## Assessment of Knowledge

## – Marking Guide

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| **Qualification** | 22329VIC Course in Heating, Ventilation and Air Conditioning Services |

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| **Unit Number** | VU22583 |
| **Unit Name** | Handle Class A2/A2L Flammable Refrigerants |

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| **Event ID** | Knowledge Assessment 1 - Open Book |

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| **Student Name** |  |
| **RTO Identifier** |  |
| **Class/Group ID** |  |

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| **Student Declaration** | * I confirm that no part of this assessment has been copied from any other source.
* This assessment contains my own work.
* Where reference to other people’s work has been permitted, I have identified the source.
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| **Student Signature** |  | **Date** |  |

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| Overview | This is a knowledge assessment designed to obtain evidence of your knowledge safely handling, using, transporting, storing and disposing of A2/A2L classified flammable refrigerants.It includes working safely while pressure testing, evacuating, charging and recovering A2/A2L refrigerant from an R32 split air conditioning system; complying with relevant legislative, regulatory/licensing, standards and codes requirements; relevant performance characteristics; manufacturer’s recommendations/ instructions and industry practices; and completing the necessary documentation.Read each question carefully.For **Multiple choice** type questions, place a circle around the letter at the beginning of the correct answer.For **Missing Word** type questions, complete the sentence by writing the correct words in the spaces provided.For **Short Answer** type questions, write a brief but accurate response in the space provided.For **Matching** type questions, place a letter alongside the correct response in the space provided.For **Calculation** type questions, show all working out and place your final answer in the space provided. |
| Items Required | The training facility will provide access to any equipment necessary to demonstrate the knowledge covered in this assessment event. You will be required to provide the appropriate:* Pens/Pencils
* Scientific calculator
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| Instructions to Student | * Mobile phones are to be turned off and removed from your person.

 You cannot access a mobile phone during this test.* You may use any text or reference book or notes for this assessment.
* All examination papers and other working papers to be clearly marked with your name.
* The whole of this assessment is to be handed to the Assessor upon completion.
* All sections must be attempted
 |
| Validation and Sponsorship | This assessment has been approved for use by representatives of the Refrigeration and Air Conditioning Industry Validation Committee. This training facility can provide further details upon request. |
| Industry Support | This assessment has been produced by the Australian Refrigeration Council and Refrigerants Australia. |

**K1 - Types, composition and applications of typical A2/A2L refrigerants including R32 and R1234yf**

* 1. Under AS/NZS ISO 817: Refrigerants – Designation and Safety Classifications, class A2L refrigerants are:
1. Higher Flammability and lower toxicity
2. No-Flame Propagation and higher toxicity
3. Flammable and lower toxicity
4. Lower Flammability and lower toxicity
	1. The HydroFluoro-Olefins (HFO) refrigerants are a mix of \_\_Hydrogen Fluorine\_\_\_ and \_\_\_Carbon.
	2. R32 will only ignite when within a \_\_14\_\_ % to \_\_\_29\_\_ % mixture with air or oxygen.
	3. List four sources of ignition applicable to A2/A2L refrigerants.

(The assessor may accept any response that is similar to the following)

1. Sparks from electrical equipment \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Welding and cutting tools \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Open flames \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Smoking\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	1. Which A2/A2L refrigerant is now most commonly used by manufacturers of:
5. Residential split air conditioners? \_\_\_\_\_R32\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Automotive air conditioners? \_\_\_\_\_R1234yf\_\_\_\_\_\_\_\_\_\_\_\_\_
	1. Is R32 suitable as a drop-in replacement for an R410A air conditioning? YES / NO

Explain why.

(The assessor may accept any response that is similar to the following statement)

R410A systems are not design for flammable refrigerants and will not meet the requirements of the relevant Standards.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. In accordance with AS/NZS 5149, determine the minimum floor area of a room required for a 12kw wall mounted split air conditioning system pre-charged with 2.5kg of R32.

\_\_\_5.91 m2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**K2 - Transport requirements of A2/A2L refrigerants**

* 1. List below four (4) requirement for transporting A2/A2L refrigerant cylinders in a vehicle.

(The assessor may accept any response that is similar to the following)

1. Secure and upright\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Safe from sources of ignition\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Not in an unventilated van, unless in a purpose built compartment or cabinet.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Check for leaks from valves\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	1. The Australian Dangerous Goods (Road and Rail Transport) Regulation applies to the transport by a person of a load of dangerous goods if the load contains dangerous goods in a receptacle with a capacity of more than:
5. 50 litres.
6. 500 litres.
7. 100 litres.
8. 1000 litres.
	1. What does the Australian Dangerous Goods Code classify A2/A2L refrigerants as?
9. 2.1 Flammable Gas
10. 2.2 Gas that is not flammable and not toxic but can cause asphyxiation
11. 2.3 Toxic Gas
12. 2.4 Flammable Liquid

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**K3 - Disposal of contaminated of A2/A2L refrigerants**

* 1. The compressor in an R32 air conditioning system has burnt out and contaminated the refrigerant. To replace the compressor, that refrigerant must be:
1. Released into the atmosphere
2. Recovered into any refrigerant recovery cylinder
3. Recovered into an R32 refrigerant cylinder
4. Recovered into a flammable refrigerant recovery cylinder

*Note: There are 2 correct answers to the following question.*

* 1. The R1234yf refrigerant contained in end-of-life air conditioning equipment can be:
		1. Released into the atmosphere
		2. Recovered into any refrigerant recovery cylinder
		3. Recovered into an R1234yf refrigerant cylinder
		4. Recovered into a flammable refrigerant recovery cylinder

**K4 - Compatibility issues with class A1 refrigerant lubricants**

* 1. Which type of compressor lubricant can be used with A2/A2L refrigerants.

\_\_Polyol ester (POE) oils \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Which 2 types of A1 refrigerant lubricants are NOT compatible with A2/A2L refrigerants.

\_\_Mineral oil (MO) or Polyalpha Olefin (PAO)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**K5 - Pipe sizing requirements for A2/A2L refrigerants**

* 1. An existing R22 split air conditioning system is to be replaced by a R32 system. List below four (4) factors that must be considered together to determine if the existing interconnecting refrigerant pipework can be used for R32.

(The assessor may accept any response that is similar to the following)

1. \_Existing R22 pipe diameters and wall thickness
2. \_R32 system manufacturers recommended pipe diameters and wall thickness
3. \_Required length of R32 pipework
4. \_Condition of the existing pipework

**K6 - Requirements for making joints and special tools for A2/A2L refrigerants**

* 1. Standard AS/NZS 5149.2:2016 Clause 5.2.3.7 which was modified by Appendix ZZ for Australia and New Zealand states that:

“Specific requirements for the installation of piping for equipment intended to use A2, A3, B2 or B3 refrigerants: Piping and joints of a split system shall be made with \_\_permanent\_\_ joints when inside an occupied space, except joints directly connecting the piping to \_\_\_ indoor\_\_\_\_ units”

Use some of the following words to correctly complete the statement:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TEMPORARY** | **PERMANENT** | **INDOOR** | **OUTDOOR** | **FLARE** |

* 1. Where flammable refrigerants are used, no valves or detachable joints can be located in areas \_\_\_accessible\_\_\_ to the general public. \_\_Soldered \_\_\_joints are preferred to \_\_flared\_\_ joints to minimise the chances of refrigerant leakage.

Use some of the following words to correctly complete the statement:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ACCESSIBLE**  | **INACCESSIBLE**  | **FLARED** | **SOLDERED** | **SWAGED** |

* 1. A2L refrigerants are generally \_\_\_Not compatible\_\_\_ with the R410A recovery units due to the \_\_\_\_flammability\_\_\_\_ of the refrigerant.

Use some of the following words to correctly complete the statement:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COMPATIBLE**  | **NON-FLAMMABILITY** | **NOT COMPATIBLE** | **FLAMMABILITY** | **TOXICITY** |

* 1. A new or existing vacuum pump that is to be used with R32 systems must to be assessed to ensure that:

(The assessor may accept any response that is similar to the following)

1. \_It conforms with relevant Standards.
2. \_The manufacturer’s manual/specification states that it is designed for use with A2/A2L flammable refrigerants.
3. \_All of its electrical components are non arcing.

**K7 - Current relevant Regulations, Standards, Codes and Guides for use of A2/A2L flammable refrigerants**

* 1. Acts and Regulations are legal documents produced by \_National\_ and \_State\_\_governments to protect the individual members of their societies.

Use some of the following words to correctly complete the statement:

|  |  |  |  |
| --- | --- | --- | --- |
| **NATIONAL**  | **LOCAL**  | **STATE** | **INTERNATIONAL** |

* 1. Under AS/NZS ISO 817: Refrigerants – Designation and Safety Classifications, class A2 refrigerants are:
1. Higher Flammability and lower toxicity
2. No-Flame Propagation and lower toxicity
3. Flammable and lower toxicity
4. Lower Flammability and lower toxicity
	1. AS/NZS 60335.2.40 Household and similar electrical appliances — Safety, Part 2.40 covers the particular requirements for :
5. commercial electric dishwashing machines
6. electrical heat pumps, air-conditioners and dehumidifiers
7. motor-compressors
8. commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor
	1. AS/NZS 5149.4: Refrigerating Systems and Heat Pumps – Safety and Environmental Requirements, Part 4: Operation, maintenance, repair and recovery, Appendix ZZ states that recovered refrigerant of different:
9. Flammability shall not be mixed
10. Flammability can be mixed
11. Toxicity can be mixed
12. Type shall not be mixed
	1. The Refrigerant Handling Code of Practice requires that when a refrigerating system is evacuated that a vacuum of:
13. 600 microns is achieved and once isolated for 60 minutes it must not remain below 1000 microns.
14. 500 microns is achieved and once isolated for 30 minutes it must not remain below 900 microns.
15. 50 microns is achieved and once isolated for 30 minutes it must not remain below 60 microns.
16. 500 microns is achieved and once isolated for 60 minutes it must remain below 600 microns.

**K8 - First aid issues and symptoms that result from short and long-term effects of contact, swallowing, splashing or inhalation for A2/A2L refrigerants**

* 1. List below three (e) effects of Short Term bodily exposure to R32 refrigerant:

(The assessor may accept any response that is similar to the following)

* 1. \_ Frostbite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. \_Asphixiation\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. \_Dizziness\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. The Long Term exposure to R1234yf refrigerant in an oxygen deficient atmosphere may affect the \_\_heart\_\_\_and the \_\_\_nervous\_\_\_\_\_ system.:

Use some of the following words to correctly complete the statement:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **KIDNEY**  | **NERVOUS**  | **HEART** | **CIRCULATION** | **BRAIN** |

**K9 - A2/A2L refrigerant cylinders requirements including pressure ratings, pressure relief devices, outlet connection type and recovery cylinders**

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| * 1. The colour coding recommended for cylinders used to store A2/A2L refrigerants is:
1. Top or Band 1:\_Red\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Second or Band 2: \_White\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Body of Cylinder: \_\_Galvanised or White\_\_\_\_\_\_
	1. The A2/A2L refrigerant cylinders must be rated at a minimum of \_\_\_4,200 kPa\_\_\_, be fitted a pressure relief valve, DIN 477-1 access valves with a \_\_left-hand thread outlet and a \_\_Flammable\_\_Gas symbol.
 |

Use some of the following words to correctly complete the statement:

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| --- | --- | --- | --- | --- | --- |
| **4,200**  | **LEFT**  | **2,400** | **RIGHT** | **NON-FLAMMABLE** | **FLAMMABLE** |

**K10 - Relevant State/Territory and national licensing requirements for A2/A2L refrigerants**

* 1. R1234yf refrigerant is covered under the following:
1. Ozone Protection and Synthetic Greenhouse Gas Management Regulations
2. Queensland’s Petroleum and Gas (Production and Safety) Regulation
3. Montreal Protocol
4. State/Territory Work Health and Safety Regulations
	1. Circle the refrigerants listed below that are covered under Australia’s Ozone Protection and Synthetic Greenhouse Gas Management legislation.
5. R1234yf
6. R32
7. R600
8. R410a
9. R134a

## Assessment Feedback

***NOTE: This section must have the assessor signature and student signature to complete the feedback.***

### Assessment outcome

[ ]  Satisfactory [ ]  Unsatisfactory

### Assessor Feedback

|  |  |  |
| --- | --- | --- |
| YES | NO |  |
|  |  | This assessment event was successfully completed |
|  |  | Reasonable adjustment was in place for this assessment event*(If yes, ensure it is detailed on the assessment document)* |

Comments:

### Assessor name, signature and date:

### Student acknowledgement of assessment outcome

Would you like to make any comments about this assessment?

### Student name, signature and date

***NOTE: Make sure you have placed your initials at the bottom of each page of this document before submitting to your assessor***