

Experiment No. 13: Flash and fire point by Cleveland's open cup-apparatus

I Practical Significance

Lubricating oil selected for a job should have a flash-point and fire point which is reasonably above its working temperature. This test is of immense importance for lubricating oils. This test helps in detecting the highly volatile constituents of the oil. If they are highly volatile at ordinary temperature, the released vapour may cause fire hazards. So to ensure safety, certain temperatures are laid down for fuels and lubricating oil below which they should not give off vapour to make them burn.

II Relevant Program Outcomes (POs) and PSOs

PO3 Experiments and practice
PO10 Life-long learning

III Relevant Course Outcomes

g) Use paints, varnishes and relevant engineering materials in industry.

IV Practical Learning Outcome

Determine the flash and fire point of given lubricating oil using Cleveland open cup apparatus.

V Practical Skills

Measurement skill: Adjustment of thermometer and test flame.

VI Relevant Affective domain related Outcomes

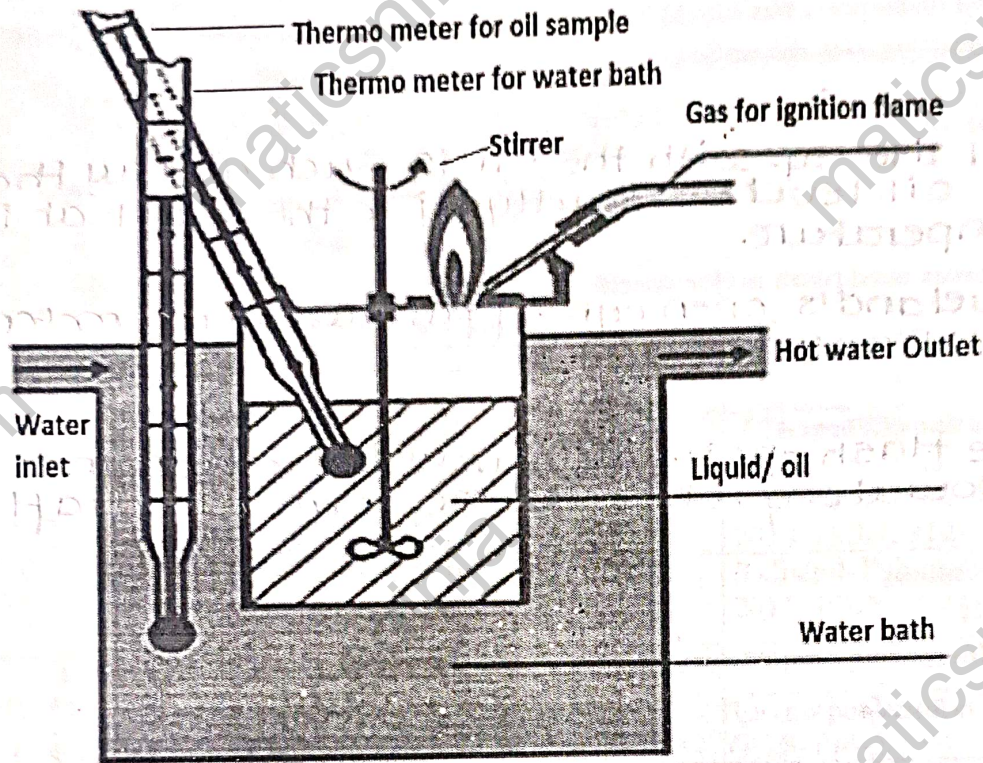
1. Maintain tools and equipments
2. Follow safety practices.

VII Minimum Theoretical Background

1. Good lubricating oil should not volatilize under the working temperature.
2. Even if some volatilization takes place, the vapours formed should not form inflammable mixture with air under the condition of lubrication. From this point of view, the flash point of lubricating oil is important.
3. If the liquid is having flash point less than 60°C , they are called flammable liquid and those with flash point above 60°C are called combustible liquid.
4. The flash point of oil is the minimum temperature at which the oil gives off sufficient vapour to ignite momentarily when a flame of standard dimension is brought near the surface of the oil for a prescribed rate in an apparatus of specified dimensions.
5. Cleveland's open cup-apparatus is generally used for determination of flash-point of fuel oils and other oils having flash-point below 79°C .
6. Fire point of oil is the lowest temperature at which it will give enough vapour, which on rising will begin to produce a continuous flame above the oil. After the flash point has been reached the oil is heated continuously at the rate of 1°C per min. and the application of the test flame is done after every 1°C rise in

temperature of oil. At certain temperature the oil will ignite and continue to burn for a period of at least 5 sec.

VIII Experimental set-up



IX Resources required (In tabular form)

| Sr. No | Name of resource | Specification | Quantity | Remark |
|--------|--------------------------------|---------------|--------------------|--------|
| 1 | Cleveland's open cup apparatus | | 05 | |
| 2 | Thermometer | | 05 | |
| 3 | Lubricating oil | | As per requirement | |

X Procedure (Step wise)

1. Fill the cup with the oil in such a way that, the oil level is exactly upto the mark at room temperature.
2. Hold the thermometer vertically by means of the clamp in such a way that, the bottom of the bulb is about 1cm above the bottom of the cup.
3. Switch on the electrical heating device and watch the thermometer reading.
4. The oil should be heated at the rate of about 3 to 5°C per minute.
5. At every degree rise of temperature, bring the standard test flame near the surface of the oil and see whether a flash appears at any point on the surface of the oil.

6. Record the minimum temperature at which a distinct flash appears on the surface of the oil in the cup as the flash-point of the oil under test.

XI Precautions

1. The flash- point test should be made in a laboratory which is free from air drafts.
2. Breathing over the surface of the oil should be avoided.

XII Actual procedure followed

Fill the cup with the oil in such a way that the oil level is exactly upto the mark at room temperature.

XIII Resources used (with major specifications)

Cleveland's open cup apparatus thermometer lubricating oil.

XIV Precautions followed

The flash -point test should be made in a laboratory which is free form air draft.

XV Observations

Table-1

| Sr. No. | Increasing temperature | Inference (No flash or flash observed) | Fire point |
|---------|------------------------|---|------------|
| 1 | 40°C | No flash | |
| 2 | 50°C | No flash | |
| 3 | 60°C | Flash | |
| 4 | 70°C | Flash | |
| 5 | 80°C | Flash | Fix |

XVI Results

- Given lubricating oil gives no flash up to... 50 °C
 Given lubricating oil gives flash up to... 70 °C
 Given lubricating oil gives fire point up to... 80 °C

XVII Interpretation of results

1. The flash point of given sample determined by Cleveland's open cup apparatus is found to be... 70 °C
2. The fire point of given sample determined by Cleveland's open cup apparatus is found to be... 80 °C.

XVIII Conclusions and Recommendations

Given, lubricating oil can be use up to 80°C working temperature.

XIX Practical Related Questions

1. Write the precautions should be taken while performing the practical.
2. For which type of oil Cleveland open cup apparatus is used to determine flash point.
3. How to mount thermometer in the oil cup.
4. At what rate oil should be heated.

XX References / Suggestions for further Reading

| Sr. No. | Title of Book | Author | Publication |
|---------|---|---------------|--|
| 1 | Engineering Chemistry | Jain and Jain | Dhanpat Rai and sons; New Delhi, 2015, ISBN : 9352160002 |
| 2 | Engineering Chemistry | Dara, S. S. | S.Chand. Publication, New Delhi, 2013, ISBN: 8121997658 |
| 3 | Experiments and calculations in engineering chemistry | Dr.S.S.Dara | S.Chand. Publication, New Delhi, 2011, ISBN: 8121908647 |
| 4 | Practical Chemistry | Dr.N.K.Verma | Laxmi publication New Delhi 81-7008-594-2 |

XXI Assessment Scheme

Process related assessment scheme


| Sr. No. | Process related | Weightage(60%) |
|---------|--------------------------------|----------------|
| 1 | For Mounting the thermometer | 15% |
| 2 | For introduction of test flame | 15% |
| 3 | For maintaining temperature | 15% |
| 4 | For temperature reading | 15% |

Product related assessment scheme

| Sr. No. | Product related | Weightage(40%) |
|---------|-------------------------------|----------------|
| 1. | Identification of flash point | 20% |
| 2. | Identification of fire point | 20% |

List of Student Team Members

1.
2.
3.
4.

| Marks Obtained | | | Dated Signature of Teacher |
|-------------------------|-------------------------|---------------|---|
| Process Related (15) | Product Related (10) | Total (25) | |
| 19 | 09 | 28 |  |

[Space to Write Answers]

Q1 — ?

i) The flash point test should be made in a laboratory which is free from air drafts which is free from air drafts.

ii) Breathing air the surface of the oil should be avoided.

Q.2 — ?

One of the earliest known identification of an oil's physical properties is its flash points references to the test associated with lamp oil, date back to the mid 19th century.

Q.3 — ?

Have you ever used a redpe that could for oil be heated to 356 or 370' wondered how short or using a deep preventing thermometer to know when the oil is not enough for flying

Q4 — ?

Heated oil is a low to costly liquid petroleum product used as a fuel oil for furnaces.