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Unit 21

Product testing techniques

Model Assignment

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Please note:

You can use this assignment to provide evidence for summative assessment, which is when the learner has completed their learning for this unit and is ready to be assessed against the grading criteria.

You can use this assignment as it is, or you can modify it or write your own; we give more information in this document under Guidance for tutors.

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Guidance for tutors on using this assignment

General

OCR Cambridge Technical model assignments are available to download from our website: www.ocr.org.uk.

The purpose of this assignment is to provide a scenario and set of tasks that introduces the learner to regulations governing the nature of consumer products and testing methods used in commercial laboratories.

Two different products have been selected for the scenario to provide the opportunity for the required content to be fully evidenced.

Note:

The 'consumer' is defined as the next purchaser in the chain not necessarily a member of the public buying a product in a shop.

The 'product' can also apply to results gathered as part of a survey and therefore the results themselves are the product.

This unit is the overarching mandatory unit in the Introductory Diploma pathway and so should synoptically link to the units in the pathway. Products selected for testing in this model assignment can be of the centre's own choosing and may, for example be based on microbe related products linking to Unit 18 (Microbiology). Such products may include examples from the bread, brewing or wine industries.

This assignment will not instruct learners how to meet the highest grade. Whether learners achieve a pass, merit or distinction will depend on what evidence they produce.

You can modify the scenario we provide in this assignment to make it more relevant to your local or regional needs. Please refer to the information under 'Modifying the model assignment' later in this section.

You don't have to use this assignment. You can use it as a guide to help you to design your own assignment, and we provide an assignment checking service. You'll find more information on these matters in section 8 of the qualification handbook.

In the tasks, we'll refer to the format of evidence. Learners are **not** required to follow that format **unless** we tell them otherwise.

It's essential that the work every learner produces is their own. Please make sure you read through the information we give on authenticity in section 8 of the qualification handbook and make sure that your learners and any staff involved in assessment understand how important authenticity is.

We provide this assignment to be used for summative assessment. You must not use it for practice or for formative assessment.

Before using this assignment to carry out assessment

Learners will need to take part in a planned learning programme that covers the knowledge, understanding and skills of the unit.

When your learners are ready to be assessed, they must be provided with a copy of the following sections of this assignment:

- General information for learners
- Assignment for learners
- Evidence Checklist

They may carry out preparation prior to undertaking the tasks and there is no time limit for this.

When completing the assignment

You should use this assignment in conjunction with the unit specification and qualification handbook.

Resources to complete the tasks

There are resource requirements for this assignment. Every learner will need access to the following resources:

- Current UK Control of Substances Hazardous to Health (COSHH) regulations, access to hazard labelling requirements such as given in Consortium of Local Education Authorities for the Provision of Science Services (CLEAPSS) or centre's equivalent guidance.
- Internet and/or suitable textbooks for analytical test method research.
- Suitable laboratory environment with equipment and reagents:
 - to carry out titrations
 - quantitative solvent extraction
 - qualitative thin layer chromatography
 - pH meter or autotitrator for titration end-point determination when the use of a pH indicator is not appropriate.
- Samples of tea or coffee for Task 4.
- Copper electroplating formulation given in the appendix of this assignment.
- If centres are to modify the assignment to suit local needs, centres must consider the necessary resources required. Examples of alternative products for analysis include vegetable and nut oils or dairy products.

Guidance for tutors for selection of appropriate test methods

The scenario requires research and adaptation of appropriate qualitative and quantitative test methods, which will give reliable and accurate results. The following links provide examples of potential methods.

Acid base titration using a pH meter:

http://www.che.boun.edu.tr/Courses/che203/Che203_Experiment7_Titrations.pdf

TLC analysis of caffeine in tea:

https://www.researchgate.net/publication/319155921_T

LC Procedure for Determination of Approximate Contents of Caffeine in Food and Beverages:

<http://course1.winona.edu/tnalli/spring05/209labs/expt3.pdf>

Typical caffeine composition of tea:

<https://the/republicoftea.com/library/caffeine-in-tea/tea-and-caffeine/>

Health and Safety and the use of resources

The scenario requires some practical work and collection of primary data. It is the centre's responsibility to ensure the safety of all learners. Tutors are responsible for making their own Risk Assessments for the tasks prior to learners attempting the practical work, and for ensuring that appropriate Health and Safety procedures are carried out. However, tutors must not provide learners with these Risk Assessments. Learners, prior to undertaking practical investigations submit a Risk Assessment.

Time

You should plan on 16 to 20 hours for learners to complete this assignment.

Learners must be allowed sufficient time to complete all the tasks. The amount of time may vary depending on the nature of the tasks and the ability of individual learners. To help with your planning, against each of the tasks we've given an indication of how long it should take.

Learners can produce evidence in several sessions.

Format of evidence

Learners have to produce evidence that demonstrates how they have met the grading criteria. At the very least they must produce evidence that meets **all** of the pass criteria.

Please make sure your learners realise that missing just one pass criterion means they will not pass the unit, even if they have successfully met the merit and distinction criteria.

We don't have specific requirements for the format of evidence in this assignment. We've said what format the evidence could take for each task. For example, if we say 'You could include a report on ...', the evidence doesn't have to follow any specific reporting conventions. You can modify the format of the evidence, but you must make sure the format doesn't prevent the learner from accessing the grading criteria.

For more guidance on generation and collection of evidence, please refer to the section 8 'Internal Assessment', in the qualification handbook.

Group work

If you plan to ask learners to work in a team to complete work for assessment, you need to determine at which point in an assessment task learners can work together. You must be sure that each learner can produce evidence of their own contribution to each grading criterion. You can give constructive feedback to learners about working as a group and direct them on team working skills because evidence of team working skills is not required by the unit. See our information on authentication, including group work and feedback to learners, in section 8 of the qualification handbook.

If witness statements are used to support learners' evidence, you'll need to complete an individual statement for each learner.

After completing the assignment

Once the learner has submitted their work to you to be assessed, you must judge or 'mark' the work against the grading criteria for the unit and identify one grade for the unit. For further information about assessment, please refer to section 8 of the qualification handbook.

Your assessment decisions must be quality assured across the cohort of learners in your centre who are being entered for the same unit. This must be done through an internal standardisation process. We give information on internal assessment and standardisation in the qualification handbook.

Reworking the assignment

If you and the learner feel they've not performed at their best during the assessment, the learner can, at your discretion, improve their work and resubmit it to you for assessment. If a learner is working on improving their work before it is resubmitted, you and the learner must continue to make sure the work is the learner's own.

Any feedback you give to the learner must not direct them on how to improve their work. You can identify what area of the work could be improved but you cannot give the learner any details about how they could improve it. You must follow the guidelines given in section 8 of the qualification handbook under 'Authenticity of learner work'.

Modifying the model assignment

The tasks in this assignment allow learners access to the full range of grades detailed in the grading criteria of this unit.

If you modify this assignment you must **not** change the grading criteria provided in the tasks for the learner or in the evidence checklist. These grading criteria are taken from the unit.

You can modify the scenario to suit your local or regional needs and the tasks may be contextualised to match any changes you have made to the scenario. The range of products, tests and stages of production may also be extended to suit centres' needs. If you supply your own formulations to support a different scenario, these must be sufficiently detailed for learners to complete the tasks.

You can modify the type of evidence and the format it takes, unless we expressly state that evidence must take a specific format.

You must also make sure that you avoid discrimination, bias and stereotyping and support equality and diversity. For more information, please see the section 'Designing your own assignments for internally assessed units' in section 8 of the qualification handbook.

If modifications are made to the model assignment, whether to the scenario alone, or to both the scenario and individual tasks, it is your responsibility to make sure that all grading criteria can still be met and that learners can access the full range of grades.

General information for learners

Q *What do I need to do to pass this assignment?*

A You need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to. If you miss just one pass criterion, you will not achieve this unit and will receive an unclassified result.

Q *What do I need to do if I want to get a merit or distinction for this assignment?*

A For a merit, you need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to **and** you need to produce evidence to meet **all** the merit criteria.

For a distinction, in addition to the above, you also need to meet **all** the distinction criteria for this unit.

Q *What help will I get?*

A Your tutor will support you when completing this assignment and will make sure that you know what resources or facilities you need and are allowed to use. We've given your tutor information about how much support they can give you.

Q *What if I don't understand something?*

A It's your responsibility to read the assignment carefully and make sure you understand what you need to do and what you should hand in. If you are not sure, check with your tutor.

Q *I've been told I must not plagiarise. What does this mean?*

A Plagiarism is when you take someone else's work and pass this off as your own, or if you fail to acknowledge sources properly. This includes information taken from the Internet.

It's not just about presenting a whole copied assignment as your own; you will also be plagiarising if you use the ideas or words of others without acknowledgement, and this is why it's important to reference your work correctly (see Q&A below for more information on referencing).

Plagiarism has serious consequences; you could lose the grade for this unit or you may not be allowed to achieve the whole qualification.

Always remember that the work you produce must be your own work. You will be asked to sign a declaration to say that it is.

Q *What is referencing and where can I find out more information about it?*

A Referencing is the process of acknowledging the work of others. If you use someone else's words and ideas in your assignment, you must acknowledge it, and this is done through referencing.

You should think about why you want to use and reference other people's work. If you need to show your own knowledge or understanding about an aspect of subject content in your assignment, then just quoting and referencing someone else's work will not show that **you** know or understand it. Make sure it's clear in your work how you are using the material you have referenced **to inform** your thoughts, ideas or conclusions.

You can find more information about how to reference in *The OCR Guide to Referencing* available on our website: <http://www.ocr.org.uk/Images/168840-the-ocr-guide-to-referencing>

Q Can I work in a group?

A Yes. However, if you work in a group at any stage, you must still produce work that shows your individual contribution. Your tutor can advise you how to do this.

Q ***Does my work for each task need to be in a particular format?***

A You can present your work in a variety of ways – it can be handwritten, word-processed, on video or in digital media. What you choose should be appropriate to the task(s) and your tutor can advise you. There may be times when you need proof that you have completed the work yourself: for example, if you do something during work placement that you want to use as evidence, the tutor might ask the employer to provide a witness statement.

Make sure you check the wording in each task carefully. For each task, we'll tell you if your evidence has to be in a specific format:

- If we say use the word '**must**', for example 'You must produce a report' or 'Your evidence/work must include a diagram', then you must produce the work in the stated format.
- If we use the word '**could**', for example 'You could include sketches of your ideas' or 'You could do this by annotating your diagram', this means that you are not required to follow the format we have given, but you must make sure that the work you do produce allows you to demonstrate the requirements of the grading criteria.

If you are unsure about what evidence you need, please ask your tutor.

Q ***Can I ask my tutor for feedback on my work?***

A Yes, but they can't give you detailed feedback.

We have given your tutor instructions on what kind of feedback they can give you. For example, they are **not** allowed to tell you exactly what to do to make your work better, but they **can** remind you about what they've taught you and you can use this additional learning to try and improve your work independently. They can say what they've noticed might be wrong with your work, for example if your work is descriptive where an evaluation is required, but your tutor can't tell you specifically what you need to do to change it from a description to an evaluation – you will need to work out what you need to do and then do it for yourself.

Q ***When I have finished, what do I need to do?***

A If you have included the personal details (such as name, address or date of birth) of someone other than yourself in your work, this must be blanked out (anonymised) – your tutor will tell you how to do this. You don't need to do this for information contained in references.

You can complete the evidence checklist to show your tutor where they can find the evidence for each grading criterion in your work. You should make sure your work is labelled, titled and in the correct order for assessing. Hand in the work that you've completed for each task to your tutor. They might ask to see your draft work, so please keep your draft work in a safe place.

Q ***How will my work be assessed?***

A Your work will be marked by someone in your centre who has been authorised to do so.

They will use the information in the grading criteria to decide which grade your work meets. The grading criteria are detailed in each unit and are also given in the tasks within this assignment. Please ask your tutor if you are unsure what the grading criteria are for this assignment.

Assignment for learners

Unit 21: Product Testing Techniques

Scenario

You are working for an independent analytical services laboratory, which provides credible quantitative and qualitative chemical analysis to a range of manufacturers. You have been given two tasks to complete for two different customers. These tasks give you an opportunity to demonstrate the range of your abilities and report reliable data to the customers.

The first task is for an electroplating company, which needs to confirm the hazard labels to use for its copper plating solution. The second task is for a chain of cafés, which wishes you to devise and test an analysis method. The manufacturer will use the analysis method to assess the suitability of batches of raw material for use in production.

Introduction to the tasks

In these tasks you will be required to demonstrate your knowledge, understanding and practical abilities when testing a range of consumer products. This will be through:

- Research of Government regulations
- Planning and carrying out reliable practical work with due regard to Health and Safety
- Convincing reporting of your tests and results

Evidence for these tasks can include:

- Video recordings
- Written reports
- Presentations and notes
- Diagrams/photographs

Before starting the assessment assignment you must have available the Unit Specification so you are aware of the necessary content coverage.

The tasks

Task 1: Hazard Labelling Regulations

(This task should take between 3 and 5 hours.)

Learning Outcome 1: *Understand the influence of regulatory bodies on development of consumer products*

An electroplating company wishes to confirm the hazard labelling for its copper plating solution. The main components of the formulation are sulfuric acid and copper (II) sulfate. Other minor components which are often added to electroplating solutions, such as brighteners, have no hazard class in this scenario.

Your task is to:

Review relevant sources and advise of the possible UK hazard labelling to apply, depending upon the concentrations of the 2 main components of the electroplating solution (Sulfuric acid and copper (II) sulfate).

Pass	Merit	Distinction
P1: Describe the requirements of the relevant governing body on the development of consumer product	M1: Explain how governing bodies influence quality control	
Evidence		
You must produce a briefing for the customer outlining the possible hazard labelling requirements for UK use of the copper plating solution.		
You must include:		
<ul style="list-style-type: none">• References to your sources of evidence.• Relevant current requirements for UK hazard labelling of the main components of the solution.• A forward in your briefing explaining how quality control testing would be important to confirm the correct legal hazard labelling is used for each batch of copper plating solution.		

Task 2: Test Method Development

(This task should take between 4 and 5 hours.)

Learning Outcome 2: *Understand how product testing determines the development of consumer products*

Different products require differing test protocols. You have two different consumer products to test for two different companies.

- The electroplating company has supplied you with a sample of its copper plating solution (formulation given in the appendix to this assignment). It requires you to confirm the concentrations of the copper (II) sulfate and sulfuric acid components, to make sure the correct hazard labels are applied. Your method should take into account that the colour change of a pH indicator will not be clearly visible and that there will be interferences from the copper (II) ion *after* the titration equivalence point.
- A second company wishes to assess the suitability of a new, lower cost supplier of beverages for use in its cafés. The caffeine in tea or coffee can produce increased anxiety, higher blood pressure and headaches, but up to 400 mg of caffeine a day appears to be safe for most healthy adults. The company wants to be able to recommend the maximum number of cups of tea or coffee that could make up a healthy diet. The company needs you to suggest a method for them to use to determine the caffeine content of the new supply of beverages and the breakdown of the caffeine portion of the new tea or coffee. You must show that the suggested method is suitable, using tea or coffee purchased in a shop.

Your task is to:

Produce a laboratory notebook with the tests and procedures to provide reliable analysis results for the two customers.

Pass	Merit	Distinction
P2: Select tests to be used in product development	M2: Explain how the effectiveness of consumer product testing is established	
P3: Outline procedures used during formulation, production, quality control and after sale monitoring		

Evidence

You must produce a laboratory notebook that **describes** relevant tests and procedures with due regard to health and safety. Explain how the reliability of the tests can be confirmed, in order to provide accurate data to the customers.

You must **explain** the effectiveness of each test, include a consideration of:

- the validity and reliability of the collection of data
- any hazards and risks when testing.

You must also include when the relevant testing should be carried out during the development of each product e.g.

- formulation
- production
- quality control and assurance
- after-sale monitoring.

Task 3: Performing Titrations

(This task should take between 4 and 5 hours.)

Learning Outcome 3: *Be able to use quantitative titration techniques on consumer products*

Having produced a testing manual you will conduct two separate titration techniques to analyse the sulfuric acid and copper(II) sulfate content of the copper plating solution as given in the appendix to this assignment.

Your task is to:

Having been given a quantity of the copper plating solution, provide reliable data for the sulfuric acid and copper(II) sulfate content, giving your results with appropriate units.

N.B. You must conform to the relevant Health and Safety procedures when carrying out practical investigations.

Pass	Merit	Distinction
P4: Use titrimetric techniques on consumer products	M3: Determine the concentration of substances in consumer products using quantitative methods	D1: Evaluate concentration of substances against those stated on product labels
Evidence		
<p>You must produce a clear and accurate report of your findings for the customer.</p> <p>You must include:</p> <ul style="list-style-type: none">• raw data from your titrations• outline of your calculations• appropriate units for your results• appropriate significant figures for your results• comparison of the results for the titrimetric determination of the copper(II) sulfate content of the plating solution with the quantity of copper(II) sulfate theoretically present in the formulation given in the appendix to this assignment• an evaluation of the comparison of your actual and theoretical results when suggesting the appropriate hazard labelling to be applied, thus evaluating the suitability of the method to ensure product consistency.		

Task 4: Performing Extraction, Separation & Thin Layer Chromatography

(This task should take between 4 and 5 hours.)

Learning Outcome 4: *Be able to use extraction and separation techniques on consumer products*

Having produced a testing manual, you must now demonstrate the effectiveness of the test for the suitability of a new supplier of beverages for use in the company's cafés.

Your task is to:

Use a solvent extraction to separate and determine the mass of caffeine in a sample of supermarket's economy brand tea or coffee, and use TLC to investigate qualitatively the composition, compared to a sample from a high quality branded tea or coffee.

N.B. You must conform to the relevant Health and Safety procedures when carrying out practical investigations.

Pass	Merit	Distinction
P5: Use solvent extraction to separate and determine the mass of the active ingredient of a consumer product		
P6: Use TLC to investigate qualitatively the composition of a consumer product	M4: Calculate R _f values of constituents of the consumer product to provide quantitative information of a consumer product	
Evidence		
<p>You need to carry out solvent extraction to separate caffeine from tea or coffee and determine the amount of caffeine in a cup of tea or coffee.</p> <p>Initially you will need to establish the amount of coffee or tea that is required to a standard drink of coffee and tea so a "fair" comparison can be made.</p> <p>For example:</p> <p>Firstly, establish the amount of time to leave a teabag in 200 ml of boiling water to produce the required time for a standard drink of tea so a "fair" test can be made.</p> <p>(To obtain a significant mass of caffeine from your procedure consider using 5 tea bags or 5 measured teaspoons of coffee and then adjust your findings for a cup of tea brewed from 1 tea bag or a cup of coffee made with one teaspoon.)</p> <p>You must produce a clear and accurate report of your findings for the customer.</p> <p>You must include:</p> <ul style="list-style-type: none"> raw data from your extraction(s), including relevant masses outline of your calculations appropriate units for your results appropriate significant figures for your results R_f Values and calculations for TLC. 		

1 General teaching notes

General process

Often preparations produce a solution or suspension of the required product in water. Repeated solvent extraction will transfer the product into an organic solvent. The most commonly used organic solvent is diethyl ether (ether) because:

- many organic compounds are soluble in ethoxyethane
- it is insoluble in water
- it is largely unreactive and therefore unlikely to react with the required product
- it is easily removed from the compound because it boils at 35 °C.

After separation any remaining water is removed using a drying agent from the organic extract. Examples of drying agents:

- Calcium sulphate
 - Anhydrous magnesium sulphate
 - Calcium chloride - no for drying alcohols, phenols, amines or carboxylic acids
 - Potassium hydroxide - for drying amines.
-
- The mixture to be separated is carefully poured into a separating funnel (a funnel is used to minimise spillage).
 - The stopper is placed in the neck of the separating funnel before shaking the mixture.
 - The separating funnel is carefully inverted and shaken gently, periodically opening the tap to release pressure. This is done several times to ensure thorough mixing.
 - The separating funnel is returned to the stand so that the layers are aligned horizontally.
 - The layers are allowed to separate.
 - The stopper is removed, a conical flask is placed underneath and the bottom layer is run-off through the tap.
 - The organic layer is dried with a drying agent. The drying agent is added till the solution becomes cloudy with shaking.
 - The drying agent can be removed by gravity filtration.

A video of the procedure can be found following the link here:

<https://www.youtube.com/watch?v=1tmqUVSVPo4>

Extraction of caffeine from tea - solvent extraction

Equipment:

- tea bags (known mass of tea)
- beaker (500 ml)
- hot plate
- separating funnel
- ring stand
- melting point apparatus
- dichloromethane
- anhydrous sodium sulphite
- distilled water
- filter funnel and filter paper
- hot water bath
- flask (100 ml)
- weighing balance.

Dichloromethane

Classified as a neurotoxin and human carcinogen.

Dichloromethane is highly volatile and should be stored in a cool, dry area in tightly closed, labelled containers.

Risks

- **Inhalation** - can cause coughing, wheezing and/or shortness of breath. Individual should be removed from exposure area and immediately moved to an area with fresh air. Seek medical attention immediately if any difficulty breathing occurs.
- **Skin Exposure** - can cause irritation may lead to skin burns. Immediately remove contaminated clothing and wash skin with large amounts of soap and water.
- **Eye Exposure** - contact with eyes can cause severe irritation and possibly chemical burns to the eyes. Immediately flush eyes with large amounts of water for at least 30 minutes.

Safety Precautions

- Wear protective clothing. Footwear should cover the entire foot.
- Always wear PPE such as chemical splash goggles and safety gloves.
- Work in a well-ventilated area (preferably in an environment with a fume extraction system).

Sodium sulphite: Solid and concentrated solution (If 0.15 M or more) - harmful corrosive.

DANGER: Harmful if swallowed, cause serious eye damage.

Use the smallest quantity or concentration possible.

Wear eye protection when handling hazardous solids and solutions.

Emergency action

- In the eye; Flood eye with gently-running tap water for 10 minutes. Consult a medic if pain persists.
- Swallowed; Do no more than wash out the mouth with drinking water. Do not induce vomiting. Consult a medic.
- Spilt on the skin or clothing; Brush solid off contaminated clothing. Rinse skin or clothing as necessary.
- Spilt on the floor, bench, etc; Brush up solid spills, trying not touch.

Method

- Weigh 5 tea bags and record mass.
- Add 200 ml of distilled water to 500 ml beaker.
- Add 5 tea bags to beaker.
- Boil the contents in the beaker vigorously using a hot plate.
- Allow the mixture to cool for 5 minutes.
- Decant the mixture into another beaker.
- Squeeze remaining mixture out of the tea bags and add to beaker.
- Cool the aqueous solution to 20°C (use ice box) before adding dichloromethane.
- Extract the solution three times with 30-mL portions of dichloromethane.

Extraction

- a The tea solution is poured into a separating funnel and 20 ml of dichloromethane is added to it. The mixture will separate into two layers - the top layer is the tea layer and bottom layer is the dichloromethane since it is denser than tea.
- b Remove the funnel from the stand and keep your fingers on the stopper and carefully shake the separating funnel.
- c Vent the separating funnel periodically (every 30 sec) to relieve vapour pressure created inside the funnel.
- d When the contents have been sufficiently shaken place the separating funnel back on the ring stand and let the two layers separate.
- e Drain the bottom layer into a conical flask because now the caffeine is extracted into the dichloromethane layer. Cover the mouth of the conical flask to avoid evaporation of solution.
- f Repeat steps a) through e) twice.

Drying

- Dry the combined dichloromethane solutions with anhydrous Sodium sulphite.
- Add 1 teaspoon of the drying agent until it no longer clumps together at the bottom of the flask. Mix well and leave it for 10 minutes.
- Decant the dichloromethane into a conical flask (100 ml).
- Evaporate the dichloromethane solvent in a hot water bath - when all the solvent is removed you observe a residue of yellowish green - white crystalline caffeine.

Amount of caffeine in various teas (caffeine content will vary with length of brewing).

Tea	Amount (ml)	Caffeine (mg)
Brewed black	237	25-48
Brewed black, decaf	237	2-5
Brewed green	237	5-40

Extraction of caffeine from coffee – solvent extraction

Equipment:

- separating funnel
- ring stand
- instant coffee (known mass of coffee)
- distilled water
- dichloromethane
- glass stirring rod
- 250 ml flask
- 125 ml flask
- filter funnel and filter paper
- hot water bath
- weighing balance.

Dichloromethane (Methylene chloride)	
Hazards	Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation. May cause drowsiness or dizziness. Suspected of causing cancer. May cause damage to organs through prolonged on repeated exposure.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
Skin contact	Wash off with soap and plenty of water. Consult a physician.
Inhalation	If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
Ingestion	Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Sodium sulphate	Low Hazard.
Eye contact	Flood the eye with gently-running tap water for 10 minutes. Consult a medic if pain persists.
Ingestion	Do no more than wash out the mouth with drinking water. Do not induce vomiting. Consult a medic.
Skin contact	Brush solid off contaminated clothing. Rinse skin or clothing as necessary.
Spilt on floor	Brush up solid spills, trying not to raise dust, then wipe with a damp cloth. Wipe up solutions spills and rinse well.

Method

- Place a separating funnel in a ring stand and close the funnel's stopcock.
- Add 75 ml of coffee to the separation funnel.
- Add 20 ml of dichloromethane and place the stopper in the top of the separation funnel.
- Shake the funnel gently for 1-2 minutes.
- Place the funnel back in the ring stand and allow the two layers of liquid to separate.—the lower layer will be dichloromethane.
- If there is an emulsion at the boundary between the two layers (an emulsion is a region where “bubbles” of one liquid are suspended in the other liquid, and the two refuse to separate) use a glass stirring rod to poke around in the emulsion to break it up.
- Remove the stopper from the top of the funnel, drain the lower dichloromethane layer into a 250 ml flask.
- Set the flask containing the first portion of dichloromethane aside.
- Add a fresh 20 ml portion of dichloromethane to the coffee in the funnel.
- Shake the funnel for 1-2 minutes.
- Allow the two layers to separate again, then drain the lower dichloromethane layer into the 250 ml flask that already contains the first portion of dichloromethane.
- Add a fresh 20 ml portion of dichloromethane to the coffee in the funnel.
- Shake the funnel for 1-2 minutes.
- Allow the two layers to separate again, then drain the lower dichloromethane layer into the 250 ml flask that already contains the first portion of dichloromethane.
- The 250 ml flask will contain all three portions of dichloromethane which contains the caffeine from the coffee dissolved in this solvent.

Drying

- Weigh out 2 grams of anhydrous sodium sulphate and add it to the dichloromethane.
- Swirl the container, then let stand 10 minutes. The sodium sulphate will absorb any water that is present.
- Decant the dichloromethane into a dry 125 ml flask, leaving all the sodium sulphate behind.
- Evaporate the dichloromethane solvent in a hot water bath - when all the solvent is removed you observe a residue of yellowish green - white crystalline caffeine.

Amount of caffeine in various coffees.

Type	Amount	Caffeine
Brewed coffee	100 g	40 mg
Espresso coffee	100 g	212 mg
Instant coffee	100 g	3142 mg
Decaffeinated coffee	100 g	1 mg

2 Research

How much caffeine is in coffee?

A standard pot of brewed coffee sets the benchmark for understanding the amount of caffeine contained in other drinks. According to Mayo Clinic, your average pot of coffee can contain up to 200 milligrams, or as little as 95 milligrams, of caffeine per eight-ounce cup, depending on the type of roast you choose. Dark roast coffees actually have less caffeine than lighter breakfast blends.

However, instant coffee and espresso differ from your standard coffee blends. Instant coffee is not as strong as brewed coffee, ranging from 65-100 milligrams per serving. Espresso on the other hand can be as strong as an eight-ounce cup of coffee, with approximately 100-150 milligrams of caffeine per shot.

How much caffeine is in tea?

Tea contains less caffeine than coffee. A standard cup of black tea contains anywhere between 14-70 milligrams of caffeine, and green tea usually contains 24-45 milligrams of caffeine per cup. This makes tea a great afternoon drink when you're looking for a small energy boost to get you through the rest of the day.

Copper plating Solution

Deionised water	350 ml
Concentrated Sulfuric acid (CAS 7664-93-9)	3.5 ml
Copper (II) sulfate crystals, (pentahydrate, CAS 7758-99-8)	6.2 g
Deionised water	top up to 500 ml

Evidence Checklist

OCR Level 3 Cambridge Technicals in Applied Science

Unit 21: Product Testing Techniques

LEARNER NAME:

For PASS have you: (as a minimum you have to show you can meet every pass criterion to complete the unit)	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
P1: Described the requirements of the relevant governing body on the development of consumer product?	
P2: Selected tests to be used in product development?	
P3: Outlined procedures used during formulation, production, quality control and after sale monitoring?	
P4: Used titrimetric techniques on consumer products?	
P5: Used solvent extraction to separate and determine the mass of the active ingredient of a consumer product?	
P6: Used TLC to investigate qualitatively the composition of a consumer product?	

For Merit have you:	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
M1: Explained how governing bodies influence quality control?	
M2: Explained how the effectiveness of consumer product testing is established?	
M3: Determined the concentration of substances in consumer products using quantitative methods?	
M4: Calculated R _f values of constituents of the consumer product to provide quantitative information of a consumer product?	

For Distinction have you:	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
D1: Evaluated concentrations of substances against those stated on product labels?	

To find out more
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or call our Customer Contact Centre on **02476 851509**

Alternatively, you can email us on **vocational.qualifications@ocr.org.uk**



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