Supporting Technical Education Teaching:

**Curriculum Resources**

Teaching Guide

Topic: Health, safety and environmental regulations and practice

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| --- | --- |
| Route | Health & Science |
| Qualification | T Level Technical Qualification in Science (Level 3) (Delivered By NCFE) [www.ncfe.org.uk/qualification-search/qualification-detail/t-level-technical-qualification-in-science-level-3-delivered-by-ncfe-883](http://www.ncfe.org.uk/qualification-search/qualification-detail/t-level-technical-qualification-in-science-level-3-delivered-by-ncfe-883) |
| Topic | Health, safety and environmental regulations and practice |
| Specification coverage | **A3: Health, safety and environmental regulations in the health and science sector**  A3.2  **A4: Application of safety, health and environmental practices in the workplace**  A4.5, A4.6, A4.7, A4.8 |

This resource is part of a series of materials to support technical education teaching. The approach to developing the materials draws from research led by Professor Kevin Orr at the School of Education, University of Huddersfield, which sets out a model for understanding of technical education pedagogy.

The curriculum development begins with the knowledge that students are working to learn and apply. Teachers draw from their subject and industry expertise, and their knowledge of their students, to make decisions about the core concepts the curriculum will focus on, how they will sequence these concepts, and the activities that are selected to support students’ learning. The decisions behind the resources suggested in this topic are the result of choices made by the curriculum development team. They will be reviewed and improved by teachers’ decision-making and ongoing reflection in their own circumstances.

The materials also seek to support teachers in bringing classroom and industry closer together, by providing assets that draw from authentic industry materials, and use opportunities to capture business practice that can be shared with students.

Materials for other topics are available at: [www.technicaleducationnetworks.org.uk](http://www.technicaleducationnetworks.org.uk)

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HEALTH AND SAFETY

This topic has been safety checked but not trialled by CLEAPSS.

It is assumed that activities outlined in this Teaching Guide will be undertaken in suitable facilities or work areas and that good practices, appropriate use policies and procedures will be observed. Teachers should consult their employers’ risk assessments before use and consider whether any modification is necessary for the particular circumstances of their own class/institution.

For practical activities, the Technical Education Networks programme has tried to ensure that experiments are healthy and safe to use in colleges and schools, and that any recognised hazards have been indicated together with appropriate control measures (safety precautions). It is assumed that experiments and activities will be undertaken in suitable laboratories or work areas and that good laboratory practices will be observed. To access the the CLEAPSS materials in this suite, institutions will need to be a member of CLEAPSS. Further details are available at [www.cleapss.org.uk](http://www.cleapss.org.uk) If necessary, CLEAPSS members can obtain further advice by contacting the Helpline by email at [science@cleapss.org.uk](mailto:science@cleapss.org.uk) or on 01895 251496.

Acknowledgments

We are grateful to the following organisations and individuals for their input and support with the teaching materials for this topic: Alyssa Fox-Charles (Author), Rosalind Eccles (Buckinghamshire College Group), CLEAPSS, Dr Peter Gordon (Microscopy Specialist, Sainsbury Wellcome Centre, UCL).

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Introduction

This document for teachers outlines the topic area covered, and approach to using the suite of resources and assets for each lesson.

# Topic purpose

This topic is an introduction to assessing and minimising potential hazards and risks, and safety management of biohazards in the workplace. The first half of the topic (Lessons 1 and 2) will ensure students develop the skills necessary to create and evaluate useful and purposeful risk assessments using the Health and Safety Executive’s (HSE's) Five Steps to Risk Assessment. The second half of the topic (Lessons 3 and 4) looks at the different biohazard categories and containment measures associated with each of them.

There are four lessons and each lesson is assumed to be 1.5 hours. You may want to adapt the suggested sequencing of concepts and activities as appropriate for your students and circumstances. The lessons are broken down to provide teacher flexibility on the depth covered in the activities; lessons can also be split over multiple shorter lessons if required.

. Ideally the lessons in each pair should be taught sequentially as the second lesson builds on knowledge and skills developed earlier, and in some cases links back to the first lesson.

How health and safety at work is promoted (A3.3) would work well after Lesson 2.

There are also opportunities to build several essential skills that are developed during the course and general competencies for maths, English and digital.

# Industry importance

Risk assessment is one of the methods used to minimise harm in the workplace and can be found across all industries and in different workplace environments. Poorly written or missing risk assessments can expose employees or members of the public to the risk of serious harm. Employers have a duty of care to their employees and the public. It is therefore important that risk assessments are not static documents; they should be regularly reviewed and updated to mitigate risk and harm. Risk assessments also consider environmental factors regarding the use and disposal of chemicals and biohazards, which may have an adverse effect on the environment. Businesses should consider their impact on the environment and ensure they have appropriate containment measures in place, are compliant with regulations and laws, and dispose of potentially hazardous materials correctly.

Although businesses often have health and safety officers or a team whose job involves completing and reviewing risk assessments, all employees are responsible for taking action to keep themselves and other safe. Therefore, all employees must be able to understand, create, review and improve risk assessments. Employees also have a duty of care to report risks as they arise and to follow the correct reporting procedures.

“It is easy to become complacent around chemicals and biohazards especially when used every day. The assessment of risk for current and new research techniques is a key part of all wet lab research, which protects you and those around you from unintended harm whilst keeping the science creative.”

**Dr Peter Gordon, Sainsbury Wellcome Centre, UCL**

# Industry links

* The Health and Safety Executive provides guidance for all workplaces along with industry-specific guidance and videos: <https://www.hse.gov.uk/guidance/index.htm>

Businesses may implement systems that help them to manage their health and safety responsibilities, such as UCL riskNET Support Hub:  
[www.ucl.ac.uk/safety-services/risknet-support-hub](http://www.ucl.ac.uk/safety-services/risknet-support-hub)

* The UK Government National Careers Service has sections focused on:
  + Health and safety roles:

[nationalcareers.service.gov.uk/job-profiles/health-and-safety-adviser](http://nationalcareers.service.gov.uk/job-profiles/health-and-safety-adviser)  
[nationalcareers.service.gov.uk/job-groups/3567](http://nationalcareers.service.gov.uk/job-groups/3567)

* + Careers in the science sector:

[nationalcareers.service.gov.uk/job-categories/science-and-research](https://nationalcareers.service.gov.uk/job-categories/science-and-research)

* Many people working in the science industry are members of a professional body. Some examples are given below:
  + Royal Society of Biology: [www.rsb.org.uk](http://www.rsb.org.uk)
  + Institute of Physics: [www.iop.org/](http://www.iop.org/)
  + Royal Society of Chemistry: [www.rsc.org/](http://www.rsc.org/)
  + Institution of Environmental Sciences: [www.the-ies.org](http://www.the-ies.org)
  + The Science Council has a full list of professional bodies:  
    [sciencecouncil.org/professional-bodies/](https://sciencecouncil.org/professional-bodies/)

# Prior learning

Students do not require any specific prior knowledge before studying the topic, however, it is worth exploring the depth of existing knowledge beforehand. Whilst the content of this series of lessons is unlikely to have been met by students at GCSE, students who have studied technical programmes previously may have been introduced to some policies and procedures relating to health and safety in workplace settings.

# Accessibility

The teaching materials have been designed to provide teachers with a flexible framework, including different approaches to activities, suggested consolidation activities to further embed knowledge, and adaptable study questions to assess learning. As with all resources, teachers will wish to consider the specific needs of their students when using the materials, including Special Educational Needs and Disabilities (SEND).

Learning outcomes and specification coverage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Lesson | Learning outcomes | Specification coverage | Skills and general competencies | Links to other specification content |
| 1 | Students will be able to:  Identify the difference between hazards and risks, and how to determine each appropriately.  Assess hazards and risks in new and familiar environments.  Introduce writing a risk assessment using the HSE’s Five Steps to Risk Assessment for a variety of new and familiar contexts.  Establish individual accountability and expertise in order to initiate evaluation of risk assessments. | **A3.2** How to assess and minimise potential hazards and risks, including specific levels of risk, by using the HSE’s Five Steps to Risk Assessment:  **step 1:** identifying the hazards  **step 2:** deciding who might be harmed and how  **step 3:** evaluating the risks and deciding on precautions  **step 4:** recording findings and implementing them, including completing risk assessment documentation  **step 5:** reviewing your assessment and updating if necessary | Skills:  **CS1** Project management  **CS3** Working with others  **CS5** Problem Solving  General Competencies:  English:  **GEC2** Present information and ideas  **GEC3** Create texts for different purposes and audiences  **GEC4** Summarise information/ ideas  **GEC6** Take part in/lead discussions  Mathematics:  **GMC6** Understanding data and risk | Specific Specification Links:  **A3.1** The purpose of legislation and regulations in the health and science sector  Wider Specification Links:  **A1** Working within the health and science sector  **A3** Health, safety and environmental regulations in the health and science sector  **A4** Application of safety, health and environmental practices in the workplace  **A5** Managing information and data within the health and science sector  **A8** Good scientific and clinical practice |
| 2 | Students will be able to:  Recall and recognise different COSHH hazard symbols and the actions needed to control the associated risks.  Identify hazards associated with different substances.  Practice writing risk assessments using the HSE’s Five Steps to Risk Assessment for a variety of new and familiar contexts, which include hazardous substances and detail appropriate control measures for each.  Evaluate Risk Assessments, including making recommendations for further improvements where appropriate. | **A3.2** How to assess and minimise potential hazards and risks, including specific levels of risk, by using the HSE’s Five Steps to Risk Assessment:  **step 1:** identifying the hazards  **step 2:** deciding who might be harmed and how  **step 3:** evaluating the risks and deciding on precautions  **step 4:** recording findings and implementing them, including completing risk assessment documentation  **step 5:** reviewing your assessment and updating if necessary | Skills:  **CS1** Project management  **CS3** Working with others    **CS5** Problem solving  General Competencies:  English  **GEC2** Present information and ideas  **GEC3** Create texts for different purposes and audiences  **GEC4** Summarise information/ ideas  **GEC6** Take part in/lead discussions  Mathematics  **GMC6** Understanding data and risk | Specific Specification Links:  **A3.1** The purpose of legislation and regulations in the health and science sector  **A4.18** The purpose of material safety data sheets and associated hazard and precautionary codes  **A4.19** The importance of ensuring that material data sheets are kept up to date, in line with relevant legislation  **A10.4** The appropriate techniques for handling a range of different substances (for example, solids, liquids and gases)  Occupational specialism- laboratory sciences  K1.22- The oxidation and reduction process  Occupational specialism- food sciences  K1.61- The advantages, limitations and uses of packaging used in the food and drink industry  Wider Specification Links:  **A1** Working within the health and science sector  **A3** Health, safety and environmental regulations in the health and science sector  **A4** Application of safety, health and environmental practices in the workplace  **A5** Managing information and data within the health and science sector  **A8** Good scientific and clinical practice  **A10** Experimental equipment and techniques |
| 3 | Students will be able to:  Recall the definition of a biohazard (biological agent).  Recall and identify the four different biohazard categories, including examples of each.  Describe possible consequences arising from not following correct handling (COSHH regulations). | **A4.5** The COSHH definition of a biohazard (biological agent):  a microorganism, cell culture or human endoparasite, whether or not genetically modified, which may cause infection, allergy, toxicity, or otherwise create a hazard to human health  **A4.6** The four hazard groups in relation to biohazards (biological agents):  **category 1:** unlikely to cause human disease  **category 2:** can cause human disease and may be a hazard to employees, unlikely to spread to the wider population and there are usually effective vaccines or other treatments available  **category 3:** can cause human disease and may be a serious hazard to employees, it may spread to the wider population but there are usually effective vaccines or other treatments available  **category 4:** causes severe human disease and is a serious hazard to employees, it is likely to spread to the wider population and there are usually no effective vaccines or other treatments available  **A4.7** The potential implications of not adhering to COSHH regulations when dealing with biohazards (biological agents):  risks to employees’ health (short and long-term effects of infection)  risks to the wider population (disease spread)  risks to the environment (vegetation, water supply, soil) | Skills:  **CS3**Working with others    **CS5** Problem solving  General Competencies:  English  **GEC2** Present information and ideas  **GEC3** Create texts for different purposes and audiences  **GEC4** Summarise information/ ideas  **GEC6** Take part in/lead discussions  Mathematics  **GMC6** Understanding data and risk | Specific Specification Links:  **A3.1** The purpose of legislation and regulations in the health and science sector  **A10.4** The appropriate techniques for handling a range of different substances (for example, solids, liquids and gases)  **A10.8** How to follow aseptic techniques  Wider Specification Links:  **A1** Working within the health and science sector  **A3** Health, safety and environmental regulations in the health and science sector  **A4** Application of safety, health and environmental practices in the workplace  **A8** Good scientific and clinical practice  **A10** Experimental equipment and techniques |
| 4 | Students will be able to:  Recall and identify the four different biohazard categories, including examples of each.  Describe the containment measures required for the four different categories of biohazard. | **A4.6** The four hazard groups in relation to biohazards (biological agents):  **category 1:** unlikely to cause human disease  **category 2:** can cause human disease and may be a hazard to employees, unlikely to spread to the wider population and there are usually effective vaccines or other treatments available  **category 3:** can cause human disease and may be a serious hazard to employees, it may spread to the wider population but there are usually effective vaccines or other treatments available  **category 4:** causes severe human disease and is a serious hazard to employees, it is likely to spread to the wider population and there are usually no effective vaccines or other treatments available  **A4.8** Containment measures that are used in relation to the four hazard groups:  levels of personal protective equipment (PPE)  laboratory location, access and controls  required laboratory facilities (for example, HEPA filters, showers)  complying with specific waste disposal regulations (for example, chemical decontamination or autoclaving) | Skills:  **CS3** Working with others    **CS5** Problem solving  General Competencies:  English  **GEC2** Present information and ideas  **GEC3** Create texts for different purposes and audiences  **GEC4** Summarise information/ ideas  **GEC6** Take part in/lead discussions  Mathematics  **GMC6** Understanding data and risk | Specific Specification Links:  **A4.10** The purpose of pressurised clean rooms and localised extraction and ventilation  **A4.17** How to decontaminate a range of common scientific equipment and substances  **A10.3** Applications of a range of equipment when undertaking scientific techniques  **A10.4** The appropriate techniques for handling a range of different substances (for example, solids, liquids and gases)  Wider Specification Links:  **A1** Working within the health and science sector  **A4** Application of safety, health and environmental practices in the workplace  **A8** Good scientific and clinical practice  **A10** Experimental equipment and techniques |

Lesson guidance

# Lesson 1: How to assess risk (A3.2)

This lesson establishes the concept of risks and hazards in the workplace, looks at how these can be assessed in new and familiar environments, and explores some examples of how to mitigate risks. It introduces the use of the HSE’s Five Steps to Risk Assessment in the workplace and asks students to write risk assessments and practise evaluating them.

This lesson is designed to be taught as a pair with Lesson 2.

## Preparation

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| Resources provided | L1 Slide Deck  L1 A1 Worksheet 1  L1 A1 Worksheet 1 Answers  L1 A3 Worksheet 2  L1 A3 Example Risk Assessment  L1 Plenary Risk assessment 1  L1 Plenary Risk assessment 2  L1 Plenary Answers  L1 Consolidation Risk Assessment Template |
| Equipment needed | None |
| Safety factors | Teachers and students are required to carry out their own risk assessments. |
| CLEAPPS references | None |
| Prior learning | It would be useful for students to be familiar with the following legislation and regulations, as these provide context for risk assessments, including where they are used and why they are useful:   * + Health and Safety at Work etc. Act 1974   + Management of Health and Safety at Work Regulations 1999   + Control of Substances Hazardous to Health (COSHH) Regulations 1994 and subsequent amendments 2004   + Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)   These are discussed as part of **A3.1**, therefore you may choose to cover that section first, before teaching these lessons, or alternatively build up students’ knowledge of legislation and regulation throughout their course. |
| Common misconceptions | Students may not distinguish between likelihood and consequence when discussing risk.  Students may catastrophise or underestimate the scale of potential harm from hazards.  There is often confusion over the meaning of key terms, such as hazard and risk, which are used in common everyday contexts. |
| Accessibility | Seek to ensure wide representation for any visiting speakers and case studies used. |

## Activity guide

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| Introduction  SUGGESTED TIME:  10 minutes  RESOURCES:  Slides 2–7 | The learning outcomes for this lesson are provided on slide 2.  Show students images of accidents at work such as on slide 3 and the four HSE case studies of incidents in different workplaces (slides 4–7). These can be found on the HSE website here: <https://www.hse.gov.uk/coshh/casestudies/index.htm> For each image/case study, ask students to suggest:   * + what happened here? (Workers have had accidents/incidents/ been exposed to harmful substances in the workplace.)   + could this have been prevented? (In some cases, there could have been additional control measures in place which would have prevented the incident, e.g. a screen in place to stop the worker from trapping their hand.)   + whose responsibility it is to try to prevent this incident? (The person performing the task; the employer’s.)   Briefly mention and explain the purposes of the Health and Safety at Work Act 1974 and the Management of Health and Safety at Work Regulations 1999.  Elicit that risk assessments are one of the approaches that employees can use to protect themselves, and organisations can use to protect their workers. |
| Activity 1: Hazards in the workplace  Suggested time:  10 minutes  Resources:  Slides 8–11  L1 A1 Worksheet 1  L1 A1 Worksheet 1 Answers | This activity is an introduction to hazards and risk. Students are given the opportunity to identify hazards in a familiar environment. Ask students to look closely at the image on slide 8 and complete Worksheet 1 by describing the hazards. There are 36 hazards in total. You may want to split the class up and ask groups to look at a certain number of hazards each.  Go through Worksheet 1 as a whole class and discuss each hazard. In some cases, ask students to discuss the questions on slide 9 with reference to specific hazards. Also ask students to identify similar hazards in their classroom environment.  Highlight use of the terms ‘hazard’ and ‘risk’. Show students slide 10 and ask them to determine the difference between the two terms. Then show them the correct definitions on slide 11. |
| Activity 2: Introduction to risk assessments  Suggested time:  10 minutes  Resources:  Slides 12–15 | * Briefly show images of the risk assessment and risk matrix (slides 12 and 13) as an introduction to a method of risk management within a workplace. There will be an opportunity to discuss the risk assessment in more detail in Activity 3. Slide 14 lists the main purposes of a risk assessment. * Another example of a proforma risk assessment can be found here: <https://www.ncfe.org.uk/media/xeyo35n4/sci-gsem-01-tq-science-osa-laboratory-sciences-assignment-1-distinction-guide-standard-exemplification-materials.pdf> * Another example of a risk matrix can be found here: <https://www.ncfe.org.uk/media/xeyo35n4/sci-gsem-01-tq-science-osa-laboratory-sciences-assignment-1-distinction-guide-standard-exemplification-materials.pdf> * Then show slide 15 and ask students to ‘THINK, PAIR, SHARE’ why risk assessments are important and what information would be needed in a risk assessment. You can encourage students to think back to Activity 1 and the questions they answered there. * Some suggestions for discussion points could be:   + There might be consequences of hazards ranging from minor injury up to life changing, severe or possibly fatal injury, to both the worker completing the task, and to those around them.   + Equipment may get damaged – this may impact business time and outputs, which in turn can cost money.   + The business’ reputation could be damaged, resulting in loss of income and possibly causing it to stop trading.   + The Health and Safety at Work Act 1974 and Management of Health and Safety at Work Regulations 1999 both hold businesses and their employees responsible for protecting the health, safety and welfare of workers and co-workers. A business could have licences taken away or face criminal charges for not providing up-to-date and accurate risk assessments.   By sharing their ideas as a whole class discussion, students should elicit some of the points included on slide 16 in preparation for the next activity.  The HSE has released guidance on what an effective risk assessment should look like and what it should aim to include: <https://www.hse.gov.uk/simple-health-safety/risk/risk-assessment-template-and-examples.htm>  It should be noted that not all employers will use a risk assessment that looks like this, and that some workplaces will use a specific service to support their staff which can record and monitor risk assessments. For example, University College London (UCL) uses a professional support service called riskNet: <https://www.ucl.ac.uk/safety-services> |
| Activity 3: Writing risk assessments  Suggested time:  50 minutes  Resources:  Slides 16–22  L1 A3 Example Risk Assessment  L1 A3 Worksheet 2 | Introduce the HSE’s Five Steps to Risk Assessment (slide 16).  Ask students to watch the video from the HSE on slide 17: [www.hse.gov.uk/simple-health-safety/risk/index.htm](http://www.hse.gov.uk/simple-health-safety/risk/index.htm)  As students watch the video, they should make notes on Worksheet 2 which might help them to complete the Five Steps to Risk Assessment themselves. This could be notes/prompts/ questions/information that helps them to understand the purpose of each step (slide 16).  As a class, discuss each step: how to complete it, why it is important, and any prompts/questions that might be useful to think about when completing that step. There is a summary of suggestions and discussion prompts on slides 18–19, and more detail below:   * + **Step 1:** Check safety sheets, manufacturers’ notes and information, health and safety records from previous incidents/accidents etc. Include everything that could potentially be a hazard, even if it is not presently. Include details so external readers can follow and understand. Walk around your workplace and observe possible tasks/activities/substances/processes that could cause harm to workers. Consult with employees/co-workers etc., who carry out the processes.   + **Step 2:** External visitors/contractors are often more at risk as they are not used to the building/area/equipment. Also consider groups of people who might have other requirements, such as disabled people, older or younger people, pregnant people, people working from home, lone workers or new employees.   + **Step 3:** Use the risk matrix to determine risk level: How likely it is to cause harm and how severe the harm might be if it is caused. Something that can easily cause a small amount of harm might be just as risky as something that can cause severe harm but is unlikely to do so. Consider the availability of first aid and also the number of persons who could be affected . Try to remove the hazard completely before putting safety measures in place. PPE should be a last resort if there are no other options to reduce the risk.   + **Step 4:** Determine that a proper check has been carried out, as well as the date it was completed and the person who completed it. Determine that a risk assessment has been completed for workplaces with five or more people. Determine that everyone who could be affected has been consulted, that all hazards have been identified, and that changes have been made to eliminate the hazard, or procedures put in place to reduce the risk. Determine that all remaining risks are low, or proper precautions have been put in place to deal with any remaining hazards. PPE is a last resort.   + **Step 5:** Regular checks should happen, as well as further checks when new equipment/procedures are brought in. If there are any incidents/accidents/near misses, these are recorded. Has anyone reported/noticed any issues/problems? This is important as safety regulations change and are improved/updated often, so risk assessments need to be kept up to date. It is important to adjust precautions and make changes to reflect any incidents/injuries that have occurred.   Briefly discuss the risk matrix (slide 20) using a couple of examples from Activity 1 to demonstrate how to use it. Highlight to students that it is common to exaggerate the possible harm caused by hazards.  Talk through the completion of a risk assessment form (slide 21), pointing out what information is expected in each section, the language used and the level of detail given. Show students an example of a completed risk assessment for a lesson (L1 A3 Example Risk Assessment).  The main part of this activity is to allow students to have a go at writing their own risk assessments. Assign students to write a risk assessment for one of the laboratory-based activities on slide 22. This is an individual task that should be completed on Worksheet 2. Give students 15–20 minutes working individually to complete as much as they can of a risk assessment for their given activity. Then divide students into five groups (for each different activity) in order that they can compare and evaluate their risk assessments. They should discuss or suggest improvements in their groups, before individually making those improvements to their own risk assessment. |
| Plenary:  Improving a risk assessment  Suggested time:  10 minutes  Resources:  Slides 23–25  L1 Plenary Risk Assessment 1  L1 Plenary Risk Assessment 2  L1 Plenary Answers | This activity is designed to encourage students to start applying their knowledge to new situations and to begin thinking about evaluating risk assessments. Hand out the two examples of risk assessments to the class: for autoclaving (Plenary Risk Assessment 1); and for the use, handling and storage of glassware (Plenary Risk Assessment 2). Half the class should look at each risk assessment. Note that both contain some errors or are missing information. The errors are not necessarily the same on each risk assessment. As answers will be shared later, students will get the chance to think briefly about the other risk assessment, involved to expand their range of evaluation points. Students should use slide 21 to improve Risk Assessment 1 or 2 by using THINK, PAIR, SHARE to address the questions on the slide, identifying the errors or missing information on the risk assessment, and discussing how they could improve it. Suggestions for answers are provided in Plenary Answers.  Use class discussions to check students’ understanding about the difference between a hazard and a risk. Ask students to recall the HSE’s Five Steps to Risk Assessment and to identify the sections or aspects of Risk Assessment 1 or 2 which fulfil the steps.  Summarise the lesson using slide 24 and introduce what will be covered in the next lesson using slide 25. |
| Follow-up / consolidation  Suggested time:  30 minutes  Resources:  L1 Consolidation Risk Assessment Template | To practise some of the skills from this lesson, ask students to complete a short risk assessment for an activity they do in their spare time, such as a sporting activity, cooking a meal, hoovering their house. If more support or structure is needed, students can fill in the Risk Assessment Template provided.  These risk assessments could be evaluated in a future lesson. This would give students the opportunity to practise evaluating risk assessments.  Once students are on industry placement they could bring risk assessments back from their respective workplaces, either for an activity they are undertaking or the environment(s) they are working in. These could be used by the class to experience a range of industry risk assessments, and to practice evaluating them. |

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# Lesson 2: Hazards and risk (A3.2)

This lesson follows on from Lesson 1 and introduces hazard symbols and the harm or injury that hazardous substances are likely to cause. It then builds on the skills developed in Lesson 1 when writing risk assessments, by asking students to identify the hazards associated with different substances. Students will write risk assessments that include hazardous substances and detail the appropriate control measures for each.

This lesson is designed to be taught as a pair with Lesson 1.

## Preparation

|  |  |
| --- | --- |
| Resources provided | L2 Slide Deck  L2 Introduction Worksheet 1  L2 Introduction Worksheet 1 Answers  L2 A1 Worksheet 2  L2 A1 Worksheet 2 Answers  L2 Consolidation Risk Assessment Template |
| Equipment needed | Clean chemical bottles and examples of Student Safety Sheets and Safety Data Sheets (SDSs) to be used to introduce students to COSHH hazard symbols, their associated hazards and control measures.  Methods for practical procedures students are likely to use in the coming weeks, or methods for practical procedures students have already completed. |
| Safety factors | Teachers and students are required to carry out their own risk assessments.  Bottles used in this lesson should be clean, so there should be no need for a risk assessment. If this is not possible, it will be necessary to carry out a risk assessment. |
| CLEAPPS references | If chemical bottles are not clean, then appropriate CLEAPPS references should be applied as necessary. CLEAPSS Student Safety Sheets: [https://science.cleapss.org.uk/Resources/Student-Safety-Sheets/](https://emea01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fscience.cleapss.org.uk%2FResources%2FStudent-Safety-Sheets%2F&data=05%7C01%7C%7C8e44af82183147ce4c4e08dbe077590a%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638350575431255807%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=XWMDZbOD1I6FVaYXTHdregLy0AgwP9Dx2Fg3zBUKdgQ%3D&reserved=0) |
| Prior learning | Students will have met the concept of oxidation during GCSE study but may not have linked this to the hazards of oxidising agents.  It would be useful for students to be familiar with the following legislation and regulations, as these provide context for risk assessments, including where they are used and why they are useful:   * + Health and Safety at Work etc. Act 1974   + Management of Health and Safety at Work Regulations 1999   + Control of Substances Hazardous to Health (COSHH) Regulations 1994 and subsequent amendments 2004.   + Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)   These are discussed as part of **A3.1**, therefore you may choose to cover that section first, before teaching these lessons, or alternatively build up students’ knowledge of legislation and regulation throughout their course. |
| Common misconceptions | Students may catastrophise or underestimate the scale of potential harm caused by hazards.  There is often confusion over the meaning of key terms, such as hazard and risk, which are used in common everyday contexts. |
| Accessibility | Seek to ensure wide representation for any visiting speakers and case studies used.  Peer reviewing is a skill that students may not have had much practice with. It may be helpful for some classes to have a discussion about what useful feedback looks like and how to mark peer review work/use a mark scheme, etc. |

## Activity guide

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| Introduction  SUGGESTED TIME:  15 minutes  RESOURCES:  Slides 2–8  L2 Introduction Worksheet 1  L2 Introduction Worksheet 1 Answers | The learning outcomes for this lesson are provided on slide 2.  This activity introduces names and symbols associated with common chemical hazards.  Ask students to look at the hazard symbols on slide 3 and suggest what each hazard symbol represents and the harm or injury that each could potentially cause. Ask students to complete L2 Introduction Worksheet 1, matching the hazard symbols to the hazard it represents. Alternatively, you could use an online/app-based quiz platform for this activity. The answers are given on slide 4 and in L2 Introduction Worksheet 1 Answers.  Check students’ understanding of oxidation and why this may be a hazard.  You may wish to demonstrate examples of oxidation and/ or use short video clips to support this as an opportunity to integrate K1.22- The oxidation and reduction process from the occupational specialism laboratory sciences.  Slides 5–8 highlight some easily confused differences between hazard symbols (common misconceptions), which should be clarified with students, including the difference in severity of the harm caused by some substances.  Notes for slide 5:   * + Note the ‘O’ in the flames of the Oxidising symbol.   + Oxidising: oxidising gases, liquids and solids.   + Flammable: flammable gases, liquids and solids – flammable aerosols, organic peroxides, self-reactive, pyrophoric, self-heating, contact with water emits flammable gas- These are examples rather than specific material students should recall.   Notes for slide 6:   * + Health hazard: harmful skin irritation, serious eye irritation, acute toxicity (harmful).   + Serious health hazard: respiratory sensitiser, mutagen, carcinogen, reproductive toxicity, systemic target organ toxicity, aspiration hazard- These are examples rather than specific material students should recall.   + ‘Health hazard’ is used to describe substances that cause irritations, whereas ‘serious health hazard’ is used to describe substances that are more seriously harmful.   Notes for slide 7:   * + Acute toxicity: severe, more serious and will likely result in a fatality or significant harm.   + Serious health hazard: respiratory sensitiser, mutagen, carcinogen, reproductive toxicity, systemic target organ toxicity, aspiration hazard. These are examples rather than specific material students should recall. Still serious but causes longer term damaging effects rather than likely immediate fatality.   Notes for slide 8:   * + Health hazard: harmful skin irritation, serious eye irritation, acute toxicity (harmful).   + Corrosive: causes severe skin burns and eye damage, serious eye damage.   + The Classification Labelling and Packaging corrosive pictogram is used for both serious eye damage and skin corrosion, whereas the exclamation mark pictogram is used for skin irritants and eye irritants. |
| Activity 1: Hazard hunt  Suggested time:  15 minutes  Resources:  Slide 9  L2 A1 Worksheet 2  L2 A1 Worksheet 2 Answers | This activity helps introduce students to Student Safety Sheets and Safety Data Sheets (SDSs) using these to find and identify hazards associated with various common chemicals.. Note that students should not be given access to Hazcards, but should instead use CLEAPSS Student Safety Sheets ([https://science.cleapss.org.uk/Resources/Student-Safety-Sheets/](https://emea01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fscience.cleapss.org.uk%2FResources%2FStudent-Safety-Sheets%2F&data=05%7C01%7C%7C8e44af82183147ce4c4e08dbe077590a%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638350575431255807%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=XWMDZbOD1I6FVaYXTHdregLy0AgwP9Dx2Fg3zBUKdgQ%3D&reserved=0))  Ask students to recap the difference between a risk and a hazard (refering back to L1 if needed).  Show students slide 9 and present them with a range of Student Safety Sheets and SDSs for different hazards and chemicals. If limited cards are available, students can work in groups, and you may wish to fit with the Student Safety Sheets/SDSs that you have.  Students complete L2 A1 Worksheet 2 matching chemicals with associated hazards. The answers to the hazard hunt can be found in L2 A1 Worksheet 2 Answers. |
| Activity 2: Writing and using risk assessments  Suggested time:  45 minutes  Resources:  Slide 10  L2 A2 and Consolidation Risk Assessment Template | In groups, students should be given examples of methods for practical procedures that they are likely to use in the coming weeks. These procedures should be chosen to contain materials for which there are SDSs and Student Safety Sheets available to the students. This will allow students to write their own risk assessments for use later in the course, providing an opportunity for them to reflect on and improve their risk assessments later. Alternatively, students could be given methods for practical procedures that they have already completed and write risk assessments for these, and then compare them with the risk assessment they used for the practical procedure.  Show students slide 10 and ask them to identify the hazards for the practical procedure they have been given. They should use the Student Safety Sheets and SDSs they have access to, or the internet if needed. (SDSs are available online; they should be provided by any chemical manufacturer/provider).  Students individually write an appropriate risk assessment for this practical procedure. A blank risk assessment template is provided that can be used for both Activity 2 and the Consolidation task.  Ask students to peer review each other’s risk assessments in their groups. They should provide each other with feedback that includes at least two points on ‘What Went Well’ and ‘Even Better If’.  If practical methods are being used where there are already risk assessments written, students could use these to compare with their own risk assessments. This will enable them to evaluate their risk assessments against real examples from their institutions. |
| Plenary:  Study question  Suggested time:  20 minutes  Resources:  Slides 11–14 | This activity is designed to encourage students to start evaluating the full risk assessment writing process. You can use this study question to check student progress. This could also be set as homework to complete/finish.  Use whole class or small group discussions to ask students to recall the HSE’s Five Steps to Risk Assessment.  Ask students to read the study question on slide 11. Then ask them to use the Five Steps to identify the sections or aspects of the process in the question which fulfils each step.  Students should then individually write an answer to the study question.  An example answer is given on slide 12 and can be used to check students’ exam answer writing skills. Highlight the command word ‘evaluate’ and remind students that this means they need to give both a pro and a con, as well as a conclusion, in their answer to gain the full three marks. This answer gives just one example of a pro and a con; there will be others not given that students can gain marks for.  If there is time, students could be asked to suggest improvements to their answers, or to add missing/further steps that would be necessary to gain full marks. for example:   * + consulting with all members of staff who will be working with or could be affected by the hazard to gain a full understanding of the hazards and risks   + writing a full risk assessment rather than just creating bullet points, including the control measures they could implement   + circulating the risk assessment to all members of staff who might be affected   + reviewing the risk assessment periodically and making improvements where necessary.   Summarise the lesson using slide 13 and introduce what will be covered in the next lesson using slide 14. |
| Follow-up / consolidation  Suggested time:  30 minutes  Resources:  L2 A2 and Consolidation Risk Assessment Template | Ask students to practise some of the skills from this lesson. They should write a short general risk assessment for the use, storage and disposal of sodium azide when used to inhibit bacteria growth in laboratories. You should either supply your students with the appropriate Student Safety Sheets or SDS for sodium azide or ask them to find an appropriate SDS online. A blank risk assessment template is provided.  An alternative proforma risk assessment can be found here: <https://www.ncfe.org.uk/media/xeyo35n4/sci-gsem-01-tq-science-osa-laboratory-sciences-assignment-1-distinction-guide-standard-exemplification-materials.pdf>  Students bring their written risk assessments to a future lesson and peer review each other’s work a. They should then have an opportunity to implement the feedback and make the suggested amendments to their own risk assessment. |

# Lesson 3: Biohazards and their categorisation (A4.5, A4.6, A4.7)

This lesson introduces students to categorisation of biohazards into four Hazard Groups and to some examples of biohazards in each group. Students will practise categorising biohazards by considering their infectability, the seriousness of the hazard, and the availability effective treatment and/ or vaccines.

This lesson is designed to be taught in a pair with Lesson 4 . This unit should be studied before students begin their industry placement.

## Preparation

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| Resources provided | L3 Slide Deck  L3 A1 Worksheet 1  L3 A2 Worksheet 2  L3 A2 Worksheet 2 Teacher Notes and Answers  L3 Plenary Worksheet 3  L3 Plenary Worksheet 3 Answers |
| Equipment needed | None |
| Safety factors | Teachers and students are required to carry out their own risk assessments. |
| CLEAPPS references | None |
| Prior learning | It would be useful for students to be familiar with the Control of Substances Hazardous to Health (COSHH) Regulations 1994, as this is referenced regularly. This lesson looks at the application of COSHH to biohazards and their control in workplaces.  These are discussed as part of **A3.1**, therefore you may choose to cover that section first, before teaching these lessons, or alternatively build up students’ knowledge of legislation and regulation throughout their course.  There is some overlap in this lesson with **A10.8** How to follow aseptic techniques: it may be useful to link back to this topic when teaching **A10.8** or alternatively you may wish to integrate teaching of these topics.  Ensure that students are familiar with the following key terminology before starting this lesson:   * + pathogen   + bacteria   + virus   + infection   + culture   + microorganism.   Ensure that students are familiar with some common infectious agents to use in discussion, such as:   * + HIV   + mumps virus   + measles virus   + Sars-Cov-2   + E. coli. |
| Common misconceptions | There is often confusion over the meaning of key terms that are used in common everyday contexts, such as:   * + decontaminate   + disinfect   + biohazard   + environment.   Students may not distinguish between ‘sterilise’ and ‘disinfect’.  Students may need support to clarify the meaning of the following terms, and the differences between them:   * + disease   + pathogen   + microorganism   + vector. |
| Accessibility | Seek to ensure wide representation for any visiting speakers and case studies used.  Some students may have more knowledge than others about the names, vaccines and consequences associated with some lesser known but still common biohazards, such as the infectious agents causing measles or mumps. Check that students are confident about these biohazards (their infectability, vaccine/treatment availability, etc.) whilst discussing and categorising them. Ensure that students can distinguish between the biohazard (infectious agent) and the disease (impaired or adverse function/structure due to infection).  There may also be some discussion about vaccines and their efficacy or safety by students. Care needs to be taken when managing discussions to allow students to raise questions. |

## Activity guide

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| Introduction  SUGGESTED TIME:  15 minutes  RESOURCES:  Slides 2–4 | The learning outcomes for this lesson are provided on slide 2.  Show students the image of a biohazard symbol on slide 3. Ask them what it represents. The answer is on slide 4. You could also ask them ‘where have you seen this symbol before?’ or ‘what does it relate to?’ There could be some confusion over the radioactive substance symbol, hence this symbol is also shown on slide 4 and students can see the difference.  If possible, show students the opening scene from the 1995 Warner Bros film 'Outbreak' (roughly the first 3 minutes). This can be found on media sharing platforms - please check your provider's terms and conditions for the use of third party materials. The opening scene tours through some different biohazard laboratory levels.  Beforehand ask students how accurate they think the information in the film will be. This can be revisited later in this lesson or at the end of  Lesson 4.  Ask students to identify and make notes of any safety and control measures they see as they watch the video, then share what they observed about the biohazard laboratory levels. Discuss why different biohazard levels are needed. |
| Activity 1: Introduction to biohazard control measures  Suggested time:  10 minutes  Resources:  Slide 5  L3 A1 Worksheet 1 | Show students slide 5 and give them L3 A1 Worksheet 1. Ask students to complete Worksheet 1 while watching the video on the slide. This video from Microbiology Mantra can be found on YouTube: <https://www.youtube.com/watch?v=xNYASNEdgg8&t=87s>  They should make brief notes about the differences between the four containment levels (CLs) discussed. Note that this video is quite fast, so some students may find it hard to write and listen. They can be encouraged just to listen and make notes/share their findings afterwards, or the video could be paused after each CL to allow students time to make notes.  After watching the video, ask students to THINK, PAIR, SHARE the question on the slide. They should suggest why different CLs are needed and how we determine which CL is required for a specific laboratory — to ensure that biohazards are handled safely and without putting workers, communities or the environment at risk, but without wasting unnecessary business resources and money.  Introduce the idea of the four Hazard Groups which link to the four CLs. |
| Activity 2: Researching biohazards and their categorisation  Suggested time:  40 minutes  Resources:  Slide 6–12  L3 A2 Worksheet 2  L3 A2 Teacher Notes and Answers | This activity asks students to independently research biohazards, how they are categorised and why, and some examples of biohazards that fit into each category. Show students slide 6 and L3 A2 Worksheet 2, Researching biohazards and their categorisation. They will use the internet, textbooks and fact books to complete the research.  They should make notes, create a mind map or fill in a table with their findings, allowing them to create some notes to be used for revision later on. The worksheet gives more details about what should be included in their notes. Note that students may also come across information on the containment measures (and CLs) necessary for each hazard group, but this is not the point of the task. This task looks at how to categorise biohazards, while containment measures are covered in more detail in Lesson 4.  In completing their research, students may also choose to touch on the implications of not adhering to COSHH regulations if this follows logically in their research.  Students sometimes need guidance to complete quality research, especially when using the internet. Therefore, they may need some support/reminders about how to find and evaluate the usefulness, reliability or applicability of online sources. Here are few websites you may choose to direct them to, if needed:  COSHH regulations, which gives definitions and descriptions of hazard groups and containment levels: <https://www.legislation.gov.uk/uksi/2002/2677/schedule/3/made>  Tecomak Environmental Services’ description of the four containment levels: <https://www.tecomak.com/containment-laboratories-the-four-classes-explained/>   * The HSE’s ‘The Approved List of biological agents’: <https://www.hse.gov.uk/pubns/misc208.pdf> * Safety Culture’s ‘Understanding the Types of Biological Hazards’: <https://safetyculture.com/topics/workplace-hazards/types-of-biological-hazards/> * The Health and Safety Executive’s guide on Control of Substances Hazardous to Health: <https://www.hse.gov.uk/pubns/priced/l5.pdf>   After completing their notes, ask students to reflect on the categories used in ‘Outbreak’ video clip and how accurate this was. Alternatively, this can be used as a consolidation activity at the end of Lesson 4.  Ask students to look at slide 7. Students should use their notes to determine which Hazard Group each of the biohazards on slide 7 belongs to (also Worksheet 2, Matching biohazards to Hazard Groups). Ask students to explain why the biohazards belong in each group using the information that has been provided which includes additional examples. The answers are shown on slide 8. All students should update their notes based on these discussions.  There are questions on slide 9 and Worksheet 2 that students can complete if they have time. These questions will help them to solidify learning, ensure they have full and useful notes, and to check they are confident in use of key terms. Alternatively, this could be set as homework or as an Introduction task for a later lesson. The answers are supplied on slides 10, 11 and 12.  L3 A2 Worksheet 2 Teachers Notes and Answers contains a summary of the information students are looking for in the research task and the answers to the other tasks on the worksheet. |
| Activity 3: Adhering to COSHH regulations  Suggested time:  15 minutes  Resources:  Slide 13 | This activity encourages students to consider the implications of not adhering to the COSHH regulations. It might be necessary to remind students of what COSHH is and where it is applicable: the Control Of Substances Hazardous to Health regulations (1994 and 2002 amendments) are used in workplaces to minimise the risks associated with working alongside substances that are hazardous to health.  Show students slide 13 and ask them to carry out the THINK, PAIR, SHARE. Students should think independently for a few minutes about the answers to the discussion prompts on the slide. Then ask them to discuss their thoughts with their partners or in small groups. Lastly, ask students to share their thoughts as a whole class.  In the whole class discussion, elicit some of these points. The expectation is for all students to have useful responses to the questions on the slide.   * + **Risks to employees’ health:** The short-term effects of infection, such as the short-term symptoms, but also possibly long-term effects of infection or death.   + **Risks to the wider population:** Disease may spread in communities, especially when a community is unaware or unprepared.   + **Risks to the environment:** Biohazards released into the environment (e.g. through effluent) could affect vegetation and could get into water supplies then affecting plants and animals further afield. They could also affect soil fertility, and therefore crop growth and harvests. |
| Plenary: Categorising biohazards  Suggested time:  10 minutes  Resources:  Slides 14–15  L3 Plenary Worksheet 3  L3 Plenary Worksheet 3 Answers | This activity is designed to give students a chance to establish the differences between the four Hazard Groups, especially the infectability, seriousness of the hazard, and availability of vaccines or effective treatment.  Show students slide 14 and then project the worksheet onto the board or hand out the sheet to groups of students to view. Carry out a whole class discussion and sort the statements into groups for Hazard Groups 1–4. Students write the correct Hazard Group number into each box. They should then summarise the information about each Hazard Group on the worksheet. Note that there are intentionally two copies of the statement “There are usually effective vaccines or treatments available”, as it is relevant to both Hazard Group 2 and 3.  L3 Plenary Worksheet 3 Answers shows the statements and examples sorted into the four Hazard Groups.  Summarise the lesson using slide 15 and introduce what will be covered in the next lesson using slide 16. |
| Follow-up / consolidation  Suggested time:  30 minutes  Resources:  None | Students create a decision tree to determine the Hazard Group for a biohazard. This should help them understand the differences between each group. This should include an example from each group. |

# Lesson 4: Biohazards and their containment (A4.8)

This lesson further develops ideas and concepts introduced in Lesson 3, including the safe handling and control measures necessary to keep people safe when they are working with hazardous substances.

This lesson should be taught in sequence after Lesson 3.

## Preparation

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| Resources provided | L4 Slide Deck  L4 A2 Teacher Notes |
| Equipment needed | Four sheets of flip-chart paper (labelled ‘CL-1’, ‘CL-2’, ‘CL-3’ and ‘CL-4’) – If you have a large class, it may be better to double up and use two sheets per CL (contamination level).  Coloured marker pens |
| Safety factors | Teachers and students are required to carry out their own risk assessments. |
| CLEAPPS references | None |
| Prior learning | It would be useful for students to be familiar with the Control of Substances Hazardous to Health (COSHH) Regulations 1994, as this is referenced regularly. This lesson looks at the application of COSHH to biohazards and their control in workplaces.  These are discussed as part of **A3.1**, therefore you may choose to cover that section first, before teaching these lessons, or alternatively build up students’ knowledge of legislation and regulation throughout their course.  There is some overlap in this lesson with **A10.8** How to follow aseptic techniques: it may be useful to link back to this topic when teaching **A10.8** or alternatively you may wish to integrate teaching of these topics.  Ensure that students are familiar with the following key terminology before starting this lesson:   * + pathogen   + bacteria   + virus   + infection   + culture   + microorganism.   Ensure that students are familiar with some common infectious agents to use in discussion, such as:   * + HIV   + mumps virus   + measles virus   + Sars-Cov-2   + E. coli. |
| Common misconceptions | There is often confusion over the meaning of key terms that are used in common everyday contexts, such as:   * + decontaminate   + disinfect   + biohazard   + environment.   Students may not distinguish e between ‘sterilise’ and ‘disinfect’.  Students may need support to clarify the meaning of the following terms, and the differences between them:   * + disease   + pathogen   + microorganism   + vector. |
| Accessibility | Seek to ensure wide representation for any visiting speakers and case studies used. |

## Activity guide

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| Introduction  SUGGESTED TIME:  10 minutes  RESOURCES:  Slides 2–3 | The learning outcomes for this lesson are provided on slide 2.  Show students the scenario on slide 3. As a class, ask them to THINK, PAIR, SHARE to determine whether switching from working with common cold cell cultures to working with HIV samples is likely to be a straightforward switch for the laboratory.  Ask students to propose questions that they could reflect on to support themselves in answering this question. Some question prompts might be:  To which Hazard Groups do these biohazards belong?  How likely are the biohazards to spread?  Are there high mortality rates?  Are these biohazards in different Hazard Groups?  Are there any vaccines/effective treatments available?  What containment measures are likely to currently be in place at the laboratory?  Would these biohazards need to be handled differently?  Would the containment measures at the laboratory therefore need to change to handle HIV samples rather than common cold cell cultures? |
| Activity 1: Containment measures  Suggested time:  35 minutes  Resources:  Slides 4–7  Students’ completed copies of L3 A2 Worksheet 2 | This activity is designed to give students the opportunity to explore the containment measures required for biohazards in each of the four Hazard Groups. There are two suggested approaches, dependent on the availability of a live video chat or visit from someone working in the science industry (Option 1). Option 2 can be used as an alternative, or for additional material.  In both options, students should expand their notes/mind map/table from L3 A2 Worksheet 2.  **Option 1:** A live video chat or visit with a person working with biohazards in the science industry to discuss questions prepared by students in advance (slide 4). If possible this could include a virtual tour around the scientist’s laboratory space.  If a live video chat or visit is not possible, then a pre-recorded video where the questions are answered would still be useful here.  Ask students to research and prepare questions to ask the scientist about biohazards and their containment, covering the four Hazard Groups. This will ensure that students gain the insight they are looking for when the scientist answers their questions. This could have been set as prior homework. Slides 5–6 contain some suggestions for questions to ask, if needed.  **Option 2:** Use slides 9–17 of Activity 2 to learn about the four CLs.  Show students slide 7 and explain that they are going to read through slides 9–17 of Activity 2. Students could look at one CL at a time and after each slide, give students the chance to improve their notes on the different protocols (Students’ completed copies of L3 A2 Worksheet 2). Note: information on Hazard Groups 1–4 is also given on the slide before the relevant CLs to support students with adding context and linking and sequencing the content. Students should add notes on the containment measures and control measures that are necessary for the different CLs.  There will be an opportunity for students to share notes and improve their summaries of the four CLs as a class in Activity 3. |
| Activity 2: Comparing containment measures  Suggested time:  30 minutes  Resources:  Slides 8–17  L4 A2 Teacher Notes | Following on from Activity 1, particularly if you have used a mixture of Options 1 and 2, this activity provides an opportunity to ensure the whole class has a good set of notes on the details of the protocols and containment measures for CLs 1–4, by practicing, recalling and sharing the information and ideas introduced and discussed during Activity 1.  Set up around the classroom four sheets of flip-chart paper (labelled ‘CL-1’, ‘CL-2’, ‘CL-3’ and ‘CL-4’) – If you have a large class, it may be better to double up and use two sheets per CL to ensure students can engage fully with the activity. Divide the class into four (or eight) groups and station each group with flip chart paper and coloured marker pens.  Show slide 8 to students and explain the task: each group has three minutes to write down as much information as they can about their given CL on the flip chart paper in front of them, before they rotate to the next CL.  When the three minutes is up, the groups should rotate to a CL they have not covered, read through the information already on the sheet and add any notes they can. This could be repeated with the groups rotating through the four CLs until you feel there is enough information on each sheet of flip chart paper.  Student groups can be given more structure by being directed to think specifically about each ‘Think about’ prompt on slide 8 for specific periods of time to ensure all points get covered in the notes. Students could also be allowed to take their notes around with them to help, or if appropriate, take more autonomy about what they make notes on.  Here are some example responses to the ‘Think about’ prompts on slide 8, to help students recall key points   * + **Levels of personal protective equipment (PPE)** e.g. For CL-1, work clothing is fine, lab coats go on over the top. For CL-4, full PPE is required, and a change of clothes and a shower before leaving.   + **Laboratory location within building and access and entry control measures** e.g. For CL-2–4, a separate facility is needed. For CL-4, air-lock key procedures are needed to enter and leave.   + **Required laboratory facilities and capabilities** e.g., For CL-1, handwashing facilities. For CL-2–4, negative air flow. For CL-3 and 4, HEPA filters and showers, and complete sealing of all pipes and vents to allow for fumigation, etc.   + **Specific waste removal and disposal capabilities** e.g. For CL-1, a sharps bin. For CL-3 and 4, infectious material to be autoclaved before being incinerated. For CL-4, an incinerator is required on site.   As additional support, or to check answers after the activity, slides 9–17 show summaries of the four Hazard Groups and summaries of the containment measures required in CLs 1–4, which may support students with thinking about the necessary control and containment measures. Students should be given time to check that their revision notes contain information that covers the ‘Think about’ prompts from slide 8. (L4A2Teacher Notes repeats the summaries along with some additional detail about the containment levels).  By the end of this activity, students should have full and detailed notes on the different hazard groups, and the protocols and containment measures for CLs 1–4, which they can use for their revision.  Note: This activity also links to A4.10 and if there is time, you may wish to discuss with students positive/negative pressure rooms and the different specific extraction techniques. However, this is not explicitly covered in this lesson. |
| Plenary: Study question  Suggested time:  15 minutes  Resources:  Slides 18–20 | This activity is designed to allow students to apply their knowledge to a new context. It also allows students to practise assessing information given in a specific situation. You could use this study question to check student progress, and it could also be set as homework to complete/finish.  Students should be shown the study question on slide 18, which they should answer independently. Then they should then peer review their partner’s work using the example answer (mark scheme) on slide 19 and provide feedback to their peers on how to improve their answer.  Each student should have provided a response to the study question, have received some feedback from a peer detailing the mark they feel the answer would have gained and had some feedback on how they could have achieved full marks.  Students should think back to the Introduction activity to propose questions they could answer first to help them create an answer for this study question. Some question prompts could be:   * + What Hazard Group do these biohazards belong to, and therefore what containment measures are likely to currently be in place?   + What additional measures are necessary?   As well as those given in the example answer, the following are further suggestions for creditable content:   * + For a containment level 3 biohazard (HIV) there must be a negative air flow within the laboratory **[1 mark]** to ensure no transmission of aerosols from inside the lab **[1 mark]**.   + There must be no air flow out of the laboratory that is not HEPA filtered **[1 mark]** to ensure there is no transmission of air-borne pathogens or harmful substances **[1 mark]**.   + There could be a shower in the anti-chamber **[1 mark]** to allow workers to shower and change before leaving, reducing the risk of transmission of the hazardous substances out of the laboratory **[1 mark]**.   + Restricted access to the laboratory is required for containment level 3 **[1 mark]** in order to ensure that only authorised staff with correct safety procedures have access to the lab **[1 mark]**.   + The door to the working area must have an observation window in it **[1 mark]** to ensure that workers can be checked on easily in case of incidents, without the need to enter the laboratory **[1 mark]**.   + The workplace should be completely sealable **[1 mark]** to allow for complete disinfection or fumigation in the case of an outbreak or spillage within the laboratory **[1 mark]**.   Summarise the lesson using slide 20. |
| Follow-up / consolidation  Suggested time:  30 minutes  Resources:  Slide 4 from L3 Slide Deck | Students could re-watch the opening scene to the 1995 Warner Bros film 'Outbreak' (see Lesson 3 introduction).  Ask students to make short notes about the discrepancies, missing control measures or outdated practices that they notice being performed in the video. They should suggest improvements and any additional control measures necessary for each of the four CLs to bring the standard of health and safety in the video up-to-scratch. |

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| Teacher Guide page 2,  Lesson 1 Slide 5, 6, 7, 16, 17.  Lesson 2 Introduction worksheet, Slide 3, 4, 5, 6, 7, 8.  Lesson 3 Slide 4 | <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>  (HSE case study 2, 3 and 4)  (HSE Five Steps to Risk Assessment)  (Hazard symbols - various)  (Radioactive symbol) | National Archives | April 2024 |
| Teacher Guide page 5 | [support.tlevels.gov.uk/hc/en-gb/articles/360015345420-Industry-placement-logbook-for-students](http://support.tlevels.gov.uk/hc/en-gb/articles/360015345420-Industry-placement-logbook-for-students) | GOV UK | April 2024 |
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| Teacher Guide page 6 | <https://sciencecouncil.org/professional-bodies/> | The Science Council | April 2024 |
| Teacher Guide page 14  Lesson 1 Slide 4, 6, 7. | <https://www.hse.gov.uk/coshh/casestudies/index.htm>  (HSE case study 1, 3 and 4) | HSE | April 2024 |
| Teacher Guide page 15 and 23  Lesson 1 Slide 12, 13 and 15 | <https://www.ncfe.org.uk/media/xeyo35n4/sci-gsem-01-tq-science-osa-laboratory-sciences-assignment-1-distinction-guide-standard-exemplification-materials.pdf>  (Risk Assessment, Risk Matrix) | NCFE International | April 2024 |
| Teacher Guide page 15 | <https://www.hse.gov.uk/simple-health-safety/risk/risk-assessment-template-and-examples.htm> | HSE | April 2024 |
| Teacher Guide page 15 | <https://www.ucl.ac.uk/safety-services> | UCL | April 2024 |
| Teacher Guide page 16 | <http://www.hse.gov.uk/simple-health-safety/risk/index.htm> | HSE | April 2024 |
| Teacher Guide page 21  Lesson 2 Slide 10 | <https://science.cleapss.org.uk/Resources/Student-Safety-Sheets/> | CLEAPSS | April 2024 |
| Teacher Guide page 26  Lesson 3 Slide 5 | <https://www.youtube.com/watch?v=xNYASNEdgg8&t=87s> (with permission) | Microbiology Mantra/YouTube | April 2024 |
| Teacher Guide page 27 | <https://www.hse.gov.uk/pubns/misc208.pdf> | HSE | April 2024 |
| Teacher Guide page 27 | <https://safetyculture.com/topics/workplace-hazards/types-of-biological-hazards/> | Safety Culture | April 2024 |
| Teacher Guide page 27 | <https://www.legislation.gov.uk/uksi/2002/2677/schedule/3/made> | Legislation GOV UK | April 2024 |
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| Lesson 1 Slide 5 | <https://www.hsmsearch.com/Food-manufacturer-fined-after-two-workers-injured> | HSM Search | April 2024 |
| Lesson 1 Slide 17 | <https://www.youtube.com/watch?v=xyANahuhGs0.> | HSE/YouTube | April 2024 |
| Lesson 1 Slide 20, 21. | <https://www.ncfe.org.uk/media/votpjuvh/sci-0007-01-tq-science-osa-laboratory-sciences-assignment-1-assignment-brief.pdf> | NCFE International | April 2024 |
| Lesson 3 Slide 3,4. | <https://www.legislation.gov.uk/> | Legislation GOV UK | April 2024 |

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