

Scheme of work - Unit 6a: Microbiology

The following scheme of work offers a route through the Applied General Science Unit 6A Microbiology, covering all the sections in a logical order. The order is by no means prescriptive and there are many alternative ways in which the content could be organised.

Assumed coverage

This scheme of work is a plan of what will be covered in each week or session of the learning programme or course. It will detail over 30 weeks the delivery of the applied science course content for the examination. The scheme of work will also give resources and ideas for practical work that can illustrate the written content.

PO1 Identify the main group of microorganisms in terms of their structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Specification Content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO1:**  Identify the main groups of microorganisms in terms of their structure and function | P1:  Describe akaryotes, in terms of their characteristic features (ultrastructure)  M1:  Relate the characteristic features of akaryotes, to their function | Posters/tables/ leaflets/PowerPoint/  Word documents  Written communication skills for notes and comparison tables.  Research and problem solving. | 1 | Tutor led presentation/discussion on the ultrastructure of viruses and how their features enable them to function.  Learners carry out independent research using the internet and electron micrographs.  Learners will use their knowledge and understanding to generate suitable portfolio evidence and will be stretched and challenged by the complexity of their response.  [Difference between Bacteria, Virus and Fungi](http://www.differencebetween.info/difference-between-bacteria-virus-and-fungi). |
| **PO1:**  Identify the main groups of microorganisms in terms of their structure and function | P1:  Describe prokaryotes and eukaryotes, in terms of their characteristic features (ultrastructure)  M1:  Relate the characteristic features of prokaryotes and eukaryotes, to their function | Posters/tables/ leaflets/PowerPoint/  Word documents  Written communication skills for notes and comparison tables.  Research and problem solving | 2 | Tutor led presentation/discussion on the ultrastructure of bacteria and fungi how their features enable them to function.  Learners carry out independent research using the internet and electron micrographs.  Learners will use their knowledge and understanding to generate suitable portfolio evidence and will be stretched and challenged by the complexity of their response.  [Difference between Bacteria, Virus and Fungi](http://www.differencebetween.info/difference-between-bacteria-virus-and-fungi/). |
| **PO1:**  Identify the main groups of microorganisms in terms of their structure and function | P2:  Describe techniques used to identify microorganisms  M2:  Explain how techniques used to identify microorganisms relate to the structure of the microorganisms | Posters/tables/ leaflets/PowerPoint/  Word documents/ discussion notes.  Written communication skills for notes and comparison tables.  Research and problem solving. | 3 | Tutor led workshop demonstration/presentation/discussion on the identification of microorganisms through:   * Microscopic investigation * Colony characteristic identification * Gram staining   Learners work in small groups to discuss how the structure of microorganisms determine the identification methods used. This is broadened into a whole group discussion and learners will use their knowledge and understanding to generate suitable portfolio evidence and will be stretched and challenged by the complexity of their response.  Microbiology Online:  [Observing Fungi in a Petri Dish](http://www.microbiologyonline.org.uk/teachers/observing-microbes/observing-fungi-in-a-petri-dish/)  [Microbiology Online](http://www.microbiologyonline.org.uk/teachers/observing-microbes/observing-fungi-in-a-petri-dish/)  Home🡪Teachers🡪Resources. Download Basic Practical Microbiology: A Manual  Gram’s stain p2 |
| **PO1:**  Identify the main groups of microorganisms in terms of their structure and function | P3:  Use Gram staining techniques to identify microorganisms  M2:  Explain how techniques used to identify microorganisms relate to the structure of the microorganisms | Tutor observation of practical techniques.  Tutor observation of risk assessments.  Written reports/witness testimonies.  Oral communication during discussion.  Practical skills and health and safety | 4 | Tutor led discussion on the use and principles of Gram staining.  Learners to fill out appropriate risk assessment.  Learners to practise technique and Gram stain a suitable mixed culture of bacteria.  Learners evidence their work.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used.  [Microbiology Online](http://www.microbiologyonline.org.uk/)  Home🡪Teachers🡪Resources. Download Basic Practical Microbiology: A Manual  Gram’s stain p24  Science Buddies  [Interpreting Plates](https://www.sciencebuddies.org/science-fair-projects/project_ideas/MicroBio_Interpreting_Plates.shtml) |
| **PO1:**  Identify the main groups of microorganisms in terms of their structure and function | D1:  Compare the use of different identification techniques in biotechnological industries | Q & A on industrial techniques  Completion of comparison tables/  SWOT analysis  Oral communication during discussion/visit.  Written communication and spelling during evidence completion.  Research | 5 | Learners observe different industrial identification techniques through website videos/ industrial visits.  Tutor led discussion.  Learners evidence their work. |
| **PO1:**  Identify the main groups of microorganisms in terms of their structure and function | P1:  Describe akayotes, prokaryotes and eukaryotes, in terms of their characteristic features (ultrastructure)  M1:  Relate the characteristic features of akayotes, prokaryotes and eukaryotes, to their function  P2:  Describe techniques used to identify microorganisms  M2:  Explain how techniques used to identify microorganisms relate to the structure of the microorganisms  P3:  Use Gram staining techniques to identify microorganisms | Written work  **(P1, P2, M1, M2, D1)**  Spelling, grammar and scientific nomenclature for evidence completion  Research skills | 6 | Learner led workshop session to complete written work for PO1.  Working independently to produce accurate work.  Work handed in on time. |
|  | D1:  Compare the use of different identification techniques in biotechnological industries |  |  |  |

PO2 Use aseptic techniques to safely cultivate microorganisms

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Specification Content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| PO2:  Use aseptic techniques to safely cultivate microorganisms | P4:  Prepare risk assessments for the safe cultivation of microorganisms  M3:  Explain the control measures taken to ensure the safe cultivation of microorganisms | Tutor observation of practical techniques. Tutor observation of risk assessments.  Oral communication during discussion.  Practical skills and health and safety | 7 | Tutor led discussion on risk assessments.  Tutor demonstration of  Learners to fill out appropriate risk assessments.  Tutor demonstration of   * Mycelial disks * Viral plaque counts   Learners to practise techniques (using simulation techniques and water to model the process).  [Microbiology online education resources](http://www.microbiologysociety.org/educationresources)  Home🡪Publications🡪 Education Resources  Viruses :A practical resource for post-16 resource for biology teachers  [Microbiology Online](http://www.microbiologyonline.org.uk/)  Home🡪Teachers🡪Resources. Download Basic Practical Microbiology: A Manual  Safety and Risk pp 1-6  Manchester Metropolitan University MMU in the Loop Microbiology Services  [An Introduction to Practical Biology](http://www.hsri.mmu.ac.uk/microbiology/education_and_communication/resources/video.asp): a downloadable PDF and video resources |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms. | P4:  Prepare risk assessments for the safe cultivation of microorganisms  M3:  Explain the control measures taken to ensure the safe cultivation of microorganisms | Tutor observation of practical techniques. Tutor observation of risk assessments.  Oral communication during discussion.  Practical skills and health and safety | 8 | Tutor led discussion on risk assessments.  Learners to fill out appropriate risk assessments.   * Lawn plate * Streak plate * Pour plate   Learners to practise techniques (using simulation techniques and water to model the process). |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques.  M4:  Explain the principles underlying the cultivation techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments.  Oral and written communication.  Practical skills and health and safety | 9 | Tutor led demonstration of how to cultivate yeast using the pour plate method and a mould using mycelial disks. Learners to fill out appropriate risk assessment. Learners carry out both techniques using aseptic equipment and yeast culture. Plates are incubated for next session.  Tutor led discussion on the underlying principles involved.  [Microbiology Online](http://www.microbiologyonline.org.uk/)  Home🡪Teachers🡪Resources. Download Basic Practical Microbiology: A Manual  Pour plate p 12 |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques  M4:  Explain the principles underlying the cultivation techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments. Additional portfolio evidence.  Oral and written communication.  Portfolio evidence.  Practical skills and health and safety | 10 | Learners review the results of the pour plate and mycelial disk techniques individually and as a group. Learners repeat pour plate technique if necessary. Learners ensure evidence for P5 and M4 is covered as appropriate.  MMU In the Loop Microbiology Service.  [Introduction to microbiology](http://www.hsri.mmu.ac.uk/microbiology/education_and_communication/resources/downloads.asp)  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used. |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques  M4:  Explain the principles underlying the cultivation techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments.  Oral and written communication.  Practical skills and health and safety | 11 | Tutor led demonstration of how to cultivate bacteria using the lawn plate method and viruses using the viral plaque method. Learners to fill out appropriate risk assessment. Learners carry out both techniques using aseptic equipment and bacterial and viral cultures. Plates are incubated for next session.  Tutor led discussion on the underlying principles involved.  [Microbiology Online](http://www.microbiologyonline.org.uk/)  Home🡪Teachers🡪Resources. Download Basic Practical Microbiology: A Manual  Spread/Lawn plate p 14 |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques.  M4:  Explain the principles underlying the cultivation techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments. Additional portfolio evidence.  Oral and written communication.  Portfolio evidence.  Practical skills and health and safety | 12 | Learners review the results of the lawn plate and viral plaque techniques individually and as a group. Learners repeat techniques if necessary. Learners ensure evidence for P5 and M4 is covered as appropriate.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used. |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques  M4:  Explain the principles underlying the cultivation techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments.  Oral and written communication.  Practical skills and health and safety | 13 | Tutor led demonstration of how to cultivate bacteria using the streak plate method. Learners to fill out appropriate risk assessment. Learners carry out streak plate technique using aseptic equipment and bacteria culture. Plates are incubated for next session.  Tutor led discussion on the underlying principles involved.  [Microbiology Online](http://www.microbiologyonline.org.uk/)  Home🡪Teachers🡪Resources. Download Basic Practical Microbiology: A Manual  Streak plate p 11 |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques  M4:  Explain the principles underlying the cultivation techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments. Additional portfolio evidence.  Oral and written communication.  Portfolio evidence.  Practical skills and health and safety | 14 | Learners review the results of the streak plate technique individually and as a group. Learners repeat technique if necessary. Learners ensure evidence for P5 and M4 is covered as appropriate.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used. |
| **PO2:**  Use aseptic techniques to safely cultivate microorganisms | P4:  Prepare risk assessments for the safe cultivation of microorganisms  P5:  Use aseptic techniques to cultivate microorganisms using three different cultivation techniques  M3:  Explain the control measures taken to ensure the safe cultivation of microorganisms  M4:  Explain the principles underlying the cultivation techniques used  D2:  Evaluate the effectiveness of the aseptic and cultivation techniques used and make justified suggestions for improvement | Tutor observation of practical techniques. Tutor observation of risk assessments. Additional portfolio evidence.  Oral and written communication.  Portfolio evidence.  Practical skills and health and safety | 15 | Tutor led discussion on the effectiveness of aseptic and cultivation techniques using the learners practical experience. Learners work individually and make notes on ways to improve the processes and justify improvements.  Learner led workshop session to complete written work for PO2 ensuring three of the five techniques are evidenced in the portfolio..  Working independently to produce accurate work.  Work handed in on time.  [Thermo Fisher Scientific :Aseptic Technique](https://www.thermofisher.com/ca/en/home/references/gibco-cell-culture-basics/aseptic-technique.html/) |

**PO3 Use practical techniques to investigate factors that affect the growth of Microorganisms**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Specification Content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | P6:  Describe a range of factors that affect the growth of microorganisms | Discussion of research findings  Notes made during research and portfolio evidence.  Calculations and equations  Oral communication during discussion.  Written communication  Research | 16 | Learner led research into the factors affecting the growth rate of microorganisms.  Class comes together to pool their findings under the guidance of the tutor.  [Bacterial Growth Factors-SlideShare](http://www.slideshare.net/scuffruff/bacterial-growth-factors/)  [Factors Affecting Microbial Growth:](http://www.authorstream.com/Presentation/blamedinnosence-154698-factors-affecting-microbial-growth-science-technology-ppt-powerpoint/) authorrSTREAM  Home🡪Teachers🡪Resources. Download  Antibiotic Resistance  Tutor led presentation/ discussion on ways of counting/measuring microbial growth to include:   * Viable colony counts * Haemocytometer total counts * Indirect colorimeter count * Serial dilution * Clear zone measurement |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | P7:  Use **one** suitable technique to count/measure microorganism  P8:  Use serial dilution techniques in one practical activity  M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count | Tutor observation of practical techniques. Tutor observation of risk assessments.  Oral and written communication.  Practical skills and health and safety | 17 | Tutor led demonstration of how to carry out a serial dilution and count yeast using a haemocytometer. Learners to fill out appropriate risk assessment. Learners to practise the techniques using aseptic equipment and yeast culture.  Learners select a suitable growth factor and culture yeast for the next session.  [Serial dilution in Microbiology: Calculation, Method & Technique](http://study.com/academy/lesson/serial-dilution-in-microbiology-calculation-method-technique.html)  [Hemocytometer - where to start](http://www.hemocytometer.org/) |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | P7:  Use **one** suitable technique to count/measure microorganism  P8:  Use serial dilution techniques in one practical activity  M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count  D3:  Draw conclusions about how the three factors affect the growth of microorganisms  D4:  Evaluate the effectiveness of the measuring and counting techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments. Additional portfolio evidence.  Oral and written communication.  Portfolio evidence.  Calculations and equations  Practical skills and health and safety | 18 | Learners carry out serial dilution and haemocytometer count individually/ as a group as appropriate using aseptic techniques and yeast culture.  Tutor demonstrates how to calculate the number of yeast in the original sample.  Tutor led discussion on how :   * the technique is used * the factor chosen affects the growth of the yeast * effective the counting/measuring technique is.   Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used.  Learners ensure evidence for P7and/or P8, M5, M6, D3and D4 is covered as appropriate. |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | P7:  Use **one** suitable technique to count/measure microorganisms  P8:  Use serial dilution techniques in one practical activity  M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count  M7:  Perform calculations to identify numbers of microorganisms in the original sample | Tutor observation of practical techniques. Tutor observation of risk assessments.  Additional portfolio evidence  Oral and written communication.  Calculations and equations  Practical skills and health and safety | 19 | Tutor led demonstration/review of how to carry out a lawn plate and count the bacteria that grow. Learners to review appropriate risk assessment. Learners may select serial dilution for this activity.  Learners select a suitable growth factor and carry out technique using aseptic equipment and bacterial culture for M5 evidence. Learners ensure evidence for P7and/or P8 (as appropriate), M5, M6 and M7 is covered as appropriate.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used. |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | P7:  Use **one** suitable technique to count/measure microorganism  P8:  Use serial dilution techniques in one practical activity  M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count  M7:  Perform calculations to identify numbers of microorganisms in the original sample  D3:  Draw conclusions about how the three factors affect the growth of microorganisms  D4:  Evaluate the effectiveness of the measuring and counting techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments.  Additional portfolio evidence.  Oral and written communication.  Calculations and equations  Practical skills and health and safety | 20 | Learners review the results of the lawn plate technique individually and as a group. Learners carry out a viable count of the lawn plates.  Tutor led discussion on how   * the technique is used * the factor chosen affects the growth of the bacteria * effective the counting/measuring technique is.   Learners ensure evidence for P7and/or P8, (as appropriate) and M5, M6, M7, D3, and D4 is covered as appropriate. |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count | Tutor observation of practical techniques. Tutor observation of risk assessments.  Additional portfolio evidence.  Oral and written communication.  Calculations and equations  Practical skills and health and safety | 21 | Tutor led demonstration/review of how to carry out a pour plate and count the bacteria that grow. Learners review appropriate risk assessment.  Learners select a suitable growth factor and carry out technique using aseptic equipment and bacterial culture for M5 evidence. Learners ensure evidence for M5 and M6 is covered as appropriate.  Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used. |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count  D3:  Draw conclusions about how the three factors affect the growth of microorganisms  D4:  Evaluate the effectiveness of the measuring and counting techniques used | Tutor observation of practical techniques. Tutor observation of risk assessments.  Additional portfolio evidence.  Oral and written communication.  Calculations and equations  Practical skills and health and safety | 22 | Learners review the results of the pour plate technique individually and as a group.  Learners carry out a viable count of the pour plates.   * the technique is used * the factor chosen affects the growth of the bacteria * effective the counting/measuring technique is.   Procedure followed with no tutor help, accurate risk assessment, results are clear, sufficient, reproducible / accurate, and correct units used.  Learners ensure evidence for M5,M6, M7 and D3 is covered as appropriate. |
| **PO3:**  Use practical techniques to investigate the factors that affect the growth of microorganisms | P6:  Describe a range of factors that affect the growth of microorganisms  P7:  Use one suitable technique to count/measure microorganism  P8:  Use serial dilution techniques in one practical activity  M5:  Perform practical activities to investigate three factors that affect the growth of microorganisms  M6:  Explain the use of the technique used and perform appropriate calculations to achieve a total count  D3:  Draw conclusions about how the three factors affect the growth of microorganisms  D4:  Evaluate the effectiveness of the measuring and counting techniques used and make justified suggestions of improvement | Practical/written work for **P6, P7, P8,M5, M6, M7, D3,D4.**  Oral and written communication.  Calculations and equations  Practical skills and health and safety | 23 | Learner led workshop session to complete written and practical work for PO3.  Working independently to produce accurate work.  Work handed in on time. |

**PO4 Identify the use of microorganisms in biotechnological industries**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Specification Content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | P9:  Describe the main features of continuous and batch processes in biotechnological industry  M8:  Explain the benefits of an industrial fermenter | Discussion of research findings and portfolio evidence  Oral communication during discussion.  Written communication  Research | 24 | Tutor led discussion on continuous and batch processing and industrial fermenters.  Learners carry out further independent research.  Learners discuss their findings under the guidance of the tutor.  Learners will use their knowledge and understanding to generate suitable portfolio evidence and will be stretched and challenged by the complexity of their response.  [**Industrial Microbiology**](http://eresources.gitam.edu/environmental/em_maruthi/industrial.htm)  **Industrial Microbiology Ghandi Institute of Technology**  [Fermentation](http://scienceaid.co.uk/biology/micro/fermentation.html) |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | P9:  Describe the main features of continuous and batch processes in biotechnological industry  M8:  Explain the benefits of an industrial fermenter | Discussion of research findings and portfolio evidence.  Oral communication during discussion.  Written communication  Research | 25 | Tutor led discussion /recap on continuous and batch processing and industrial fermenters.  Learners carry out any additional independent research.  Learners will use their knowledge and understanding to generate suitable portfolio evidence for P9 and M8 as appropriate and will be stretched and challenged by the complexity of their response.  Learners ensure evidence |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | P10:  Describe the use of named microorganisms and the relevant industrial processes or techniques used in two different biological industries  M9:  Explain the benefits to society of the use of microorganisms in the biotechnological industries described | Discussion of research findings  and presentation of evidence  Oral communication during discussion  Written communication  Research | 26 | Tutor divides the class into small groups to research and investigate the use of specific microrganisms in a range of different biotechnological industries.  Learners come together and present their findings under the guidance of the tutor.  Learners work in small groups to discuss the benefits to society.  Learners come together and present their findings under the guidance of the tutor.  [Biotechnology and Microorganisms](http://scienceaid.co.uk/biology/micro/biotechnology.html) |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | P10:  Describe the use of named microorganisms and the relevant industrial processes or techniques used in two different biological industries  M9:  Explain the benefits to society of the use of microorganisms in the biotechnological industries described | Discussion of research findings  and portfolio evidence  Oral communication during discussion.  Written communication | 27 | Tutor provides a resume of last week’s findings and confirms learners’ understanding through Q & A.  Learners will use their knowledge and understanding to generate suitable portfolio evidence for P10 and M9 as appropriate and will be stretched and challenged by the complexity of their response. |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | D5:  Compare the relevant industrial processes or techniques used for two named microorganisms in specific biotechnological industries | Discussion and portfolio evidence  Oral communication during discussion.  Written communication | 28 | Tutor led discussion encouraging learners to differentiate between process/techniques in various biotechnological processes.  Learners ensure evidence for D5 is covered as appropriate and will be stretched and challenged by the complexity of their response. |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | D6:  Evaluate the use of genetic engineering of microorganisms in one biotechnological industry | Discussion, worksheets and portfolio evidence  Oral communication during discussion.  Written communication | 29 | Tutor delivers a presentation on genetic engineering and learners complete worksheets to confirm understanding.  Learners ensure evidence for D6 is covered as appropriate and will be stretched and challenged by the complexity of their response.  Making Human Insulin: apbi Resources for schools  [Diabetes](http://www.abpischools.org.uk/page/modules/diabetes/diabetes6.cfm?coSiteNavigation_allTopic=1) |
| **PO4:**  Identify the use of microorganisms in biotechnological industries | P9:  Describe the main features of continuous and batch processes in biotechnological industry  P10:  Describe the use of named microorganisms and the relevant industrial processes or techniques used in two different biological industries  M8:  Explain the benefits of an industrial fermenter  M9:  Explain the benefits to society of the use of microorganisms in the biotechnological industries described  D5:  Compare the relevant industrial processes or techniques used for two named microorganisms in specific biotechnological industries  D6:  Evaluate the use of genetic engineering of microorganisms in one biotechnological industry | Written work for **P9, P10, M8, M9, D5, D6.** | 30 | Learner led workshop session to complete written work for PO4.  Working independently to produce accurate work.  Work handed in on time. |