effect physical changes in the materials used to manufacture medicines is important. This is to ensure that the processes and chemical reactions are safe and can be reproduced again and again.
KS4 Chemistry	**Quantitative chemistry**	Quantitative methods and chemical equations are used to determine the quantities of raw materials required and predict the yield of pharmaceutical produced by the manufacturing process.
	Bonding, structure, and properties of materials.	Understanding how bonding and structure are related to the properties of substances and how these properties may change as chemical reactions take place, is essential in the design and development of safe and effective pharmaceutical manufacturing processes.
	Energy changes and rate of reaction	Energy changes occur through the chemical reactions which form part of the pharmaceutical manufacturing process. Understanding these energy transfers and the impact these could have on the manufacturing processes, rates of reaction and equipment e.g. significant temperature increases caused by an exothermic reaction, enable pharmaceutical manufacturers to keep their facilities safe and their processes and yields consistent.
	Chemical analysis	Chemical analysis is an essential part of the pharmaceutical manufacturing process in order to ensure medicines are safe and effective. Raw materials and finished pharmaceutical products are tested for purity and to ensure correct formulation using methods such as chromatography (e.g. HPLC)
KS4 Physics	**Forces**	Engineers designing and operating pharmaceutical manufacturing plants analyse contact and non-contact forces and energy transfers. It is important they can understand and predict how both the materials and equipment will interact so they can ensure the desired product is made safely and of consistent quality.
	Energy	Calculating the amount of energy stored or released from a system as its temperature changes, and how much energy is required to change the temperature of a substance, enables engineers to design pharmaceutical manufacturing processes which are safe and efficient.
Additional subject related skills	Development of skills such as scientific thinking, experimental skills and strategies, analysis and evaluation of data and an understanding of scientific vocabulary, units and nomenclature is essential in the industry in order to enable the precise and efficient manufacture of safe effective medicines.	

English curriculum links

Key stage and subject	Curriculum link	These skills and knowledge are important to this industry because
KS3	**Spoken language**	The ability to hold discussion and debate as well as to work collaboratively is important to communicate effectively with colleagues. Being able to use technical language and adapt the language used depending on your audience is key when communicating with customers and other stakeholders.
	Reading and writing	Reading for information, enhancing vocabulary through sector specific language and able to write for a variety of purposes and audiences e.g. through reading technical publications and instructions or to produce reports for a variety of audiences.
KS4	**Spoken language**	Selecting and organising information and ideas effectively and persuasively for prepared spoken presentations is an important skill across many roles in pharmaceutical manufacturing. For example, when marketing services or products to customers or presenting to internal teams and colleagues. Planning the content and language of these presentations for different purposes and audiences ensures that the information is understood, and the presentation has the intended impact. For example, the technical content and language used to present a new analytical process to an internal team may not be appropriate to used when promoting services to an external customer. Listening to and responding appropriately to any questions and feedback is an important skill when communicating with all stakeholders.
	Critical reading and comprehension	Identifying and interpreting themes from written text and reading in different ways for different purposes is helpful for roles in pharmaceutical manufacturing. For example, when evaluating and interpreting clinical research papers and technical reports. The ability to accurately comprehend written standard operating procedures in detail is important to ensure the safe production and testing of pharmaceutical products.
	Writing	Producing clear and coherent text for different purposes and audiences, selecting, organising and emphasising facts and key points, is important across many functions in pharmaceutical manufacturing. For example when producing technical reports, writing safety procedures or developing marketing materials. Accurate recording and reporting of information ensures quality and safety can be monitored throughout the manufacturing process.
Additional information	Skills developed through English are important for a variety of roles in pharmaceutical manufacturing to ensure that employees are able to clearly read and understand safety instructions, able to accurately record and report information for a variety of audiences and to work collaboratively.	

Additional activities and further information

There is an optional research task on slides 5 and 6 of the PowerPoint presentation if you would like to expand this activity into a full lesson. There is also an optional plenary which could be used as a reflection activity following a subject lesson. These could also be set as home learning tasks.

You can access more resources relating to careers in the curriculum on the North East Ambition website and on the Careers and Enterprise Company website.

If students are interested in finding out more about the industry in the North East and the varied career routes and opportunities available, there are some links on the plenary activity on the final slide which may be of interest.

You can find out more about the North East labour market via the LMI toolkit for educators on the North East Ambition website and through the North East Local Enterprise Partnership website.

Careers in the curriculum CPD resources

Useful links for teachers to develop skills and knowledge to connect careers to the curriculum:

- Careers in the curriculum online CPD course delivered in partnership with NU:STEM
  https://www.northeastambition.co.uk/directory/careers-initial-teacher-education
- Industry insights session - life sciences - Feb 2021
  https://www.youtube.com/watch?v=boUFb3AJIUw
- Online CPD course available from STEM learning
  Linking STEM curriculum learning to careers | STEM