CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS
ASSESSMENT SUMMARY

The assessment activities for *CPCSUS4002 Use building science principles to construct energy efficient buildings* cover all aspects of the unit of competency. For Apprentices/Trainees, this includes supervisor completion of the Apprentice/Trainee Record (ATR).

Participants must read all the information given before starting any assessment task. The assessment tasks are intended to be fair, flexible, valid and reliable. If a Participant has any questions or requires alternative arrangements to be made such requests should be directed to their Trainer/Assessor, who should note such arrangements in the 'Assessor Comments' on the affected assessment. If a Participant feels they are not yet ready to be assessed, they should discuss their options with their Trainer/Assessor.

To satisfactorily complete the assessment, the Participant is required to answer all questions correctly and demonstrate their skills to industry standards. If a Participant does not answer all questions or perform all tasks, they will be deemed 'Not Satisfactory' for the task and 'Not Yet Competent' for the unit of competency.

The Trainer/Assessor can provide the Participant with additional information on interpreting the assessment outcomes and guide the Participant's options. If a Participant is still deemed 'Not Satisfactory' they will have the opportunity to undertake a supplementary assessment or appeal the result as per the process in the Student Handbook.

By signing below, the Participant acknowledges:
- They understand the assessment instructions and requirements, and consent to being assessed.
- The work submitted is to be their own work – with the work of/with others needing to be clearly acknowledged and documented.
- They consent to any photo/video recording of their work that occurs during assessment.

Participant name	Rex Henderson
Participant signature	R.H.

Pre-requisite unit(s) to be achieved and authenticated prior to undertaking assessment
☑ Not applicable

Task	**Date completed**	**Assessment Results**	
Theory Exam	Select Date.	☐ Satisfactory	☐ Not Satisfactory
Workbook	Select Date.	☐ Satisfactory	☐ Not Satisfactory
Practical Assessment	Select Date.	☐ Satisfactory	☐ Not Satisfactory
Outcome for CPCSUS4002	Select Date.	☐ **Competent**	☐ **Not Yet Competent**

Evidence requirements checklist (ticked by assessor and evidence supplied to RTO)	
☐ Theory Exam	☐ Residential Construction Energy Efficiency report
☐ Workbook	☐ Commercial Construction Energy Efficiency report
☐ Practical Assessment	

Assessor name	
Assessor signature	

CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

THEORY EXAM

Participant name	Rex Henderson

FOR THE PARTICIPANT
Instructions

• You will complete written questions as outlined on the following pages. You must attempt all questions and provide enough detail in your responses to demonstrate your knowledge.
• It is anticipated that you should complete this assessment within two (2) hours, but additional time may be allowed upon negotiation with the Assessor.
• You must complete all questions unassisted by the Assessor or other personnel but may refer to reference material as needed. All questions must be answered correctly for a 'Satisfactory' assessment outcome to be awarded.
  ○ An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
  ○ Any written questions that are incomplete, or not answered satisfactorily will need to be completed again after further training support.
  ▪ If you answer a question incorrectly but modify your response, put your initials next to the written change (or the Assessor must initial a verbal change).

Resources required
Pen

FOR THE ASSESSOR
Instructions
• Where oral examination has occurred, ensure that this is acknowledged in writing (e.g. FT001 and Assessor Comments) • All questions must be satisfactorily demonstrated by the Participant for a Satisfactory determination (indicated by an Assessor tick to the right of the question). • Assessors are to complete marking in pen of a different colour to the Participant. • If the Participant verbally modifies their response, write in the modified response verbatim and put your initials next to the written change.

ASSESSOR COMMENTS
As necessary, outline: • Details on reattempts, alternative arrangements or reasonable adjustments made. • Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

Q1. **Define systems theory.**

Answer

Q2. **Below are elements of an energy-efficient building. Basing on systems theory, explain how each element (part of a system) contributes to the overall energy efficiency of a building (whole system).**

Answer

Element	Explanation
Thermal envelope	The energy efficiency of a building's thermal envelope is critical in maintaining indoor comfort while minimizing energy consumption. The thermal envelope includes all the building components that separate the interior from the exterior environment, such as walls, roofs, windows, doors, and floors.
Ventilation	• **Controlled Ventilation**: Mechanical ventilation systems with heat recovery ventilators (HRVs) or energy recovery ventilators (ERVs) maintain indoor air quality while minimizing energy loss. • **Natural Ventilation**: Designing for natural ventilation can reduce reliance on mechanical systems while maintaining comfort.
Cooling system	Cooling systems are crucial for maintaining indoor comfort in buildings, especially in warmer climates. These systems can vary widely in complexity, efficiency, and suitability for different types of buildings.

Q3. **Clarify health risks and considerations associated with the following building types and indoor activities that must be considered.**

Answe

Type of building	Indoor activity	Risks	Health and safety considerations
House	Cooking	Indoor air quality Exposure to smoke and odours Fire and burn hazards Chemical exposure Ergonomics and physical safety	Ventilation, using exhaust fans, open windows, keeping flammable materials away from heat sources. Using ergonomically designed kitchens, appliances etc.
House	Washing	Mold and mildew Physical strain Dish washing Hot water burns Chemical exposure	Improved ventilation Ergonomic design Regular maintenance and cleaning Safe handling of chemicals
Factory	Roof tile manufacturing	Engineering controls Administrative controls PPE Regular monitoring and maintenance	Dust suppression and ventilation system Training and education Respiratory protection and hearing protection Equipment maintenance and emergency plans
School	Laboratory experiment	Chemical hazards Chemical spills Biological hazards Physical hazards	Training and learning Safety equipment Supervision and monitoring Planning, clear communication and signs.

Q4. **Explain how failing to meet requirements for minimisation of heat gain in summer can affect the building occupants' health.**

Answer

Failing to minimize heat gain in a building during summer can have significant negative impacts on the health and well-being of its occupants.

Failing to minimize heat gain in a building during summer can lead to health issues such as heat stress, dehydration, respiratory problems, sleep disturbances, cardiovascular strain, and negatively impact mental well-being, particularly affecting vulnerable populations like the elderly, infants, and individuals with chronic illnesses.

Q5. **Discuss three (3) challenges and considerations to be made, related to beachfront buildings.**

Answer

Beachfront buildings encounter distinct challenges stemming from their exposure to saltwater, high humidity, and coastal weather patterns. These environmental factors accelerate the degradation of building materials, leading to corrosion of metal components and deterioration of exterior finishes. To mitigate these effects, construction must utilize corrosion-resistant materials such as stainless steel and marine-grade coatings,

Moreover, the vulnerability of beachfront structures to high winds, hurricanes, and storm surges necessitates robust structural design and engineering. This includes reinforcing the building's framework, employing impact-resistant windows and doors, and elevating foundations or utilizing pilings to mitigate flood risk. Implementing erosion control measures, such as seawalls and beach nourishment, is also vital to safeguard against coastal erosion and maintain foundation stability amidst shifting shoreline dynamics.

Environmental regulations and zoning laws aimed at preserving the delicate coastal ecosystem. This involves adhering to guidelines for building setbacks, height restrictions, and environmental protection measures, as well as engaging with local communities and environmental stakeholders to ensure sustainable development practices that minimize ecological disruption while fostering resilience in the face of coastal hazards.

Q6. **Explain how each of the following weather conditions impact a building.**

Answer

Weather condition	Explanation
Cyclonic activity	Cyclonic storms may spawn tornadoes, which are violent rotating columns of air with high wind speeds that can cause widespread damage in localized areas.
Extreme heat	Extreme heat can cause thermal expansion of building materials, leading to structural movement, cracks, and deformation. It also increases the demand for cooling systems, leading to higher energy consumption.
Risk of fire	Fires can weaken structural elements, including beams, columns, and load-bearing walls, compromising the integrity of the building.
Heavy rain	Heavy rain can lead to water infiltration through the building envelope, causing moisture damage, mold growth, and structural weakening. Cyclonic storms often bring heavy rainfall, leading to flash flooding, landslides, and soil erosion.
Flooding	Floodwaters can infiltrate buildings through doors, windows, cracks, and foundation leaks, causing extensive water damage.
Storm weather	High winds exert lateral pressure on the building envelope, causing structural stress and potential damage.

Q7. **Describe techniques or methods that are applied to improve the durability of concrete, particularly in coastal areas.**

Answer

In coastal areas where concrete structures face heightened exposure to saltwater and harsh environmental conditions, a multi-faceted approach is employed to bolster their durability. Firstly, corrosion-resistant reinforcement materials, such as stainless steel rebar or epoxy-coated steel, are integrated into the concrete framework. This shields against corrosion caused by chloride ions present in seawater, mitigating the risk of structural deterioration over time. Secondly, meticulous attention is paid to the concrete mix design, aiming for low permeability mixes supplemented with appropriate materials like fly ash or slag, and maintaining optimal water-cement ratios. This formulation minimizes the ingress of moisture and aggressive substances, safeguarding the concrete's integrity and resilience against chemical attacks. Additionally, the application of surface treatments and coatings, such as sealers and corrosion-resistant paints, acts as an additional barrier against moisture and salt intrusion, fortifying the concrete surfaces and prolonging their service life in coastal environments.

Q8. **Discuss the purpose of building using cavity brick masonry techniques and the benefits in relation to energy efficiency.**

Answer

The purpose of building using cavity brick masonry techniques is primarily to enhance energy efficiency and structural performance. Cavity brick masonry involves constructing exterior walls with two separate layers of bricks, leaving a gap or cavity between them.

Cavity brick masonry techniques offer several advantages in terms of energy efficiency, thermal comfort, and structural integrity. By reducing heat transfer, managing moisture, and enhancing air tightness, cavity walls contribute to creating healthier, more sustainable, and cost-effective buildings

Q9. **Discuss how the Greenhouse and Energy Minimum Standards (GEMS) Act affects which products are used during energy efficient construction.**

Answer

The Greenhouse and Energy Minimum Standards (GEMS) Act mandates minimum energy performance standards for various construction products, compelling the reduction of energy consumption through the adoption of energy-efficient technologies and practices. Compliance with GEMS regulations ensures the selection of products that contribute to sustainable building construction by minimizing energy usage.

Q10. **Describe the 'Minimum Energy Performance Standards' (MEPS).**

Answer

Minimum Energy Performance Standards (MEPS) are regulatory requirements established to set a minimum level of energy efficiency for various energy-consuming products and appliances. These standards aim to reduce energy consumption, lower greenhouse gas emissions, and promote the use of more efficient technologies. MEPS are typically implemented through legislation or regulations enforced by government agencies responsible for energy and environmental policies. Products covered by MEPS may include appliances such as refrigerators, air conditioners, lighting, electric motors, and industrial equipment. MEPS specify the minimum energy efficiency levels that products must meet or exceed to be legally sold or imported into a particular market. Manufacturers are required to test their products to ensure compliance with MEPS and may need to label products with energy efficiency information to inform consumers about their performance. MEPS are regularly updated to reflect advancements in technology and to raise the bar for energy efficiency standards, driving innovation and market transformation towards more sustainable energy use.

Q11. **Specify what each of the following Australian Standards address relevant to energy efficiency of buildings.**

Answer

Weather condition	Explanation
AS/NZS ISO 9972:2015	Outlines the instrumentation, measurement procedures, and calculation methods necessary to conduct air permeability tests accurately. It is an essential tool for assessing the airtightness of buildings, which directly impacts energy efficiency, indoor air quality, and thermal comfort.
AS/NZS 2904:1995	Is essential for engineers, designers, contractors, and regulators involved in the planning and implementation of buried pipeline projects. Compliance with this standard helps mitigate risks associated with buried pipelines, such as corrosion, structural failure, and environmental contamination, ultimately promoting safety and sustainability in pipeline infrastructure.
AS 4654.1-2012	Is essential for architects, engineers, builders, and waterproofing contractors involved in the design, construction, and maintenance of buildings with external above-ground waterproofing requirements.
AS 2047-2014	"Windows and external glazed doors in buildings." This standard specifies requirements for the design, construction, performance, and installation of windows and external glazed doors used in buildings. It covers various aspects related to the quality, safety, and performance of these building components.
AS/NZS 4859.1:2018	"Materials for the thermal insulation of buildings - General criteria and technical provisions." This standard provides specifications and guidelines for the selection, installation, and performance requirements of materials used for thermal insulation in buildings.
AS/NZS 5141:2018	"Specification for user-applied sealing compounds for porous and non-porous substrates in indoor and outdoor applications." This standard provides specifications and guidelines for the selection, application, and performance requirements of sealing compounds used on various substrates in both indoor and outdoor settings.

Q12. **What is ANSI/ASHRAE 55-2020 - Thermal Environmental Conditions for Human Occupancy?**

Answer

"Thermal Environmental Conditions for Human Occupancy," is a widely recognized standard developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). This standard establishes guidelines and criteria for achieving thermal comfort in indoor environments, taking into account various factors such as air temperature, radiant temperature, air velocity, humidity, and personal clothing insulation.

ANSI/ASHRAE Standard 55-2020 serves as a valuable resource for ensuring occupant comfort and well-being in indoor environments by providing comprehensive guidelines and criteria for achieving optimal thermal conditions. It is widely used by building professionals, HVAC engineers, and researchers involved in the design, operation, and evaluation of building systems.

Q13. **Discuss theory of heat flow and how heat transfers between objects.**

Answer

In many real-world scenarios, heat transfer often involves a combination of these mechanisms. For example, in a heated room, conduction occurs through the walls, convection circulates warm air, and radiation transfers heat between objects and surfaces.

Understanding heat transfer mechanisms is essential in various fields, including engineering, physics, and environmental science, as it influences the design of thermal systems, buildings, and energy-efficient technologies. By applying principles of heat transfer, engineers and designers can optimize thermal performance, enhance energy efficiency, and improve comfort in various applications.

Q14. **Listed below are different types of central heating systems. Compare each system by indicating how much their running cost (either low, medium, or high) and their greenhouse gas emissions, and answer the questions that follow.**

Answe

Energy Efficient System	Running Cost	Greenhouse Gas Emissions
High efficiency ducted natural gas	Medium to high cost	Medium to high
Hydronic zoned natural gas or heat pump	Medium cost	Low to medium
Ducted reverse cycle or heat pump	Medium cost	Low to medium
In-slab high off-peak electric	Medium to high cost	high

Q15. **Discuss the factors that may affect variations in HVAC energy use between different types of buildings.**

Answer

HVAC energy use between different types of buildings can vary significantly due to a multitude of interconnected factors. One key determinant is the size and layout of the building, where larger structures typically demand more heating or cooling to maintain consistent indoor temperatures. Moreover, the design and construction of the building envelope, encompassing elements like insulation, windows, and doors, greatly influence heat transfer rates, thus impacting HVAC energy consumption.

Additionally, factors such as building orientation and solar heat gain play pivotal roles, with buildings exposed to direct sunlight requiring more cooling efforts, especially if proper shading mechanisms are lacking. Furthermore, the occupancy levels and specific activities conducted within a building can dictate HVAC usage patterns, as spaces with varying occupancy or specialized requirements may necessitate tailored heating or cooling solutions.

Q16. **Explain the difference between exhaust ventilation systems and supply ventilation systems.**

Answer

Exhaust ventilation systems expel indoor air from the building using fans, creating negative pressure to draw in fresh air passively. Supply ventilation systems, on the other hand, actively bring outdoor air into the building through fans, pressurizing the indoor space and forcing stale air out. While exhaust systems focus on removing indoor pollutants, supply systems prioritize introducing fresh outdoor air, often incorporating filtration to improve indoor air quality. The direction of airflow and pressure dynamics differ between the two systems, influencing factors such as air infiltration, energy efficiency, and indoor comfort.

Q17. **Why should you review mechanical ventilation systems and equipment to aid air flows prior to purchase and installation?**

Answer

reviewing mechanical ventilation systems and equipment before purchase and installation helps ensure that the chosen systems meet the requirements for air flow, compliance, efficiency, compatibility, performance, noise levels, and functionality, ultimately leading to a successful and effective ventilation solution.

Read the installation guide below to respond to Q18. & Q19.

Bradford™

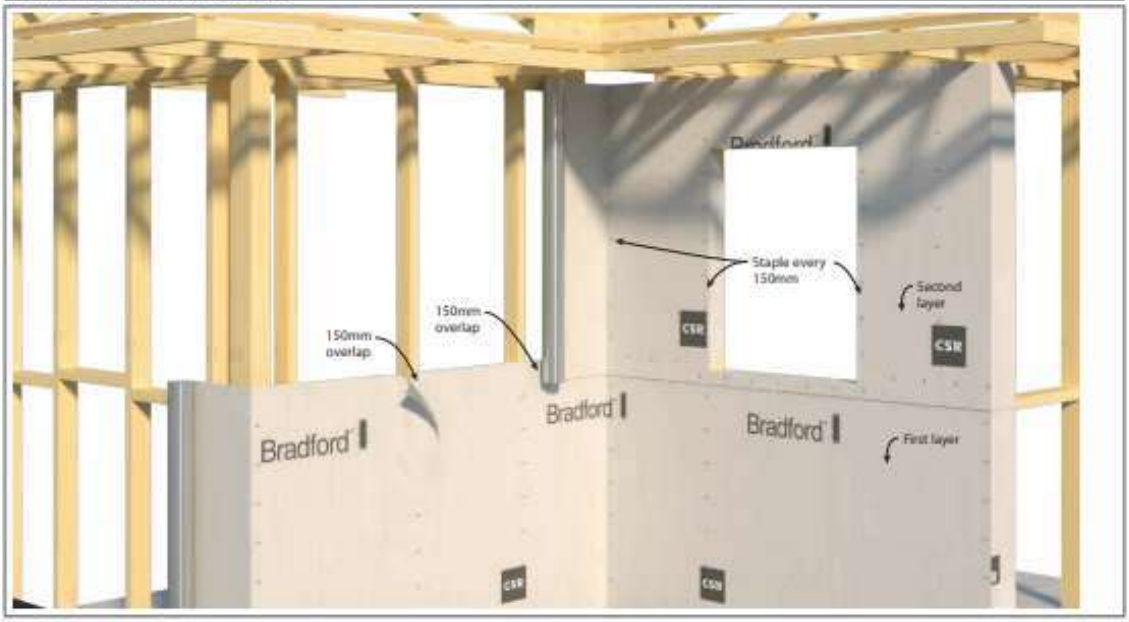
Installation Guide

Visit bradfordinsulation.com.au for the latest version of this installation guide
Revision Level A

WALL WRAP INSTALLATION GUIDANCE

CLASS 1 RESIDENTIAL TIMBER AND METAL FRAMES

WALL WRAP INSTALLATION GUIDANCE



WALL WRAP INSTALLATION GUIDANCE

Wall wrap should be installed in accordance with AS/NZS 4200.2:2017 Pliable Building Membranes and Underlays - Installation.
Recommended instructions for a compliant installation:

- The printed, non-reflective or antiglare surface of this product must be installed facing outward.
- The product should be applied to a stud and rolled around the wall frame horizontally.
- When wrapping around corners, 150mm should extend around that corner.
- When applying a new roll horizontally it should overlap the previous roll by 150mm.
- **Timber frame**: Affix using galvanised staples./metal fixings every 150mm, where possible all overlaps and end joints should line up with a wall stud.
- **Metal Frame**: Affix using adhesive if cladding is directly fixed to the stud work, or; mechanical fixings with a broad headed washer at 300mm centres for cavity walls.
- When applying the top layer of wrap, it should overlap the bottom layer of wrap by 150mm.
- To create an air or vapour barrier, all overlaps should be sealed and taped.

* All damaged, punctured or torn material should be repaired or replaced to maintain the original properties of the product.
* When this product is being used as an air barrier, to achieve air tightness, it is recommended that the building have mechanical ventilation.
* For additional installation guidance, refer to AS/NZS 4200.2:2017.

WINDOW INSTALLATION GUIDANCE

Windows: Install in accordance AS/NZS4200.2 Pliable building membranes and underlays Part 2: Installation or window manufacturers recommended guidance.

If windows are already installed, flash in accordance with window manufacturers recommended instructions.

Weather Exposure: Wall wrap is a secondary sarking material and is not designed to withstand prolonged direct exposure to the elements - accordingly, the exterior cladding should be installed without delay. Product exposed to harsh weather conditions for more than 6 weeks for walls should be inspected for damage prior to installation of the exterior cladding and damaged product should be repaired or replaced to comply with the product warranty.

CSR Bradford Locked Bag 1345 North Ryde BC NSW 1670
bradfordinsulation.com.au

For further technical advice
call **1300 850 305** or
visit **bradfordinsulation.com.au**

CSR

Q18. **Describe how this product should be applied to a stud wall and around a corner.**

Answer

To effectively apply the product to a stud wall and around a corner, begin by carefully measuring and cutting it to the appropriate size. Secure the cut pieces snugly between the studs of the wall, ensuring a tight fit and proper coverage. When fitting the product around a corner, cut it at an angle to ensure seamless integration and extend it past the corner for continuous insulation. Use staples, nails, or adhesive to secure the product in place, and seal any joints or gaps with insulation tape, caulk, or foam sealant to prevent air leakage and enhance insulation efficiency.

Q19. **Explain why exterior cladding should be installed without delay following the installation of the wall wrap.**

Answer

Exterior cladding should be installed promptly after wall wrap to protect the building from moisture, UV damage, and other weather elements. Delaying cladding installation can compromise the integrity of the wall wrap, leading to potential structural and aesthetic issues. Additionally, timely installation enhances energy efficiency and ensures the building's long-term durability.

Q20. **Explain passive solar heating and why this must be considered when designing the position for a building.**

Answer

Considering passive solar heating when designing a building's position involves orienting it to maximize sunlight exposure in colder months for natural heating. This approach reduces reliance on mechanical heating systems, enhances comfort, lowers energy costs, and promotes sustainability by minimizing environmental impact. It's essential for optimizing energy efficiency and creating comfortable, environmentally friendly spaces.

Q21. **What is embodied energy?**

Answer

Embodied energy refers to the total amount of energy consumed throughout the lifecycle of a product or material, including its extraction, processing, manufacturing, transportation, installation, maintenance, and disposal/recycling. It encompasses both direct energy (such as fuel and electricity used in manufacturing) and indirect energy (energy used in producing raw materials and transportation). Embodied energy provides insight into the environmental impact of a product or material beyond its immediate use, considering the energy expended in its entire life cycle.

Q22. **Explain why consideration of embodied energy is made when selecting construction materials and products for energy-efficient buildings.**

Answer

consideration of embodied energy when selecting construction materials and products for energy-efficient buildings is essential for minimizing environmental impact, enhancing energy efficiency, conducting comprehensive life cycle assessments, conserving resources, and achieving regulatory compliance and certification. It supports the overarching goal of creating sustainable, high-performance buildings that minimize their environmental footprint throughout their lifecycle.

Q23. **Discuss energy efficient treatment that can be applied to combat insulating material gaps around old style halogen downlights.**

Answer

To address insulating material gaps around old-style halogen downlights, consider sealing gaps with fire-rated sealant, installing insulation covers or LED retrofit kits, and using insulation guards to maintain clearance. Conducting air sealing and insulation inspections, as well as seeking professional assessment for tailored retrofitting solutions, can significantly improve energy efficiency and safety.

Q24. **Discuss effective energy efficient treatment that can be used for the following situations.**

Answer

Situation	Effective energy efficient treatment
Gaps under and around doors	Installing weather stripping, door sweeps, threshold seals, draught excluders, or door insulation kits effectively seals gaps under and around doors, reducing energy loss and improving energy efficiency.
Openings for floor or ceiling ducts used to transmit heating or cooling	Covering openings for floor or ceiling ducts with insulated registers or grilles helps to minimize air leakage and maintain the efficiency of heating or cooling systems.
Wall, floor or ceiling cracks	Sealing wall, floor, or ceiling cracks with caulking or sealant prevents air infiltration, enhances insulation, and improves energy efficiency in buildings.
Window seals	Repairing or replacing window seals with weather-stripping or caulking helps to prevent air leaks, improve insulation, and enhance energy efficiency in buildings.
Thermal mass	Thermal mass refers to the ability of a material to absorb, store, and release heat energy. It plays a crucial role in passive solar design and energy-efficient buildings by helping to regulate indoor temperatures. Materials with high thermal mass, such as concrete, brick, or stone, absorb heat during the day and release it slowly at night, stabilizing indoor temperature fluctuations and reducing the need for mechanical heating or cooling.

Q25. **Discuss the benefit of using a Nationwide House Energy Rating Scheme (NatHERS) assessor for predicting the energy efficiency of a building before building.**

Answer

Using a Nationwide House Energy Rating Scheme (NatHERS) assessor offers several benefits for predicting the energy efficiency of a building before construction:

Accurate Energy Performance Prediction: NatHERS assessors utilize sophisticated software tools to model the energy performance of a building based on its design, orientation, materials, and other factors. This provides an accurate prediction of the building's energy efficiency, helping designers and builders make informed decisions to improve performance.

Compliance with Building Regulations: Many regions require compliance with energy efficiency regulations as part of the building approval process. NatHERS assessments help ensure that new buildings meet or exceed these requirements, reducing energy consumption and greenhouse gas emissions while promoting sustainable development.

Cost Savings: By identifying energy-efficient design strategies early in the planning stages, NatHERS assessments can help minimize the need for costly retrofits or upgrades after construction. Optimizing the building's energy performance from the outset can result in long-term cost savings for owners and occupants through reduced energy bills.

Improved Comfort and Livability: Energy-efficient buildings tend to offer better thermal comfort and indoor air quality, creating healthier and more comfortable living and working environments for occupants.

Q26. **Discuss the digital tools builders use to communicate with clients, suppliers, architects, and others.**

Answer

Project management software
Collaborative Platform
Virtual design and construction software
Mobile apps
Client portals

CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

WORKBOOK

Participant name	Rex Henderson

FOR THE PARTICIPANT
Instructions

• You will complete written activities as outlined on the following pages. You must attempt all questions and provide enough detail in your responses to demonstrate your knowledge.
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  ○ An oral examination may be allowed under certain circumstances, whereby your answers will be documented by another party.
  ○ Any written questions that are incomplete, or not answered satisfactorily will need to be completed again after further training support.
  ▪ If you answer a question incorrectly but modify your response, put your initials next to the written change (or the Assessor must initial a verbal change).

Resources required
Pen

FOR THE ASSESSOR
Instructions
• Where oral examination has occurred, ensure that this is acknowledged in writing (e.g. FT001 and Assessor Comments) • All questions must be satisfactorily demonstrated by the Participant for a Satisfactory determination (indicated by an Assessor tick to the right of the question). • Assessors are to complete marking in pen of a different colour to the Participant. • If the Participant verbally modifies their response, write in the modified response verbatim and put your initials next to the written change.

ASSESSOR COMMENTS
As necessary, outline: • Details on reattempts, alternative arrangements or reasonable adjustments made. • Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

NOTE

At times, you will be provided with a specific business context to which you must respond, otherwise it is anticipated that you will use a workplace of your choosing (your own, or hypothetical) to provide the context to the task.

At all times, the responses in your assessment must reference **Australian** (Queensland or Federal) documentation, including legislation, regulations, codes of practice, standards and guidance publications.

a)

Access and review Section J of the National Construction Code (NCC) Volume 1 and Part 2.6 of the NCC Volume 2 and answer the following questions.

a) What is the NCC's objective regarding Energy Efficiency?

b) List all the performance requirements found under P2.6.1.

a) What is the NCC's objective regarding Energy Efficiency?

The National Construction Code (NCC) aims to promote energy efficiency in buildings by setting minimum performance standards and requirements for energy efficiency. The objective regarding energy efficiency in the NCC is to reduce the environmental impact of buildings, improve the sustainability of the built environment, and enhance the comfort and well-being of building occupants.

b) List all the performance requirements found under P2.6.1.

- **P2.6.1.1**: Energy Efficiency Compliance. This requirement specifies that buildings must comply with the energy efficiency provisions set out in the NCC, including the deemed-to-satisfy (DTS) provisions or alternative solutions demonstrating equivalent or better performance.

- **P2.6.1.2**: Building Envelope. This requirement focuses on the energy efficiency of the building envelope, including insulation levels, glazing performance, air leakage rates, and thermal bridging.

- **P2.6.1.3**: Heating, Cooling, and Ventilation Systems. This requirement addresses the efficiency and performance of heating, cooling, and ventilation systems, including requirements for energy-efficient equipment, controls, and commissioning.

- **P2.6.1.4**: Lighting Systems. This requirement relates to the energy efficiency of lighting systems, including requirements for lighting power density, lighting controls, and daylighting strategies.

- **P2.6.1.5**: Hot Water Systems. This requirement focuses on the energy efficiency of hot water systems, including requirements for water heating equipment, insulation, and distribution systems.

- **P2.6.1.6**: Renewable Energy. This requirement encourages the use of renewable energy sources to offset energy consumption from conventional sources, such as solar photovoltaic (PV) systems, wind turbines, or solar water heating systems.

- **P2.6.1.7**: Energy Monitoring and Reporting. This requirement may mandate the installation of energy monitoring and reporting systems to track energy consumption, identify opportunities for energy savings, and demonstrate compliance with energy efficiency provisions.

- **P2.6.1.8**: Verification and Compliance Documentation. This requirement entails providing documentation, such as energy efficiency certificates, compliance declarations, or energy assessment reports, to verify compliance with energy efficiency provisions.

Satisfactory Outcome ☐

b)

Use the internet to research building science methods on the evaluation of energy efficiencies and respond to the questions below:

ACTIVITY 2 One (1) local (Australian) - The Evaluation of the 5-Star Energy Efficiency Standard for Residential Buildings

ACTIVITY 3 One (1) international - Energy performance of buildings: The evaluation of design and construction measures concerning building energy efficiency in Iran

ACTIVITY 3 Local research on building science method

Research Title

Assessment of the Effectiveness of the 5-Star Energy Efficiency Standard for Residential Buildings in Australia

Author/publisher

Australian Building Codes Board (ABCB), a government agency responsible for developing and maintaining the National Construction Code

Date research is published

June 2023

Summary of research

The 5-Star Energy Efficiency Standard for Residential Buildings is a rating system used in Australia to assess the energy efficiency of residential buildings. It aims to encourage the construction of energy-efficient homes by setting minimum standards for insulation, heating, cooling, lighting, and other factors that contribute to energy consumption.

Research on the evaluation of the 5-Star Energy Efficiency Standard for Residential Buildings in Australia involves assessing the effectiveness of the standard in achieving its objectives and identifying areas for improvement

URL/Source

https://www.dcceew.gov.au/energy/publications/evaluation-5-star-energy-efficiency-standard-residential-buildings

- Continued

ACTIVITY 4 International research on building science method

Research Title

Simulation_of_climate_change_impact_on_energy_consumption_in_buildings_case_study_of_Iran

Author/publisher

published by a university research center focusing on sustainable building design and construction,

Date research is published

January 2024

Summary of research

n Iran, the evaluation of design and construction measures concerning building energy efficiency involves assessing the performance of buildings in terms of energy consumption, thermal comfort, and indoor environmental quality.

Conducting energy audits and performance assessments of existing buildings to evaluate their energy consumption patterns and identify opportunities for energy savings.

Analyzing the thermal performance of building envelopes, including insulation levels, glazing types, and air sealing measures, to assess their impact on energy efficiency.

Evaluating the effectiveness of passive design strategies, such as orientation, shading, and natural ventilation, in reducing the need for mechanical heating and cooling.

Investigating the performance of HVAC systems, lighting systems, and other building services to optimize their energy efficiency and minimize energy use.

Assessing the impact of building codes, standards, and regulations on promoting energy-efficient design and construction practices in Iran.

Examining the role of building occupants' behavior and awareness in influencing energy consumption patterns and indoor environmental quality in buildings.

URL/Source

https://www.researchgate.net/publication/257126333_Simulation_of_climate_change_impact_on_energy_consumption_in_buildings_case_study_of_Iran

Satisfactory Outcome ☐

Research two (2) manufacturers of energy-efficient materials and respond to the following:

a) Identify the name of the manufacturer
b) Identify the website links of the manufacturer you provided
c) Provide two (2) examples of their products:
   i. energy-efficient material
   ii. energy-efficient system

Manufacturer 1

i. Name of manufacturer

Kingspan Insulation

ii. Website / link

https://www.kingspan.com/au/en/business-groups/kingspan-insulation/

iii. Products

1. energy-efficient material

Kingspan Kooltherm K10 FM Soffit Board: An advanced phenolic insulation board with excellent thermal performance, used for insulating concrete soffits.

2. energy-efficient system

Kingspan KoolDuct System: A pre-insulated ducting system that offers high energy efficiency and is used for HVAC applications, reducing air leakage and improving overall energy performance.

Manufacturer 2

1. Name of manufacturer

Bradford Insulation (CSR Bradford)

2. Website / link

https://www.bradfordinsulation.com.au/

3. Products

- energy-efficient material

Bradford Gold Hi-Performance Batts: These are high-performance insulation batts designed for residential and commercial applications, providing excellent thermal resistance and energy savings.

- energy-efficient system

Enviroseal ProctorWrap: A breathable membrane system that enhances the energy efficiency of buildings by providing superior moisture control and improving the thermal performance of wall and roof systems.

Satisfactory Outcome ☐

Research the work health and safety requirements and guidelines related to installing ceiling insulation in your state or territory and respond to the following:

List your State/Territory
WHS regulator researched
Risks related to installing ceiling insulation
Guidelines to follow during insulation installation
Guidelines to follow after insulation installation.

a) **List your State/Territory**

Queensland

b) **WHS regulator researched**

The Queensland Work Health and Safety (WHS) regulator

c) **Risks related to installing ceiling insulation**

Installing ceiling insulation can pose several risks if not done properly. Here are some potential risks related to installing ceiling insulation:

Electrical Hazards: Installers may encounter electrical wiring or fixtures in the ceiling space. Accidental contact with live wires can result in electric shock or fire. Proper precautions, such as turning off the electricity supply to the area and using insulated tools, should be taken to mitigate this risk.

Fall Hazards: Working in the ceiling space poses a risk of falls from height. Installers must use appropriate fall protection equipment, such as safety harnesses and guardrails, when accessing elevated areas to install insulation.

Poor Indoor Air Quality: Improper installation of insulation can lead to poor indoor air quality. Insulation materials may release volatile organic compounds (VOCs) or become breeding grounds for mold and mildew if not installed correctly or if moisture becomes trapped within the insulation.

Fire Hazards: Certain insulation materials, such as fiberglass or foam board, are combustible and can contribute to the spread of fire if not installed according to manufacturer guidelines and local building codes. Fire-rated insulation or proper fire-blocking measures should be used to reduce fire hazards.

Respiratory Hazards: Installers may be exposed to airborne particles or fibers released during the installation process, especially when working with materials such as fiberglass or mineral wool. Proper personal protective equipment (PPE), including dust masks or respirators, should be worn to minimize respiratory hazards.

Structural Damage: Excessive weight from insulation or improper installation methods can cause structural damage to the ceiling or roof assembly. Installers should ensure that insulation materials are properly supported and distributed to avoid overloading structural elements.

Inadequate Insulation Performance: Poorly installed insulation may not achieve the desired level of thermal performance,

d) **Guidelines to follow during insulation installation**

During insulation installation, it's crucial to follow guidelines to ensure safety, effectiveness, and compliance with regulations. Here are some essential guidelines to follow:

Safety Precautions.
Electrical Safety.
Fall Protection.
Proper Ventilation.
Moisture Management.
Manufacturer Guidelines.
Quality Assurance.
Fire Safety.
Code Compliance.

e) **Guidelines to follow after insulation installation.**

Maintenance of insulation involves several key tasks to ensure its continued effectiveness and performance. Here's a maintenance checklist for insulation:

Regular Inspections
Sealing Gaps and Air Leaks
Moisture Management
Ventilation Maintenance
Protection from Physical Damage
Pest Control
Fire Safety:
Energy Monitoring
Documentation
Professional Assistance

Satisfactory Outcome ☐

CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

PRACTICAL ASSESSMENT

Participant name	Rex Henderson

FOR THE PARTICIPANT

Instructions

- The tasks outlined on the following pages will require performance of normal workplace activities, as a result of a structured activity set by an Observer in the workplace or a simulated activity set by your Assessor/Observer.
- The timeframe for these tasks will be established by your Assessor/Observer, in consideration of location conditions and industry requirements.
- You must complete all tasks unassisted by the Assessor or other personnel, unless the steps note this assistance.
- You must attempt all tasks (and itemised steps) for a 'Satisfactory' assessment outcome to be awarded.
    - For any observation conducted that is incomplete, or without satisfactory performance, the observation will need to be completed again after further training support.

FOR THE ASSESSOR/OBSERVER

Instructions

- The following observation record should be used to judge and record your observations of the Participant as they complete the task(s) set. You must record your observations of the Participant's performance.
    - For each occasion, indicate the task performed and whether it was a simulation or workplace-based task.
        - Any simulated assessment must ensure the Participant still performs under workplace conditions which reflect industry standards.
    - In the comments, provide clear detail regarding the task that the Participant was required to do (e.g. PPE used, materials handled, attachments connected, plant types).
- All steps must be satisfactorily demonstrated by the Participant for a 'Satisfactory' determination (indicated by an Assessor tick to the right of each itemised step, or an Observer tick to the right of each itemised step, and confirmation by an Assessor in the Assessor Comments).
    - Where you have determined that one or more task steps have not been satisfactorily demonstrated, provide the Participant with additional support and outline details of such assistance in the Assessor/Observer Comments. Allow the Participant two (2) further opportunities to demonstrate the task again to allow an opportunity for a 'Satisfactory' assessment outcome to be achieved.
    - If after three (3) attempts the Assessor determines that the Participant cannot demonstrate the required steps, a 'Not Satisfactory' outcome is to be determined.

TASK OUTCOME					
Task	Date	Task Type (Tick)	Location	Task outcome (Tick)	
				Satisfactory	Not Satisfactory
Task 1 (Occasion 1)	30/05/2024	☑ Workplace ☐ Simulation	Maroochydore private hospital	☑	☐
Task 1 (Occasion 2)	30/05/2024	☑ Workplace ☐ Simulation	Maroochydore private hospital	☑	☐

ASSESSOR COMMENTS: GENERAL

As necessary, outline:

- Details on reattempts, alternative arrangements or reasonable adjustments made.
- Where a Participant is deemed 'Not Satisfactory', provide recommendations for future training.

Rex has a great understanding of energy efficient building practices and principles.

ASSESSOR COMMENTS: PRACTICAL TASK 1: OCCASION 1- Residential construction project

☑ Individual student (as named on cover page)

☐ Multiple students [☐ All from Attendance Report, ☐ Specific students involved – identify students]

Task	Provide detail
1.1E. 1.2A.	Specify how research on a range of energy efficient design and construction methods was conducted:
1.2C. 1.2D.	Specify how levels of energy efficiency, ventilation and indoor air quality were determined:

ASSESSOR COMMENTS: PRACTICAL TASK 1: OCCASION 2 Commercial construction project

☐ Individual student (as named on cover page)

☐ Multiple students [☐ All from Attendance Report, ☐ Specific students involved – identify students]

Task	Details
1.1E. 1.2A.	Specify how research on a range of energy efficient design and construction methods was conducted:
1.2C. 1.2D.	Specify how levels of energy efficiency, ventilation and indoor air quality were determined: Levels of energy efficiency, ventilation, and indoor air quality are determined through a combination of assessments, measurements, calculations, and standards.

CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

Practical Task 1 (2X)

Description of task:

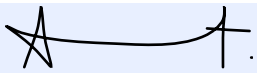
The participant must demonstrate the skills and knowledge required to incorporate building science principles into the construction of energy efficient buildings by making recommendations in the form of a report for the use of energy efficient materials, products and construction methods for one (1) residential construction project (Occasion 1) and one commercial construction project (Occasion 2) (template available) in the State/Territory of place of work, including:

- Determine the building envelope expectations.
- Determine the building use and energy efficiency expectations.
- Identify risks associated with occupants' indoor activities and health and safety considerations.
- Determine environmental and climatic conditions that impact the resilience of building materials.
- Determine construction methods to be applied that factor in durability of materials.
- Consult relevant legislation, standards, regulations and codes to identify minimum energy efficient standards to be met.
- Assess energy efficiency construction.
- Research and consult relevant domestic and international codes, standards and examples of best practice that meet or exceed current energy efficient standards and apply building science principles.
- Review embodied energy of the specified products or materials to evaluate the energy efficiency.
- Research heating, ventilation and air conditioning (HVAC) systems to identify levels of energy efficiency, ventilation and indoor air quality.
- Review mechanical ventilation systems and equipment to aid air flows for appropriateness and operational costs.
- Research and identify durability and appropriateness of moisture and vapour barriers to gain high levels of energy efficiency.
- Research and report on energy efficient construction methods and systems.
- Decide on method of construction.
- Incorporate building science principles for energy efficient materials and products used in the building envelope.
- Identify site location and building position to maximise energy efficiency relating to environmental factors, climatic conditions and use of building.
- Identify and assess energy efficiency of thermal energy, heating and cooling, air and moisture flows throughout the building.
- Develop and document strategies to minimise unwanted air leakages.
- Evaluate and select mechanical ventilation systems and equipment for appropriateness to the site and operational costs.
- Evaluate and select materials for interior and exterior barriers for energy efficiency, durability and appropriateness for building site climate.

These tasks may be simulated or real. The Participant is to gather evidence of how they have completed each component of the Practical Task, which is to be submitted with this Practical Assessment sheet. The Observer is to provide detailed comments on the tasks completed by the Participant (on the Observer Comments, overleaf). The Assessor is to verify the Observer's comments, noting their findings in the Assessor Comments (on the back of the Practical Assessment cover page) and provide the assessment outcome.

Resources required:

Construction project (1 residential and 1 commercial) Plans, drawings, access to internet, access to PC, report template (workplace or supplied). policies, procedures and other quality documentation, Communication equipment.

Observer details	
Name of observer:	Adrian Wyatt
Role of observer (Confirm suitability to sign)	Site Manager
Email address of observer	Adrian.wyatt@mcnab.net.au
Signature of observer:	
Date:	30/05/2024

When completing the task, did the Participant:		Tick if satisfactorily completed. Provide comments if left unticked.	
		1st Occasion	2nd Occasion
1 Determine the building envelope expectations.			
1.1A.	Determine the building use and energy efficiency expectations.	☑	☑
1.1B.	Identify risks associated with occupants' indoor activities and health and safety considerations.	☑	☑
1.1C.	Determine environmental and climatic conditions that impact the resilience of building materials.	☑	☑
1.1D.	Determine construction methods to be applied that factor in durability of materials.	☑	☑
1.1E.	Consult relevant legislation, standards, regulations and codes to identify minimum energy efficient standards to be met.	☑	☑
2 Assess energy efficiency construction			
1.2A.	Research and consult relevant domestic and international codes, standards and examples of best practice that meet or exceed current energy efficient standards and apply building science principles.	☑	☑
1.2B.	Review embodied energy of the specified products or materials to evaluate the energy efficiency.	☑	☑
1.2C.	Research heating, ventilation and air conditioning (HVAC) systems to identify levels of energy efficiency, ventilation and indoor air quality.	☑	☑
1.2D.	Review mechanical ventilation systems and equipment to aid air flows for appropriateness and operational costs.	☑	☑
1.2E.	Research and identify durability and appropriateness of moisture and vapour barriers to gain high levels of energy efficiency.	☑	☑
1.2F.	Research and report on energy efficient construction methods and systems.	☑	☑
3 Decide on method of construction.			
1.3A.	Incorporate building science principles for energy efficient materials and products used in the building envelope.	☑	☑
1.3B.	Identify site location and building position to maximise energy efficiency relating to environmental factors, climatic conditions and use of building.	☑	☑
1.3C.	Identify and assess energy efficiency of thermal energy, heating and cooling, air and moisture flows throughout the building.	☑	☑
1.3D.	Develop and document strategies to minimise unwanted air leakages.	☑	☑
1.3E.	Evaluate and select mechanical ventilation systems and equipment for appropriateness to the site and operational costs.	☑	☑
1.3F.	Evaluate and select materials for interior and exterior barriers for energy efficiency, durability and appropriateness for building site climate.	☑	☑
1.3G.	Use digital tools and devices to communicate effectively with others	☑	☑

Observer comments:
Great work Rex I can see you have gained a good understanding from this module.