**GENERAL INTEGRATED SCIENCE**

**UNIT 2**

**Task 9 – Separation Techniques Practical**

NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

DUE DATE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ WEIGHTING: 6 %

TEACHER: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ MARK: \_\_\_ / 53 = \_\_\_\_\_\_\_ %

**Conditions**

Time for the task:

Part 1: 5 minutes reading time

Part 2: (30 minutes) Investigate material properties and plan experiment.

Part 3: (55 minutes) Conduct experiment, collect data and clean up.

Part 4: (30 minutes) Analysis and Validation questions

**Introduction**

The body of a woman was found early this morning in an alley way in Kalgoorlie. Local detectives have identified the woman as 24-year-old Janet Lewis, a reporter from the Kalgoorlie Miner. Janet was a happy and well-liked member of the community. She played hockey for a local team and had recently joined the local ‘Pain and Relaxation’ Centre, which specialised in magnesium baths, aromatherapy and coconut-oil scrubs.

Preliminary tests on Janet reveal that she was murdered at approximately 4pm on Wednesday afternoon. Because of the severe bruising on her neck and shoulders, and the presence of water in her lungs, it appears that Janet was drowned, and her body was moved.

When trying to identify which body of water Janet was drowned in, detectives discovered the presence of a magnesium salt, flaked coconut and coconut oil mixed in with the water in her lungs. This led the detectives to two possible murder locations; Janet’s home or the ‘Pain and Relaxation’ Centre.

When investigating Janet’s home, detectives saw that the bath had been filled but was not drained. There was an empty sample pack from the spa that contained magnesium salt and a coconut-oil scrub, which was sitting next to the bath. They collected a 100mL sample of the water, and measured the amount of all the substances present in the 100mL:

*Flaked coconut = 2g*

*Magnesium Chloride (salt): 10g*

*Coconut oil: 15mL*

When investigating the ‘Pain and Relaxation Centre’, detectives learned that much stronger concentrations of the magnesium were used in their baths. They collected a 100mL sample of the bath water that Janet typically bathed in and measured the amount of all the substances present in the 100mL.

*Flaked coconut = 3g*

*Magnesium Chloride (Salt): 80g*

*Coconut oil: 18mL*

The detectives have now given you, the forensic analyst in Kalgoorlie, the sample from Janet’s lungs so that you can determine the concentration of the substances in this sample, and therefore the murder location. To do this, you must find a way to separate each of the substances from the mixture. In order to decide which separation techniques to use, you will need to determine some physical or chemical properties of each substance. Fill in the table below by investigating the materials you have been given.

|  |  |
| --- | --- |
| **Substance** | **Chemical and Physical Properties.**  **(e.g, density, solubility in water, particle size, etc.)** |
| **Coconut Oil** |  |
| **Flaked coconut** |  |
| **Magnesium Chloride (salt)** |  |

***(4 marks)***

**Individual Activity: Experimental design (18 marks)**

Using your knowledge of the properties of the three substances, design an experiment that would allow you to determine the amount of substances in the liquid found in Janet’s lungs and therefore determine the location that Janet was drowned at.

***Materials (2 marks)***

In the space below, list all of the materials that will be required to complete your experiment. Make sure you include enough detail (e.g, quantities).

***Methods (4 marks)***

In the space below, outline the steps that must be followed to complete your lab. Make sure that the steps are explained in enough detail that the experiment could be replicated, and that they are neat and easy to follow.

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***Safety Notes (4 marks)***

In the space below, outline any safety precautions relevant to your practical.

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**Remember you are being marked on conducting your experiment appropriately and collecting your data. (4 marks)**

***Record your data, along with the data you’ve been given by the police, in a labelled table below (4 marks).***

**Analysis and Validation Questions (27 marks)**

1. Where did the murder occur? Use your data to justify your decision. *(3 marks)*

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1. How do the separation techniques you used relate back to the physical properties of the four substances?

*(8 marks)*

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1. Explain how you could improve this experiment *(2 marks)*

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1. Explain whether the mixture is homogenous or *heterogenous (2 marks)*

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1. Describe why the magnesium salt and the water made a solution, but the water and the coconut would make a mixture *(4 marks)*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is decanting, and how does it relate to the physical properties of the substances it can be used on?

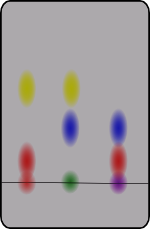
(*2 marks)*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is distillation, and how does it relate to the physical properties of the substances it can be used on?

*(2 marks)*

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1. Look at the image on the right. It is a chromatogram of different inks separated into their pigments by water.

Why have the pigments (colours) moved different distances along with filter paper? *(2 marks)*

Yellow

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Blue

Red

Start

1. A crime occurred, and the criminal left a letter. One of the suspects had a marker on him that was tested against the crime scene letter using chromatography. It was found to be a match. Is this strong enough evidence to convict this suspect? *(2 marks)*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Make sure you have gone back through your answers to check for errors, and ensure that you have answered all the questions.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skill Description** | **4** | **3** | **2** | **1** | **0** |
| **Materials** |  |  | All materials and set-up used in the experiment are clearly and accurately described | Most of the materials and set-up used in the experiment are clearly and accurately described | Non-attempt |
| **Safety warning** | Identified at least 2 safety risks and provided enough detail for safety procedures to ensure safe conduct | Identified at least 2 potential risks and briefly described strategies to avoid these | Identified 2 potential risks | Identified one potential risk | Non-attempt |
| **Method detail** | Procedure is detailed, logically organised, with numbered steps and would separate substances perfectly, allowing for measurements to be made | Procedure is logically organised, with numbered steps can be repeated, and would mostly separate substances, allowing for measurements to be made | Procedure has vague steps in order, procedure would somewhat separate substances, allowing for measurements to be made. | A procedure was planned that used separation techniques but experiment cannot be replicated | Non-attempt |
| **Experimental conduct** | Lab is carried out with full attention to relevant safety procedures. All lab skills are appropriate for year level. | Lab is carried out following safety procedures, but one lab skill needs to be reviewed. | Lab is carried out following safety procedures, but several lab skills need to be reviewed. | Lab is carried out following safety procedures, but lab techniques need serious development. | Non-attempt  Some aspect of the experiment, posed a safety threat to an individual or equipment. |
| **Data Presentation** | All data organised into a neat and logical table with headings and units included | All data organised into a neat table with units included | Most data organised into a table | Data was jotted down in the bank space | Non-attempt |

|  |  |
| --- | --- |
| **Substance** | **Chemical and Physical Properties.**  **(e.g, density, solubility in water, particle size, etc)** |
| **Coconut Oil** | Liquid, floats on top of water – less dense than water, Does not mix with water |
| **Flaked coconut** | Solid, floats on water, less dense than water |
| **Magnesium Chloride (salt)** | Solid white crystal, dissolves in water |

Properties of substances – *3 marks* for stating what will happen if put in water, *1 mark* for if comment on density

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Amount of flaked coconut (g)** | **Amount of coconut oil (mL)** | **Amount of magnesium chloride (g)** |
| **Janet’s Bath** |  |  |  |
| **Pain and Relaxation Centre** |  |  |  |
| **Janet’s Lungs** |  |  |  |

**Sample data table:** Refer to rubric for marking

**Curriculum Links:**

* conduct investigations safely, competently and methodically for the collection of valid and reliable data
* plan, select and use appropriate investigation methods, to collect reliable data; assess risk and address ethical issues associated with these methods
* represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and use evidence to make and justify conclusions
* scientific knowledge can enable scientists to offer valid explanations and make reliable predictions
* the use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences
* mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques

**Marking key**

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| --- | --- | --- |
| **Analysis and Validation Question Criteria** | **Possible mark** | **Mark** |
| **Where did the murder occur? Use your data to justify your decision** | **3** |  |
| Correctly identifies where the murder occurred (Janet’s home) | 1 |  |
| Refers to their raw data | 1 |  |
| Relates their raw data to the data collected from Janet’s lungs | 1 |  |
| **How do the separation techniques you used relate back to the physical properties of the four substances?** | **8** |  |
| Names the substances: water, coconut oil, salt and flaked coconut (1/2 ea) | 2 |  |
| Uses the terms decanting, evaporating and filtering/sieving (1/ea) | 3 |  |
| Explains the relationship between filtering/sieving and particle size | 1 |  |
| Explains the relationship between decanting and density | 1 |  |
| Explains the relationship between evaporation and boiling point | 1 |  |
| **Suggest a way to improve this experiment** | **2** |  |
| States a suggestion to improve the experiment | 1 |  |
| Explains why suggestion would actually improve the validity/reliability of the experiment | 1 |  |
| **Explain whether the mixture is homogenous or heterogeneous** | **2** |  |
| Correctly identifies mixture as heterogeneous | 1 |  |
| Explains non-uniform distribution of substances in the mixture in some way | 1 |  |
| **Describe why the magnesium salt and the water made a solution, but the water and the flaked coconut would make a mixture** | **4** |  |
| States that salt is soluble in water, or that it dissolves in water | 1 |  |
| States that flaked coconut is insoluble in water, or that it does not dissolve in water | 1 |  |
| Explains a mixture is two or more substances mixed together | 1 |  |
| Explains a solution is a homogenous mixture, or the product of a solute dissolving in a solvent | 1 |  |
| **What is decanting, and how does it relate to the physical properties of the substances it can be used on?** | **2** |  |
| States that decantation is a separation technique | 1 |  |
| Relates to the density of substances | 1 |  |
| **What is distillation, and how does it relate to the physical properties of the substances it can be used on?** | **2** |  |
| States that distillation is a separation technique | 1 |  |
| Relates to the boiling points of substances | 1 |  |
| **Why have the pigments (colours) moved different distances along with filter paper?** | **2** |  |
| States ‘the substances have different solubilities in water’ | 1 |  |
| States ‘more soluble’ substances move further, or some variation. | 1 |  |
| **A crime occurred, and the criminal left a letter…** | **2** |  |
| Provides a logical justification for their decision | 1 |  |
| States that this is not strong enough evidence | 1 |  |
| **Total mark** | **27** |  |