**COMET BAY COLLEGE**

**Physics - Unit 1 - Task 8**

**Practical Exam**

**Name: SOLUTIONS Total Marks /55**

**Question 1:**

A student wanted to find the temperature of the Bunsen flame in his school laboratory. He ties a length of iron wire around an iron cube. He heated the iron cube for 5 minutes in the flame and transferred the iron cube into water in the calorimeter. The water was stirred and the final temperature measured. He repeats the experiment several times and the average values are recorded below. The calorimeter is of poor quality and has an affect on the experiment and the iron wire remains around the iron cube throughout the entire experiment.

The student collected the following averaged data.

*Type of metal cube used: iron*

*Temperature of water at start of experiment: 190 C*

*Temperature of water at end of experiment: 410 C*

*Mass of iron cube: 73.5 g*

*Mass of iron wire tied around cube: 3.50 g*

*Mass of copper calorimeter 44 g*

*Mass of copper calorimeter and water 144 g*

*Specific Heat of Iron 440 J kg-1 K-1*

*Specific Heat of Copper 390 J kg-1 K-1*

1. Write an aim for this experiment

To determine the temperature of the flame of a Bunsen burner

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1. From the data, determine the temperature of the Bunsen flame. Include any assumptions the calculations are based on.  **[6 marks]**

### Heat lost = heat gained

mcΔTiron = mcΔT water + mcΔTcopper (1 mark)

0.077 × 440 × (Tf − 41) = [(0.10 × 4180 × (41 – 19) + (0.044 × 390 × (41 – 19)]

(1 mark) (1 mark) (1 mark)

33.88Tf – 1389.08 = 9196 + 377.52

33.88Tf = 1389.08 + 9196 + 377.52

33.88Tf = 10962.6

Tf = 323.6 0C (1 mark)

(1 mark for any assumptions)

1. Using a thermal imaging device the student finds out the actual temperature is 326.7oC. With this new piece of information discuss any three (3) potential errors. **[3 marks]**

Cube temperature loss during motion from Bunsen burner to water (lost to air)

Vaporisation of water during initial contact with cube.

Thermometers initial temperature effecting the average Kinetic energy of the water (minimal).

Five (5) minutes may not be long enough for the iron cube to reach the flames energy level throughout the cube.

Time cube in water not measured.

Enclosed, isolated system is not evident.

**Question 2:**

The following graph is of the reading on a Geiger counter of beta and alpha particles as the distance from the source increases. The sources of each had the same activity.

A

a) Which was the beta source, A or B? \_\_\_\_\_\_\_\_\_ **[1 marks]**

b) Fully explain, including your understanding of the characteristics of alpha and beta radiation, why you selected this source and why it couldn’t be the other source? **[3 marks]**

Beta particles are very small (light), negative particles that travel at high speeds (1 mark)

Therefore penetrate further than alpha particles in air (½ mark)

Alpha particles are very large, positive and slow moving particles (1 mark)

Easily stopped by air particles (ionisation) so rapid reduction in count. (½ mark)

**Question 3:**

In a university laboratory, a student was trying to determine the melting point of 10.0 g of solid paradichlorobenzene (moth repellent). He used a test tube of paradichlorobenzene which had previously had a thermometer placed inside it when liquid and had been left to set and reach room temperature as a solid. The student had then placed the test tube in a clamp attached to a retort stand and had heated the paradichlorobenzene measuring the temperature every half minute. His results are shown below.

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| Time  (min) | 0 | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 |
| Temp  0C | 18 | 20 | 24 | 28 | 30 | 33 | 35 | 39 | 43 | 45 | 48 | 50 | 53 | 53 | 53 | 53 | 53 | 61 | 70 | 77 | 84 |

1. Draw a graph which will show the heating curve of the paradichlorobenzene. [6 marks]

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1. Determine from the graph the melting point of the paradichlorobenzene. \_\_\_\_\_\_\_ [1 mark]

53 0C

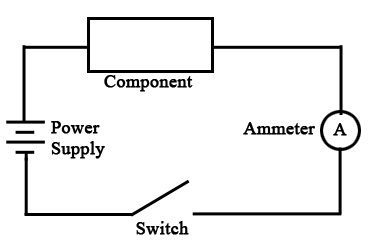
1. What effect do you think using 20.0 g of paradichlorobenzene would have had on the shape of the heating curve? Explain. [2 marks]

The general shape would not change as the melting point is the same. (1 mark)

The length of the horizontal section would increase as there is more substance to change from solid to liquid. (1 mark)

The heating curve is temperature versus time, so discuss these.

**Question 4:**

A student sets up a circuit (shown below: Fig 2). He has also been given two different electrical components. Component 1 is first added to the circuit and the results are recorded. Component 1 is removed and replaced with Component 2. The results of Component 2 are recorded.

*Figure 2: Simple Circuit*

He then records the following readings in the table below.

|  |  |  |
| --- | --- | --- |
| **Potential Difference** | **Current in Component One** | **Current in Component Two** |
| 0 | 0 | 0 |
| 2 | 4 | 4 |
| 4 | 8.1 | 7.9 |
| 6 | 11.9 | 10.8 |
| 8 | 16 | 12.9 |
| 10 | 19.9 | 14.8 |
| 12 | 24.1 | 16 |

1. What do you think the purpose of this investigation was? **[2 marks]**

The purpose was to compare the relationship between current and potential difference in two components (1 mark)

Answer to include - one that was ohmic and one non-ohmic (1 mark)

1. (i) What does the table show about the relationship between potential difference and

current in Component Two? **[2 marks]**

It is not directly proportional. (1 mark)

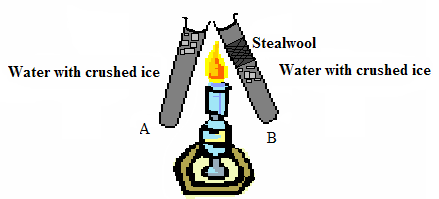
As the potential difference increases, the current increases but at a slower rate. (1 mark)

1. What name is given to these types of components? **[1 mark]**

Non-ohmic resistors

**Question 5:**

The diagram show two test tubes with ice being heated. In A, the ice is floating on the top of the water. In B, the ice is held halfway down by some steel wool. The test tubes are positioned so the flame is heating the top of the test tubes. Over time it is observed how quickly the ice cubes in each test tube melt.



B

* 1. In which test tube does the ice melt the slowest? \_\_\_\_\_\_\_\_\_\_\_ **[1 mark]**
  2. What would be a relevant hypothesis for this experiment **[3 marks]**

Convection is a process of heated water rising (1 mark)

The hotter water would accumulate at the top until thermal equilibrium with the air resulted in the water sinking back down. (1 mark)

Prediction: Greatest area of thermal difference between ice cube and water is located at the top of the test tube. (1 mark)

Position of ice cube

Time taken for ice cubes to melt (s)

Amount and temperature of water in test tubes

Thermal energy supplied.

* 1. What is the independent variable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **[1 mark]**
  2. What is the dependent variable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **[1 mark]**
  3. What are the controlled variables \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **[2 marks]**

* 1. Explain why the ice melts the slowest with your choice in part (a). **[3 marks]**

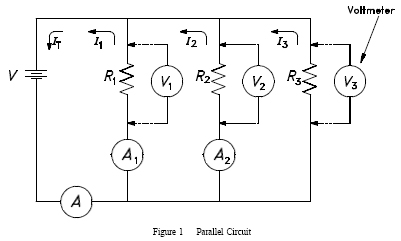
Main idea is that as heating from the top, convection currents will not be set up. (1 mark)

Ice at top is in contact with heat so melts quickly. (1 mark)

Ice below steel wool remains frozen longer as it takes time for the heat to travel downwards to the ice as heat rises. (1 mark)

**Question 6:**

Tom and Michael set up a parallel circuit as shown below (Figure 1).



Once the circuit was set up, Tom and Michael started collecting results, intending to change the power pack setting on each occasion. From this they obtained the following results recorded in the table below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Power pack | A | V1 | A1 | V2 | A2 | V3 | A3 |
| 6 V | 12 | 6 | 4 | 6 | 5 | 6 | **3** |
| 8 V | **16** | 8 | **5.33** | 8 | **6.67** | 8 | **4** |
| 12 V | **24** | **12** | **8** | **12** | **10** | **12** | **6** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Power pack | A | V1 | A1 | V2 | A2 | V3 | A3 |
| 6 V | 12 | 6 | 4 | 6 | 5 | 6 |  |
| 8 V |  | 8 |  | 8 |  | 8 |  |
| 12 V |  |  |  |  |  |  |  |

1. Having wasted a lot of time talking, they only obtained the results for the first set of data. Also they realised they forgot to collect the amperage for the circuit at R3. Not having time to go back and redo the experiment, they decide to calculate the missing data in the hopes that their teacher has not noticed. Complete Tom and Michaels data, including the current running through the parallel circuit of R3. Use the space below for working. *Note: legible working may acquire marks.* **[6 marks]**

**Question 7:**

A student was carrying out an investigation on half-life and radioactive decay using a normal dice. He counted the dice and found he had been given 200 dice. He decided to let the number 6 represent an atom that had decayed. He mixed them up in an ice-cream container and threw them on the bench, removing all the dice that showed a 6 and counted the dice left. He did this for a total of 12 throws. His results, and the graph of these results, are shown below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Throws | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Dice Left | 200 | 164 | 141 | 114 | 97 | 80 | 70 | 52 | 44 | 37 | 32 | 24 | 21 |

a)Plot the data and complete the graph. **[3 marks]**

Marks:

title (1/2 mark)

points (2 marks)

labels (1/2 mark)

3.7 throws

b) What is the half-life of his experiment? (Also show this on the graph). \_\_\_\_\_\_\_\_ **[2 marks]**

One sixth

c) What is the chance of the dice landing with a 6 facing upwards? \_\_\_\_\_\_\_\_\_\_\_\_\_ **[1 mark]**

d) Is the rate of decay increasing, decreasing or remaining constant. Use values from the graph to justify your answer. **[3 marks]**

Half-life: half the number of die from 100 to 50 then the number of throws doubles from 3.7 to 7.4. (1 mark)

The relationship will be inversely proportional in that as the decrease in die increases the number of throws needed to get a six. (1 mark)

e) Describe how the student could have made the experiment more accurate? **[1 mark]**

Use a larger number of dice (1 mark)