

# CBSE | DEPARTMENT OF SKILL EDUCATION

## Air Conditioning & Refrigeration (Subject Code - 827)

### MARKING SCHEME FOR CLASS XI (SESSION 2024 - 2025)

Max. Time: 3 Hours

Max. Marks: 60

#### General Instructions:

1. Please read the instructions carefully.
2. This Question Paper consists of **24 questions** in two sections – Section A & Section B.
3. Section A has Objective type questions whereas Section B contains Subjective type questions.
4. **Out of the given (6 + 18 =) 24 questions, a candidate has to answer (6 + 11 =) 17 questions in the allotted (maximum) time of 3 hours.**
5. All questions of a particular section must be attempted in the correct order.
6. **SECTION A - OBJECTIVE TYPE QUESTIONS (30 MARKS):**
  - i. This section has 06 questions.
  - ii. There is no negative marking.
  - iii. Do as per the instructions given.
  - iv. Marks allotted are mentioned against each question/part.
7. **SECTION B – SUBJECTIVE TYPE QUESTIONS (30 MARKS):**
  - i. This section contains 18 questions.
  - ii. A candidate has to do 11 questions.
  - iii. Do as per the instructions given.
  - iv. Marks allotted are mentioned against each question/part.

## **SECTION A: OBJECTIVE TYPE QUESTIONS**

Q. No.	QUESTION	Source Material (NCERT/PSSCIVE/ CBSE Study Material)	Unit/ Chap. No.	Page no. of source material	Marks
<b>Q. 1</b>	<b>Answer any 4 out of the given 6 questions on Employability Skills (1 x 4 = 4 marks)</b>				
i.	C) Writing	CBSE Study Material/ NCERT Employability Skill	Unit-01	03	<b>1</b>
ii.	b) Cntl+n	CBSE Study Material/ NCERT Employability Skill	Unit-03	109	<b>1</b>
iii.	C) Principles or standards of behaviour influencing attitude and actions	CBSE Study Material/ NCERT Employability Skill	Unit-02	69	<b>1</b>
iv.	b) A person who tries to meet customer needs through new ideas or ways of doing business and makes a profit	CBSE Study Material/ NCERT Employability Skill	Unit-04	138	<b>1</b>
v.	C) It helps us stay healthy and creates a good image.	CBSE Study Material/ NCERT Employability Skill	Unit -02	81	<b>1</b>
vi.	b) Air and water pollution, waste management, and biodiversity conservation	CBSE Study Material/ NCERT Employability Skill	Unit-05	176	<b>1</b>
<b>Q. 2</b>	<b>Answer any 5 out of the given 7 questions (1 x 5 = 5 marks)</b>				
i.	c) Receiver tank	Study Material	Unit-02	32	<b>1</b>
ii.	b) The relationship between heat and other forms of energy	Study Material	Unit-01	06	<b>1</b>
iii.	c) Centrifugal compressor	Study Material	Unit-03	53	<b>1</b>
iv.	c) Dry air mixed with water vapor (moist air)	Study Material	Unit-05	87	<b>1</b>
v.	c) Volt	Study Material	Unit-04	72	<b>1</b>
vi.	c) Mechanical or heat energy to operate the heat pump	Study Material	Unit-06	102	<b>1</b>
vii.	c) Multi-meter	Study Material	Unit-04	79	<b>1</b>
<b>Q. 3</b>	<b>Answer any 6 out of the given 7 questions (1 x 6 = 6 marks)</b>				
i.	a) Open compressor	Study Material	Unit-003	56	<b>1</b>
ii.	c) Wet bulb depression	Study Material	Unit-05	89	<b>1</b>
iii.	c) The flow of electrons through a circuit	Study Material	Unit-04	7	<b>1</b>
iv.	b) Copper	Study Material	Unit-06	103	<b>1</b>
v.	c) Polytropic compression	Study Material	Unit-02	42	<b>1</b>

vi.	c) Connection by ducts with various rooms	Study Material	Unit-06	109	1
vii.	b) Removing heat from a substance under controlled conditions.	Study Material	Unit-01	9	1
<b>Q. 4</b>	<b>Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)</b>				
i.	d) If two bodies are in thermal equilibrium with a third body, they are in thermal equilibrium with each other.	Study Material	Unit-01	09	1
ii.	c) To protect the compressor motor by connecting the supply when the temperature exceeds safe limits	Study Material	Unit-04	82	1
iii.	c) Preferable for low temperature applications	Study Material	Unit-03	58	1
iv.	b) Light intensity	Study Material	Unit-05	97	1
v.	c) To put auxiliary windings in the circuit at startup	Study Material	Unit-02	46	1
vi.	d) Central air conditioning plants	Study Material	Unit-06	108	1
<b>Q. 5</b>	<b>Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)</b>				
i.	b) Cooling Coil	Study Material	Unit-03	68	1
ii.	c) Willis Haviland Carrier	Study Material	Unit-01	10	1
iii.	c) It is the rate of doing work	Study Material	Unit-04	72	1
iv.	c) By running refrigerant coils alongside water tubes	Study Material	Unit-02	46	1
v.	d) At the bottom of the console	Study Material	Unit-06	108	1
vi.	c) Climatic and seasonal differences	Study Material	Unit-05	101	1
<b>Q. 6</b>	<b>Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)</b>				
i.	c) Heavier clothing requires a higher optimum temperature	Study Material	Unit-05	100	1
ii.	c) Ton of Refrigeration (TR)	Study Material	Unit-01	11	1
iii.	c) Starting capacitor	Study Material	Unit-04	85	1
iv.	b) Electronic leak detector	Study Material	Unit-02	48	1
v.	D) Capillary Tube	Study Material	Unit-03	68	1
vi.	b) The heat which brings about a change of state with no change in temperature.	Study Material	Unit-01	13	1

## **SECTION B: SUBJECTIVE TYPE QUESTIONS**

Q. No.	QUESTION	Source Material (NCERT/PSSCIVE/ CBSE Study Material)	Unit/ Chap. No.	Page no. of source material	Marks
<b>Answer any 3 out of the given 5 questions on Employability Skills in 20 – 30 words each (2 x 3 = 6 marks)</b>					
<b>Q. 7</b>	To change the font style and size, select the text, click on the font dropdown in the toolbar, and choose the desired style and size.	CBSE Study Material/ NCERT Employability Skill	Unit-03	119	<b>2</b>
<b>Q. 8</b>	Correct pronunciation helps express yourself clearly and confidently, ensuring others can easily understand your words.	CBSE Study Material/ NCERT Employability Skill	Unit-01	17	<b>2</b>
<b>Q. 9</b>	The NAPCC is an action plan that includes various missions aimed at sustainable development, each with a specific action date and budget.	CBSE Study Material/ NCERT Employability Skill	Unit-05	176	<b>2</b>
<b>Q. 10</b>	Knowing your identity is important because it helps you measure your strengths and weaknesses, guiding personal growth and self-improvement.	CBSE Study Material/ NCERT Employability Skill	Unit-	70	<b>2</b>
<b>Q. 11</b>	A manufacturing business converts raw materials into finished products to meet customer demands. For example, Ojasvi's factory, which produces purified packaged drinking water, is a manufacturing business because it processes raw materials into a finished product that is sold directly to customers.	CBSE Study Material/ NCERT Employability Skill	Unit-04	139	<b>2</b>
<b>Answer any 3 out of the given 5 questions in 20 – 30 words each (2 x 3 = 6 marks)</b>					
<b>Q. 12</b>	In the condenser, the high-temperature, high-pressure refrigerant vapour gives off heat to cooler air, causing its temperature to drop to the saturation temperature, leading to condensation into a liquid state.	Study Material	Unit-03	32-34	<b>2</b>
<b>Q. 13</b>	The surroundings are everything outside the boundaries of a thermodynamic system. They interact with the system by exchanging energy and matter, influencing the thermodynamic processes taking place within the system.	Study Material	Unit-01	06	<b>2</b>
<b>Q. 14</b>	The evaporator provides a heat transfer surface through which heat passes from the refrigerated space or product into the vaporizing refrigerant, thus cooling the space or product.	Study Material	Unit-02	32	<b>2</b>
<b>Q. 15</b>	A thermostat is a thermal switch that automatically cuts off the supply to the refrigerator when the temperature reaches -7°C in the freezer and 10°C in other parts. It reconnects the supply when the temperature rises, maintaining the desired temperature.	Study Material	Unit-04	82	<b>2</b>
<b>Q. 16</b>	Relative humidity is the ratio of the actual mass of water vapour in a given volume of moist air to the mass of water vapour in the same volume of saturated air at the same temperature and pressure.	Study Material	Unit-05	89	<b>2</b>

<b>Answer any 2 out of the given 3 questions in 30– 50 words each (3 x 2 = 6 marks)</b>					
<b>Q. 17</b>	The suction line conveys low-pressure vapour from the evaporator to the compressor. During this process, the vapour often absorbs heat from the surrounding air, becoming superheated. Despite this temperature increase, the vapour pressure remains constant until it enters the compressor for further processing.	Study Material	Unit-02	34	<b>3</b>
<b>Q. 18</b>	Boundaries in a thermodynamic system are crucial as they separate the system from its surroundings and define the limits within which thermodynamic processes occur. For instance, in a tank of compressed gas, the tank's walls form fixed boundaries. These walls prevent the gas from escaping, allowing the study of pressure, temperature, and volume changes within the confined space.	Study Material	Unit-01	06	<b>3</b>
<b>Q. 19</b>	Vertical compressors are single acting, compact, and enclosed, requiring less floor space. Horizontal compressors are double acting, needing more installation space due to their design with crankshaft, connecting rod, cross head, and piston rod.	Study Material	Unit-03	56	<b>3</b>
<b>Answer any 3 out of the given 5 questions in 50– 80 words each (4 x 3 = 12 marks)</b>					
<b>Q. 20</b>	Single acting reciprocating compressors compress vapor on one side of the piston per crankshaft revolution, limiting their efficiency and output compared to double acting compressors. They are typically smaller and vertically oriented, suitable for applications where space is constrained and moderate compression ratios suffice. In contrast, double-acting compressors compress vapor on both sides of the piston, offering higher efficiency and compression ratios. They are larger and horizontally designed, making them suitable for industrial settings requiring continuous operation and higher output capacities.	Study Material	Unit-03	56	<b>4</b>
<b>Q. 21</b>	A winter air conditioning system is designed to heat the air while often incorporating humidification to maintain comfort. The system typically includes heating elements that raise the temperature of incoming air to desired levels, ensuring indoor spaces remain warm during colder months. In addition to heating, humidification may be employed to increase relative humidity levels, preventing discomfort caused by dry air.	Study Material	Unit-06	105	<b>4</b>

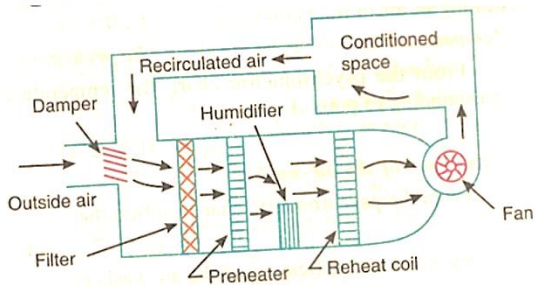
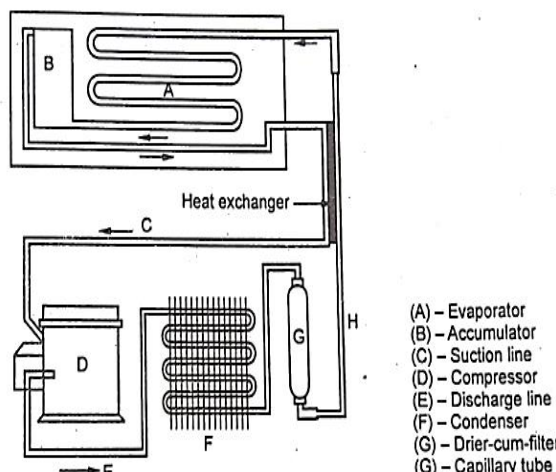


Fig 1.1

The schematic arrangement involves air being drawn into the system, heated by a heat source (e.g., electric heaters or gas-fired furnaces), and then distributed throughout the space via ducts or vents. Humidification, if required, is integrated into the system to balance humidity levels for optimal comfort. This ensures occupants remain comfortable and productive in indoor environments during winter conditions.

<p><b>Q. 22</b></p>	<ol style="list-style-type: none"> <li>1. Manifold Gauge Set: Used to measure the pressure of refrigerants in the system.</li> <li>2. Refrigerant Recovery Machine: Safely removes refrigerant from a system for recovery, recycling, or disposal.</li> <li>3. Vacuum Pump: Removes air and moisture from the refrigeration system before charging it with refrigerant.</li> <li>4. Thermometer: Measures temperatures in various parts of the system.</li> <li>5. Refrigerant Scale: Weighs refrigerant accurately during charging or recovery.</li> <li>6. Pipe Cutter: Cuts copper or aluminum tubing used in refrigeration systems.</li> <li>7. Flaring Tool: Creates a flared end on the tubing for secure connections.</li> <li>8. Brazing Torch: Joins metal parts together using a filler metal with a higher melting point than solder.</li> <li>9. Leak Detector: Identifies leaks in the refrigeration system.</li> <li>10. Clamp Meter: Measures the current flowing through a conductor without direct contact.</li> <li>11. Service Wrenches: Tighten or loosen service valves and other fittings in refrigeration systems.</li> </ol>	<p>Study Material</p>	<p>Unit-01</p>	<p>15-30</p>	<p><b>4</b></p>
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<p><b>Q. 23</b></p>	<p>The domestic refrigerator operates on a closed-loop refrigeration cycle. The hermetically sealed compressor (D) compresses the low-pressure refrigerant vapor from the evaporator (A), raising its temperature and pressure. The compressed vapor then moves through the discharge line (E) into the condenser (F), where it releases heat to the surrounding air and condenses into a high-pressure liquid. This liquid passes through a drier cum filter (G) and enters the capillary tube (H), which regulates flow into the evaporator. Inside the evaporator, the liquid refrigerant absorbs heat, evaporating to low pressure, and the cycle repeats. The accumulator (B) ensures no liquid enters the compressor.</p>  <p>(A) – Evaporator  (B) – Accumulator  (C) – Suction line  (D) – Compressor  (E) – Discharge line  (F) – Condenser  (G) – Drier-cum-filter  (H) – Capillary tube</p>	<p>Study Material</p>	<p>Unit-02</p>	<p>44</p>	<p>4</p>
<p><b>Q. 24</b></p>	<p>Psychrometry is crucial in engineering as it deals with the study of moist air, which is a mixture of dry air and water vapor. It encompasses understanding how this mixture behaves under different conditions of temperature and pressure. Engineers use psychrometric principles to analyze and manipulate air properties such as humidity, enthalpy, and dew point, essential for designing efficient HVAC systems, industrial drying processes, and environmental control in buildings. By studying psychrometric charts and terms like dry air, moist air, and saturated air, engineers can optimize indoor air quality, comfort levels, and energy efficiency in various applications.</p>	<p>Study Material</p>	<p>Unit-05</p>	<p>88</p>	<p>4</p>