Obtain the Material Safety Data Sheets (MSDS’s) for all chemicals used in the practical. These are readily available online. Determine the Hazard Rating for each chemical, using the Risk Assessment Excel Spreadsheet available online. The Hazard Rating for each individual task is determined using the following formula:

\[ \text{Hazard Rating} = S \times F \times P \times N \]

- **S** is related of the severity of any injuries that may occur as a result of exposure to the chemical
- **F** is a measure of the frequency of the task
- **P** is a measure of the probability of an injury occurring
- **N** is dependant on the number of people exposed

**STEP 1: Severity Factor (S)**
This involves a five-step process, and uses information related to the hazard group of the chemicals involved, the amount being used and the volatility or dustiness of the chemical.

**STEP 1A: Hazard Group**
Use the R-phrases associated with the chemical to determine the appropriate Hazard Group.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>R36</td>
<td>R20</td>
<td>R23</td>
<td>R26</td>
<td>R42</td>
</tr>
<tr>
<td>R36/38</td>
<td>R20/21</td>
<td>R23/24/25</td>
<td>R26/27</td>
<td>R42/43</td>
</tr>
<tr>
<td>R38</td>
<td>R20/21/22</td>
<td>R23/24/25</td>
<td>R26/27/28</td>
<td>R45</td>
</tr>
<tr>
<td>R65</td>
<td>R20/22</td>
<td>R23/25</td>
<td>R26/28</td>
<td>R46</td>
</tr>
<tr>
<td>R67</td>
<td>R21</td>
<td>R24</td>
<td>R27</td>
<td>R49</td>
</tr>
<tr>
<td></td>
<td>R21/22</td>
<td>R24/25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R22</td>
<td>R25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68</td>
<td>R26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68/20/21</td>
<td>R27</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68/20/21/22</td>
<td>R28/29</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68/20/22</td>
<td>R30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68/21</td>
<td>R31</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68/21/22</td>
<td>R32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R68/22</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plus all substances that do not have R-phrases in groups B to E

---

Prepared by Dr Claude Farrugia – University of Malta (2007)
STEP 1B: Amount being used
Determine whether the amount of the chemical being used is small, medium or large from the following table.

<table>
<thead>
<tr>
<th></th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Less than 500g</td>
<td>500g to 500kg</td>
<td>More than 500kg</td>
</tr>
<tr>
<td>Volume</td>
<td>Less than 500ml</td>
<td>500ml to 500l</td>
<td>More than 500l</td>
</tr>
</tbody>
</table>

STEP 1C Volatility/Dustiness

For **liquids** determine whether the chemical is of low, medium or high volatility using the boiling point and operating temperature of the chemical and the graph below:

For **solids** determine whether the chemical is low, medium or high dustiness using the following definitions:

<table>
<thead>
<tr>
<th>Dustiness</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Pellet-like solid&lt;br&gt;Little dust produced or seen</td>
</tr>
<tr>
<td>Medium</td>
<td>Crystalline solid&lt;br&gt;Dust is visible but settles quickly&lt;br&gt;Dust on surfaces</td>
</tr>
<tr>
<td>High</td>
<td>Fine light powder&lt;br&gt;Dusts clouds produced&lt;br&gt;Dust is visible and remains in the air</td>
</tr>
</tbody>
</table>
STEP 1D: Control Approach
Use the hazard group, amount being used and volatility/dustiness to find the control approach from the table below:

<table>
<thead>
<tr>
<th>Amount Used</th>
<th>Low dustiness or volatility</th>
<th>Medium volatility</th>
<th>Medium dustiness</th>
<th>High dustiness or volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hazard Group A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Large</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Hazard Group B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Large</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Hazard Group C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Medium</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Large</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Hazard Group D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Large</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Hazard Group E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For all Hazard Group E substances, use control approach 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

STEP 1E: Severity Factor (S)
Use the table below to determine the severity factor from the control approach:

<table>
<thead>
<tr>
<th>Control Approach</th>
<th>Severity Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

STEP 2: Frequency Factor (F)

<table>
<thead>
<tr>
<th>F = Frequency of task</th>
<th>Frequency Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Annually</td>
<td>0.1</td>
</tr>
<tr>
<td>Annually</td>
<td>0.2</td>
</tr>
<tr>
<td>Monthly</td>
<td>1</td>
</tr>
<tr>
<td>Weekly</td>
<td>1.5</td>
</tr>
<tr>
<td>Daily</td>
<td>2.5</td>
</tr>
<tr>
<td>Hourly</td>
<td>4</td>
</tr>
<tr>
<td>Continuously</td>
<td>5</td>
</tr>
</tbody>
</table>
STEP 3: Probability Factor (P)
Determine the Probability Factor using the following table. The effect of any preventative measures taken and the circumstances of the work undertaken should be considered. Use the Hazard Symbols, R phrases and S phrases to judge what the Probability Factor should be.

<table>
<thead>
<tr>
<th>Probability Factor</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impossible</td>
<td>It is inconceivable that injury could happen</td>
<td>0.1</td>
</tr>
<tr>
<td>Unlikely</td>
<td>It is conceivable that injury could happen though it is very unlikely</td>
<td>1</td>
</tr>
<tr>
<td>Possible</td>
<td>Injury could occur but its occurrence would be unusual</td>
<td>2</td>
</tr>
<tr>
<td>Even chance</td>
<td>Injury could occur</td>
<td>3</td>
</tr>
<tr>
<td>Probable</td>
<td>Injury is sufficiently probable or no surprise when it happens</td>
<td>4</td>
</tr>
<tr>
<td>Likely</td>
<td>The occurrence of an injury is to be expected</td>
<td>5</td>
</tr>
<tr>
<td>Certain</td>
<td>It is almost certain that injury will occur</td>
<td>6</td>
</tr>
</tbody>
</table>

STEP 4: Number Factor (N)

\[
N = \text{Number of people exposed} \\
\begin{align*}
1 \text{ to } 2 \text{ persons} & \quad 1 \\
3 \text{ to } 7 \text{ persons} & \quad 2 \\
8 \text{ to } 15 \text{ persons} & \quad 3 \\
16 \text{ to } 50 \text{ persons} & \quad 4 \\
\text{More than } 50 \text{ persons} & \quad 5
\end{align*}
\]

STEP 5: Hazard Rating Number
Calculate the hazard rating number and interpretation using the following formula and table.

\[
\text{Hazard Rating} = S \times F \times P \times N
\]

<table>
<thead>
<tr>
<th>Hazard Rating Number</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5</td>
<td>Acceptable Hazard</td>
</tr>
<tr>
<td>5 – 15</td>
<td>Low Hazard</td>
</tr>
<tr>
<td>15 – 40</td>
<td>Significant Hazard</td>
</tr>
<tr>
<td>40 – 100</td>
<td>High Hazard</td>
</tr>
<tr>
<td>&gt; 100</td>
<td>Extreme Hazard</td>
</tr>
</tbody>
</table>

Prepared by Dr Claude Farrugia – University of Malta (2007)
# APPENDIX I

## EUROPEAN HAZARD SYMBOLS AND INDICATIONS OF DANGER

<table>
<thead>
<tr>
<th>Indication of Danger</th>
<th>Symbol</th>
<th>Pictogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive</td>
<td>E</td>
<td>![Explosion Symbol]</td>
</tr>
<tr>
<td>Oxidising agent</td>
<td>O</td>
<td>![Oxidizer Symbol]</td>
</tr>
<tr>
<td>Highly flammable</td>
<td>F</td>
<td>![Flammable Symbol]</td>
</tr>
<tr>
<td>Extremely flammable</td>
<td>F+</td>
<td>![Extremely Flammable Symbol]</td>
</tr>
<tr>
<td>Toxic</td>
<td>T</td>
<td>![Toxic Symbol]</td>
</tr>
<tr>
<td>Very toxic</td>
<td>T+</td>
<td>![Very Toxic Symbol]</td>
</tr>
<tr>
<td>Harmful</td>
<td>Xn</td>
<td>![Harmful Symbol]</td>
</tr>
<tr>
<td>Irritant</td>
<td>Xi</td>
<td>![Irritant Symbol]</td>
</tr>
<tr>
<td>Corrosive</td>
<td>C</td>
<td>![Corrosive Symbol]</td>
</tr>
<tr>
<td>Dangerous for the environment</td>
<td>N</td>
<td>![Dangerous for the Environment Symbol]</td>
</tr>
</tbody>
</table>
APPENDIX II
LIST OF EUROPEAN RISK PHRASES

R1: Explosive when dry
R2: Risk of explosion by shock, friction, fire or other sources of ignition
R3: Extreme risk of explosion by shock, friction, fire or other sources of ignition
R4: Forms very sensitive explosive metallic compounds
R5: Heating may cause an explosion
R6: Explosive with or without contact with air
R7: May cause fire
R8: Contact with combustible material may cause fire
R9: Explosive when mixed with combustible material
R10: Flammable
R11: Highly flammable
R12: Extremely flammable
R14: Reacts violently with water
R15: Contact with water liberates extremely flammable gases
R16: Explosive when mixed with oxidising substances
R17: Spontaneously flammable in air
R18: In use, may form flammable/explosive vapour-air mixture
R19: May form explosive peroxides
R20: Harmful by inhalation
R21: Harmful in contact with skin
R22: Harmful if swallowed
R23: Toxic by inhalation
R24: Toxic in contact with skin
R25: Toxic if swallowed
R26: Very toxic by inhalation
R27: Very toxic in contact with skin
R28: Very toxic if swallowed
R29: Contact with water liberates toxic gas.
R30: Can become highly flammable in use
R31: Contact with acids liberates toxic gas
R32: Contact with acids liberates very toxic gas
R33: Danger of cumulative effects
R34: Causes burns
R35: Causes severe burns
R36: Irritating to eyes
R37: Irritating to respiratory system
R38: Irritating to skin
R39: Danger of very serious irreversible effects
R40: Limited evidence of a carcinogenic effect
R41: Risk of serious damage to eyes
R42: May cause sensitisation by inhalation
R43: May cause sensitisation by skin contact
R44: Risk of explosion if heated under confinement
R45: May cause cancer
R46: May cause heritable genetic damage
R48: Danger of serious damage to health by prolonged exposure
R49: May cause cancer by inhalation
R50: Very toxic to aquatic organisms
R51: Toxic to aquatic organisms
R52: Harmful to aquatic organisms
R53: May cause long-term adverse effects in the aquatic environment
R54: Toxic to flora
R55: Toxic to fauna
R56: Toxic to soil organisms
R57: Toxic to bees
R58: May cause long-term adverse effects in the environment
R59: Dangerous for the ozone layer
R60: May impair fertility  
R61: May cause harm to the unborn child  
R62: Possible risk of impaired fertility  
R63: Possible risk of harm to the unborn child  
R64: May cause harm to breast-fed babies  
R65: Harmful: may cause lung damage if swallowed  
R66: Repeated exposure may cause skin dryness or cracking  
R67: Vapours may cause drowsiness and dizziness  
R68: Possible risk of irreversible effects  

R14/15: Reacts violently with water, liberating extremely flammable gases  
R15/29: Contact with water liberates toxic, extremely flammable gases  
R20/21: Harmful by inhalation and in contact with skin  
R20/22: Harmful by inhalation and if swallowed  
R20/21/22: Harmful by inhalation, in contact with skin and if swallowed  
R21/22: Harmful in contact with skin and if swallowed  
R23/24: Toxic by inhalation and in contact with skin  
R23/25: Toxic by inhalation and if swallowed  
R23/24/25: Toxic by inhalation, in contact with skin and if swallowed  
R24/25: Toxic in contact with skin and if swallowed  
R26/27: Very toxic by inhalation and in contact with skin  
R26/28: Very toxic by inhalation and if swallowed  
R26/27/28: Very toxic by inhalation, in contact with skin and if swallowed  
R27/28: Very toxic in contact with skin and if swallowed  
R36/37: Irritating to eyes and respiratory system  
R36/38: Irritating to eyes and skin  
R36/37/38: Irritating to eyes, respiratory system and skin  
R37/38: Irritating to respiratory system and skin  
R39/23: Toxic: danger of very serious irreversible effects through inhalation  
R39/24: Toxic: danger of very serious irreversible effects in contact with skin  
R39/25: Toxic: danger of very serious irreversible effects if swallowed  
R39/23/24: Toxic: danger of very serious irreversible effects through inhalation and in contact with skin  
R39/23/25: Toxic: danger of very serious irreversible effects through inhalation and if swallowed  
R39/24/25: Toxic: danger of very serious irreversible effects in contact with skin and if swallowed  
R39/23/24/25: Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed  
R39/26: Very Toxic: danger of very serious irreversible effects through inhalation  
R39/27: Very Toxic: danger of very serious irreversible effects in contact with skin  
R39/28: Very Toxic: danger of very serious irreversible effects if swallowed  
R39/26/27: Very Toxic: danger of very serious irreversible effects through inhalation and in contact with skin  
R39/26/28: Very Toxic: danger of very serious irreversible effects through inhalation and if swallowed  
R39/27/28: Very Toxic: danger of very serious irreversible effects in contact with skin and if swallowed  
R39/26/27/28: Very Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed  
R42/43: May cause sensitisation by inhalation and skin contact  
R48/20: Harmful: danger of serious damage to health by prolonged exposure through inhalation  
R48/21: Harmful: danger of serious damage to health by prolonged exposure in contact with skin  
R48/22: Harmful: danger of serious damage to health by prolonged exposure if swallowed  
R48/20/21: Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin  
R48/20/22: Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed  
R48/21/22: Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed  
R48/20/21/22: Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed  
R48/23: Toxic: danger of serious damage to health by prolonged exposure through inhalation  
R48/24: Toxic: danger of serious damage to health by prolonged exposure in contact with skin  
R48/25: Toxic: danger of serious damage to health by prolonged exposure if swallowed
R48/23/24: Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin
R48/23/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed
R48/24/25: Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R48/23/24/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R52/53: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R68/20: Harmful: possible risk of irreversible effects through inhalation
R68/21: Harmful: possible risk of irreversible effects in contact with skin
R68/22: Harmful: possible risk of irreversible effects if swallowed
R68/20/21: Harmful: possible risk of irreversible effects through inhalation and in contact with skin
R68/20/22: Harmful: possible risk of irreversible effects through inhalation and if swallowed
R68/21/22: Harmful: possible risk of irreversible effects in contact with skin and if swallowed
R68/20/21/22: Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed
APPENDIX III
LIST OF EUROPEAN SAFETY PHRASES

S1: Keep locked up
S2: Keep out of the reach of children
S3: Keep in a cool place
S4: Keep away from living quarters
S5: Keep contents under ... (appropriate liquid to be specified by the manufacturer)
S6: Keep under ... (inert gas to be specified by the manufacturer)
S7: Keep container tightly closed
S8: Keep container dry
S9: Keep container in a well-ventilated place
S10: Do not keep the container sealed
S11: Keep away from food, drink and animal feedingstuffs
S12: Keep away from ... (incompatible materials to be indicated by the manufacturer)
S13: Keep away from heat
S14: Keep away from ... (incompatible materials to be indicated by the manufacturer)
S15: Keep away from sources of ignition - No smoking
S16: Keep away from combustible material
S17: Handle and open container with care
S18: Do not use in the vicinity of open flames
S19: When using do not eat or drink
S20: When using do not smoke
S21: Do not breathe dust
S22: Do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer)
S23: Avoid contact with skin
S24: Avoid contact with eyes
S25: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S26: Take off immediately all contaminated clothing
S27: After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer)
S28: Do not empty into drains
S29: Never add water to this product
S30: Take precautionary measures against static discharges
S31: This material and its container must be disposed of in a safe way
S32: Wear suitable protective clothing
S33: Wear suitable gloves
S34: In case of insufficient ventilation wear suitable respiratory equipment
S35: Wear eye/face protection
S36: To clean the floor and all objects contaminated by this material use ... (to be specified by the manufacturer)
S37: During fumigation/spraying wear suitable respiratory equipment (appropriate wording to be specified by the manufacturer)
S38: In case of fire use ... (indicate in the space the precise type of fire-fighting equipment. If water increases the risk add - Never use water)
S39: In case of accident or if you feel unwell seek medical advice immediately (show the label where possible)
S40: If swallowed, seek medical advice immediately and show this container or label
S41: Keep at temperature not exceeding ... °C (to be specified by the manufacturer)
S42: Keep wet with ... (appropriate material to be specified by the manufacturer)
S43: Avoid exposure - obtain special instructions before use
S44: Observe all instructions and material data sheets
S45: If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label
S46: In case of accident by inhalation: remove casualty to fresh air and keep at rest
S47: Dispose of this material and its container at hazardous or special waste collection point
S48: Use appropriate containment to avoid environmental contamination
S49: Refer to manufacturer/supplier for information on recovery/recycling
S50: Do not mix with ... (to be specified by the manufacturer)
S51: Use only in well-ventilated areas
S52: Not recommended for interior use on large surface areas
S53: Avoid exposure - obtain special instructions before use
S54: Dispose of this material and its container at hazardous or special waste collection point
S55: Use appropriate containment to avoid environmental contamination
S56: Refer to manufacturer/supplier for information on recovery/recycling
S57: This material and its container must be disposed of as hazardous waste
S58: Avoid release to the environment. Refer to special instructions/safety data sheet
S59: If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label
S60: In case of accident by inhalation: remove casualty to fresh air and keep at rest
S61: If swallowed, rinse mouth with water (only if the person is conscious)
S1/2: Keep locked up and out of the reach of children
S3/7: Keep container tightly closed in a cool place
S3/7/9: Keep container tightly closed in a cool, well-ventilated place
S3/9/14: Keep in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer)
S3/9/14/49: Keep only in the original container in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer)
S3/9/49: Keep only in the original container in a cool, well-ventilated place
S3/14: Keep in a cool place away from ... (incompatible materials to be indicated by the manufacturer)
S7/8: Keep container tightly closed and dry
S7/9: Keep container tightly closed and in a well-ventilated place
S7/47: Keep container tightly closed and at temperature not exceeding ... °C (to be specified by the manufacturer)
S20/21: When using do not eat, drink or smoke
S24/25: Avoid contact with skin and eyes
S27/28: After contact with skin, take off immediately all contaminated clothing, and wash immediately with plenty of ... (to be specified by the manufacturer)
S29/35: Do not empty into drains; dispose of this material and its container in a safe way
S29/56: Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point
S36/37: Wear suitable protective clothing and gloves
S36/37/39: Wear suitable protective clothing, gloves and eye/face protection
S36/39: Wear suitable protective clothing and eye/face protection
S37/39: Wear suitable gloves and eye/face protection
S47/49: Keep only in the original container at temperature not exceeding ... °C (to be specified by the manufacturer)