CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

THEORY EXAM

Participant name	

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 you know the
- 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.

ANSWERS

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

Should reflect but is not limited to: Systems theory is the study of the nature of complex systems where one can investigate small parts of a system that work together to produce benefits for a whole system where they all belong.

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	e.g. The thermal envelope is everything about the building that helps to protect the living area from the outside atmosphere, which will keep the living space well-insulated. A well-insulated building adds to the building's overall energy efficiency.
Ventilation	e.g. Efficient ventilation minimises the loss of energy. By moving heat from the warm inside air being exhausted into the fresh supply air, good ventilation reduces the cost of heating ventilated air in the winter, thus contributing to the overall energy efficiency of a building.
Cooling system	e.g. Effective cooling system reduces energy use of cooling equipment during summer, thus helping to save for the overall energy efficiency of the building.

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	e.g. Harmful gasses from cooking	e.g. sufficient ventilation must be provided usually as windows in kitchen area
House	Washing	e.g. Mould due to water vapour	e.g. Sufficient water barrier and ventilation must be provided
Factory	Roof tile manufacturing	e.g. concrete dust inhalation; worker fatigue due to heat	e.g. sufficient exhaust facilities to be installed, large doors and opening to dissipate heat
School	Laboratory experiment	e.g. Development of respiratory and neurological problems due to inhalation of poisonous substances	e.g. Laboratories must have windows (in addition to special ventilating equipment) to allow contaminated air to dissipate and clean air to replenish.

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

Answer

Should reflect but is not limited to: When the building envelope is not properly applied with the appropriate insulation, it can pave the way for heat to transfer to the building interior. Working under high temperature causes fatigue in workers inside the building, which further results in other health problems. If services installed are not sufficient to compensate for temperature changes caused by environmental elements such as heat, air, and moisture (as a result of the insufficient design of the building envelope), it causes discomfort to building occupants. For example, when the cooling system cannot eliminate humidity inside a room, it causes excessive sweating and overheating or fatigue can occur.

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

Answer

Should reflect but is not limited to three of: Challenges related to corrosion caused by salt spray and water environment according to the NCC requirements include the use of marine grade materials and the level of protection is determined by the proximity to a saltwater source. Multiple construction considerations need to be applied to protect the building from water. When building in a flood or storm tide-prone area, requirements and recommendations include - habitable floor levels should be built as high as possible. Air conditioning and hot water systems should be installed higher. Tiles instead of carpeting. A stronger, commercial-grade frame may need to be used to meet the requirements of AS4055 due to wind loading. Window frames and other elements that may need to be upgraded including the thickness of the glazing and the type of roof frame.

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

Answer

Weather condition	Explanation
Cyclonic activity	e.g. Due to the high wind pressure and improper connection of the building to the footings, the building can be blown away or components of the building may be ripped away.
Extreme heat	e.g. Hot and dry conditions can cause soil shrinkage, particularly of those that are clay-rich, can lead to building subsidence, structural deformation and collapse in the most severe cases.
Risk of fire	e.g. Risk of fire can also dramatically decrease the life cycle of a building, including components made of steel. Fire greatly reduces the overall structural capacity of steel
Heavy rain	e.g. rainwater puddles around a building, the water seeps into the ground and can crack the foundation. Once cracks form, water can leak in, making the basement damp or wet. The dampness in the basement will attract mould and mildew, along with termites and carpenter ants.
Flooding	e.g. Flooding causes structural and electrical damage, produces sharp glasses, and metals, and damages the drainage system of a building.
Storm weather	e.g. May cause damage to building can include roof and structural damage as well as damage to exterior pipes and siding. It can also cause shingles to break loose and destroy utility lines. Lightning storms can cause damage to electrical wires, appliances, and antennas.

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

Answer

Should reflect but is not limited to: As there is a risk of sulphate (i.e. salt plus acid) attacks in reinforced concrete structures (especially near coastal areas), admixtures, which are materials that improve the quality of concrete, are added to the concrete mix. One example of an admixture that addresses this is fly ash.

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

Answer

Should reflect but is not limited to: This refers to a technique that involves laying two separate layers of brick (i.e. one exterior leaf and one interior leaf) with a small cavity or space between them. This improves the overall resistance of the brick wall against moisture or dampness, as opposed to only having one layer of brick (which is susceptible to damage against rainwater due to its porous nature). This added resistance contributes to energy efficiency by retaining heat or cool within the building better to avoid the need for additional heating or cooling as well as prevention of moisture entering.

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

Answer

Should reflect: This Act is Australia's national framework for product energy efficiency in Australia, regulated and administrated by the GEMS Regulator. Specifications under the GEMS Act include the requirements for Minimum Energy Efficiency Standards (MEPS) and Energy Rating Labelling (ERL), are set out in a further statutory instrument called a GEMS Determination. A GEMS Determination sets out the requirements which products need to comply with in order to be 'legally registered, supplied, or offered for supply in Australia.'

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

Answer

Should reflect: The Minimum Energy Performance Standards (MEPS) is a standard used in Australia to promote energy efficiency of products. It specifies the minimum level of energy performance that appliances, lighting, and electrical equipment must meet in order to be sold and used and forms part of the specifications included in the broader GEMS Act.

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	e.g. Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurisation method
AS/NZS 2904:1995	e.g. Damp-proof courses and flashings.
AS 4654.1-2012	e.g. Waterproofing membranes for external above-ground use, Part 1: Materials
AS 2047-2014	e.g. Windows and external glazed doors in buildings
AS/NZS 4859.1:2018	e.g. Thermal insulation materials for buildings, Part 1: General criteria and technical provisions
AS/NZS 5141:2018	e.g. Residential heating and cooling systems - Minimum applications and requirements for energy efficiency, performance and comfort criteria

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

Answer

Should reflect: Created by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) and approved by the American National Standards Institute (ANSI), this standard contains provisions regarding conditions for environmental thermal acceptability (i.e. evaluation of thermal environments).

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

Answer

Should reflect but is not limited to: Heat flow is the transfer of heat from one object to another. Heat transfers in three ways – Conduction- the natural movement of heat from a warmer object to a cooler object through direct contact. Convection - the natural movement of air in cycles, where hot air naturally rises and cold air sinks Radiation - the movement of heat as heat waves travel across space and absorbed by cooler objects. Heat will continue to flow (from a warm object or space to a cooler object or space) until both objects or spaces reach equilibrium, which means that both their temperatures are equal. This theory guides the design principle that heat from outside the building can get inside by passing through walls and the roof. Bearing this in mind, you need to apply a material that can block the transfer of heat through the building.

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	e.g. Low	e.g. Low
Hydronic zoned natural gas or heat pump	e.g. Low	e.g. Low
Ducted reverse cycle or heat pump	e.g. Medium	e.g. Medium (low with green/renewable electricity source)
In-slab high off-peak electric	e.g. Medium - High	e.g. Very high (low with green/renewable electricity source).

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

Answer

Should reflect discussion around equipment efficiency, building design, orientation and location type of HVAC system, ventilation/ air quality and condensation and dampness. May include information such as: efficient HVAC equipment allows for demand control by heating or cooling according to the occupants' needs. Heating and cooling typically produce a lot of waste; therefore, consider HVAC equipment that uses natural conditions. Energy use for ventilation is minimised if building is oriented to the natural flow of the breeze. Type of system will affect the energy distribution between its different end uses. Condensation is generally addressed via proper air conditioning - determine expected condensation levels when researching

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

Answer

Should reflect but is not limited to:. An exhaust ventilation system exhausts air from the building, effectively depressurising it and causing outside air to be pulled in through intentional, passive vents due to the change in pressure. This type of mechanical ventilation is typically used in colder climates.

Supply ventilation systems pressurise a structure by forcing outside air into the building using a fan. This pressure pushes indoor air out of the building through holes in the building envelope, e.g. Bath and range fan ducts, and intentional vents. This type of ventilation system works best in hot or mixed climates. Like an exhaust ventilation system, a supply ventilation system typically consists of a fan and duct system that introduces fresh air into the building. A well-designed supply ventilation system has ducts that bring fresh air into rooms where occupants are likely to stay. This system allows better control of the air than exhaust systems. It can also filter pollen and dust and dehumidify incoming outside air to provide humidity control.

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

Answer

Should reflect: Different ventilation systems are suited to different situations, and operational costs. Some are more cost-effective in climates with extreme winters or summers. The cost of additional electricity consumed by the system fans may outweigh the energy savings from not having to condition the supply air. You must always research and select the most suitable system for the location, climate and environmental conditions as well as the use of the building.

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

Bradford™

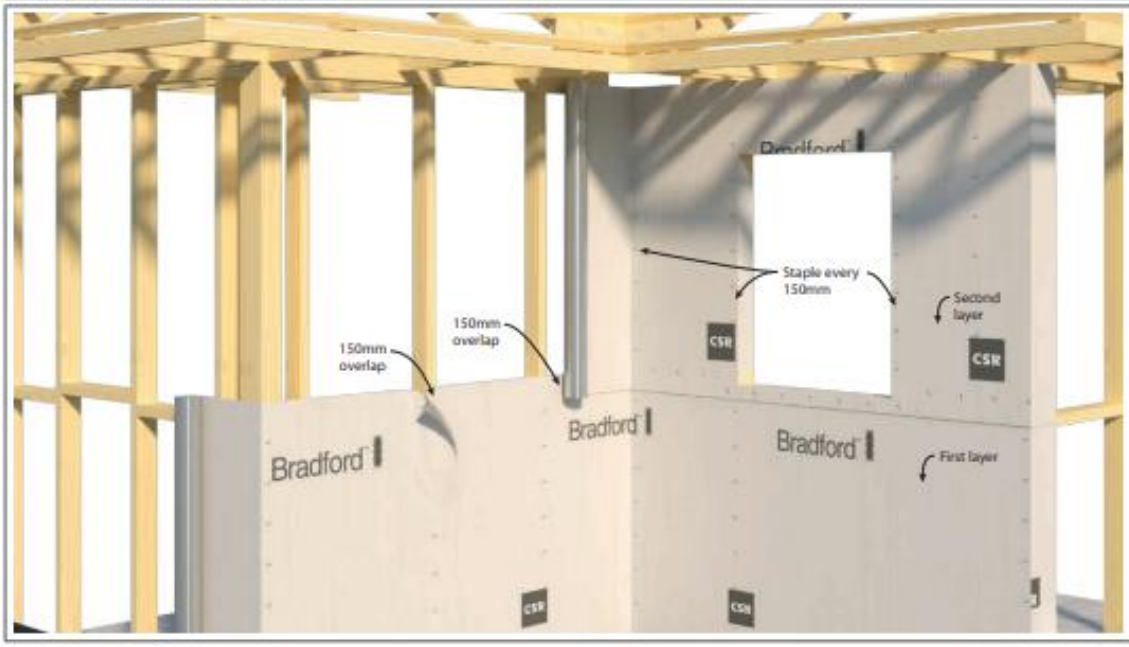
Installation Guide

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**

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CSR

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

Answer

Should reflect: Should be applied according to AS/NZS 4200.2. 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.

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

Answer

Should reflect: : Wall wrap is a secondary sarking material and is not designed to withstand prolonged direct exposure to the elements . 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.

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

Answer

Should reflect: : Passive solar heating aims to ensure the overall thermal efficiency of a structure by retaining heat during winter while excluding and allowing it to escape during summer.

In terms of building positioning, you can achieve this by orienting daytime living areas towards the north. A greenhouse effect is created by north-facing glass areas exposed to the sun, which traps solar radiation and provides heating. Passive heating can be used in conjunction with thermal mass to maximise its effects.

Q21. **What is embodied energy?**

Answer

Should reflect: Embodied energy is the energy consumed by all the processes associated with the production of a building, from the mining and processing of natural resources to manufacturing, transport and product delivery.

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

Answer

Should reflect: : When the concept of embodied energy is used for a whole building, it encompasses energy involved in the building construction processes in addition to the embodied energy of its construction materials. The level of embodied energy of a material is a criterion in selecting construction materials for energy efficiency. Builders select construction materials that have low embodied energy because it is an indicator that the materials are sustainable, energy-efficient, and eco-friendly. On the other hand, builders are hindered from selecting materials with high embodied energy because they waste a lot of energy.

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

Answer

Should reflect: : The halogen downlights should be replaced with new LED downlights that are sealed and rated to have insulation installed over them. The insulation material can then be installed without gaps.

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	e.g. Close the gaps by adding weatherstripping around doors. Door seals should be fitted to laundry and front doors. Compressible rubber seals should be fitted rather than foam seals. Test for fit prior to installation to ensure your doors will still close correctly.
Openings for floor or ceiling ducts used to transmit heating or cooling	e.g. If there are openings for floor ducts, they should be duct sealed. Duct sealing should be done using a silicone caulking or a special cement (mastic) with an embedded fabric. If there are openings for ceiling ducts, they should be duct sealed. Duct sealing should be done using a silicone caulking or a special cement (mastic) with an embedded fabric.
Wall, floor or ceiling cracks	e.g. Caulk and seal air leaks where plumbing, ducting, or electrical wiring comes through wall cracks.
Window seals	e.g. Use caulk to seal cracks on the non-movable parts of your window, mainly around the frame and where the trim meets the wall. The gaps around the glazing could be filled with glazing silicone.
Thermal mass	e.g. Apply passive solar design technique and natural ventilation to effectively eliminate the requirement for air conditioning.

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

Should reflect but is not limited to: State and territory governments use NatHERS for regulatory purposes, to support the building industry to demonstrate compliance with the National Construction Code (NCC)..

NatHERS is being used by the finance sector to underpin green loans, which are driving the delivery of above minimum standard homes. It can also support disclosure frameworks and rental standards, all of which help to boost the energy efficiency of residential buildings – saving on bills, improving comfort and contributing to abatement.

NatHERS Accredited Assessor reviews house plans and use NatHERS Accredited Software to model and estimate the ability of the building to remain at a comfortable temperature year-round and the amount of heating or cooling likely to be needed over an average year.

On completion of the assessment, the assessor will issue a NatHERS Certificate. The certificate will display a 'thermal' star rating out of 10 and a 'Whole of Home' rating out of 100. The NatHERS Certificate can be used as evidence to satisfy state and territory energy efficiency regulations.

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

Answer

Should reflect: use of mobile telephones; websites (e.g. councils) email, printers and scanners, landlines, PC

CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

WORKBOOK

Participant name	

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.
- The timeframe for these tasks will be established by your Assessor or Training Provider and 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.

ANSWERS

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.

ACTIVITY 1

Access and review Section J of the National Construction Code (NCC) Volume 1 and Part H6 of the NCC Volume 2 and answer the following questions.

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

b) List the total thermal performance requirements found under J1P2

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

Should reflect: The objective of NCC on Energy Efficiency is to reduce energy consumption and energy peak demand; and reduce greenhouse gas emissions; and improve occupant health and amenity.

b) List the total thermal performance requirements found under J1P2.

Should reflect:

The total thermal energy load of the habitable rooms and conditioned spaces in a Class 4 part of a building must not exceed the thermal energy load limit in Specification 44.

Satisfactory Outcome ☐

ACTIVITY 2

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

a) One (1) local (Australian) - The Evaluation of the 5-Star Energy Efficiency Standard for Residential Buildings
b) One (1) international - Energy performance of buildings: The evaluation of design and construction measures concerning building energy efficiency in Iran

a) Local research on building science method

i. Research Title

Should reflect: The Evaluation of the 5-Star Energy Efficiency Standard for Residential Buildings

ii. Author/publisher

Should reflect: Michael Ambrose, Melissa James, Andrew Law, Peter Osman, and Stephen White

iii. Date research is published

Should reflect: December 2013

iv. Summary of research

Should reflect: In Australia, a five-star rating system is used to evaluate energy efficiency of buildings. To get a five-star rating, building science methods must be followed to promote energy efficiency. These methods include increasing insulation, using double glazing, and redesigning house layout.
In the findings of the research, it was found that there is higher energy efficiency in higher-rated buildings (five stars being the highest) than in lower-rated buildings (one star being the lowest) when it comes to heating consumption. By following the building science methods to reduce heating energies, higher-rated buildings can promote more energy efficiency than lower-rated buildings.

v. URL/Source

Should reflect: https://www.energy.gov.au/sites/default/files/evaluation-5-star-energy-efficiency-standard-residential-buildings-report-2013.pdf

ACTIVITY 2 - Continued

b) International research on building science method

i. Research Title

Should reflect: Energy performance of buildings: The evaluation of design and construction measures concerning building energy efficiency in Iran

ii. Author/publisher

Should reflect: Gholamreza Heravi and Mahsa Qaemi

iii. Date research is published

Should reflect: 2014

iv. Summary of research

Should reflect: After an evaluation of energy efficiency of buildings in Iran, the findings show that the method of using passive solar energy is the most applicable renewable energy system in Iran.

v. URL/Source

Should reflect: https://www.sciencedirect.com/science/article/abs/pii/S0378778814001492

Satisfactory Outcome ☐

ACTIVITY 3

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

a) Name of manufacturer

e.g. Air Change

b) Website / link

e.g. https://www.airchange.com.au

c) Products

i. energy-efficient material

e.g. Fresh air louver

ii. energy-efficient system

e.g. Wall Mounted Energy Recovery Ventilator (ERV-WM)

Manufacturer 2

a) Name of manufacturer

e.g. Living Green Designer Homes

b) Website / link

e.g. https://www.livinggreendesignerhomes.com.au

c) Products

i. energy-efficient material

e.g. Australian Hardwood

ii. energy-efficient system

e.g. Sanden Eco® Plus Hot Water Heat Pump System

Satisfactory Outcome ☐

ACTIVITY 4

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

a) List your State/Territory
b) WHS regulator researched
c) Risks related to installing ceiling insulation
d) Guidelines to follow during insulation installation
e) Guidelines to follow after insulation installation.

a) List your State/Territory

e.g. Queensland

b) WHS regulator researched

e.g. WorkSafe Qld; Workplace Health and Safety Queensland,

c) Risks related to installing ceiling insulation

e.g. Serious electric shocks or burns caused by contact with: – defective electrical cables — e.g. perished or rodent-damaged insulation; exposed terminals or conductors of electrical equipment in the ceiling space — e.g. behind light fittings, fans, etc; – electrical cables damaged while installing insulation materials e.g. by cutting, piercing, nailing or stapling into electrical cables, and – foil insulation which has become energised through contact between the foil and a source of electricity.

Fire resulting from insulation material installed near recessed lights (in particular halogen downlights) and accessories without suitable clearances/barriers in place

The safe operating temperature of electrical cables may be affected when surrounded by thermal insulation material — advice regarding such de-rating of electrical cables may be obtained from a person with specialist expertise such as a licensed electrical contractor

Insulation containing synthetic mineral fibres (SMF's) — rockwool, glasswool, other fibres or dust can irritate the skin, eyes and upper respiratory tract.

Hazardous substances — e.g. asbestos, pesticides, chemicals or lead

Heat and humidity — these and other factors can cause heat stress.

Vermin or insects in the ceiling cavity or in untreated or damp insulation

Non fire-retardant insulation

Accessing and traversing the roof cavity, tripping over debris, material and tools

Working at heights, inadequate lighting, and manual handling.

d) Guidelines to follow during insulation installation
e.g. Before you enter the roof cavity to start the installation do a pre-work risk assessment of the roof cavity and advise the owner/occupier of any identified risks that you cannot prevent or minimise – such an on-site operational risk assessment must include the electrical risk from the installation of the ceiling insulation and implement any control measures necessary. While installing the insulation identify and mark the position of all electrical cables in the work area and ensure that all insulation fixing points are well clear of electrical cables and equipment, and make sure you do not damage any electrical cables or electrical equipment while trimming, cutting or fixing insulation. Do not place material over recessed lights and associated equipment such as transformers (in particular halogen downlights) maintain minimum required clearances for insulation materials around electrical equipment (e.g. downlights) and fit fire resistant barriers where required. Follow the safe work procedures for removing and installing insulation. Keep in constant contact with someone. Wear appropriate, maintained and correctly-fitted PPE. Handle the insulation with care and minimise the release of fibres or dust. Step on roof beams — not the ceiling material, and keep your work areas clean and clear of fibres and dust, by regularly using an industrial vacuum cleaner fitted with high efficiency particulate filters, and place waste in plastic bags capable of containing dust.
e) Guidelines to follow after insulation installation.
e.g. Immediately after you have installed the insulation if you suspect that electrical equipment such as cables, light fittings, etc have been damaged, or the ceiling insulation could be energised by contact with electricity, do NOT turn the power on — liaise with the owner/occupier and engage a licensed electrical contractor to assess/control the electrical risks. Dispose of debris and waste appropriately Wash your hands, face, neck and hair, with soap and water

Satisfactory Outcome ☐

CPCSUS4002
USE BUILDING SCIENCE PRINCIPLES TO CONSTRUCT ENERGY EFFICIENT BUILDINGS

PRACTICAL ASSESSMENT

Participant name	

ANSWERS

FOR THE PARTICIPANT

Instructions

- The tasks outlined on the following pages will require performance in 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)		☐ Workplace ☐ Simulation		☐	☐
Task 1 (Occasion 2)		☐ Workplace ☐ Simulation		☐	☐

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.

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: e.g. Accessed the internet
1.2C. 1.2D.	Specify how levels of energy efficiency, ventilation and indoor air quality were determined: e.g. Accessed relevant websites

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: e.g. Accessed the internet
1.2C. 1.2D.	Specify how levels of energy efficiency, ventilation and indoor air quality were determined: e.g. Accessed relevant websites

Energy Efficiency Assessment Report

Residential Building

Report researched and documented by	e.g. Participant name
Date	e.g. Insert date of assessment
Building and construction project	e.g. Participant must record the type of project being assessed
Project overview	e.g. Participant must provide a brief overview of the project
Building classification	e.g. The participant must specify the building classification for this project, e.g., Class 1a, Class 1b, etc.
Project site address	e.g. The participant must specify the site address for the project. In this example Brisbane is used
NCC Climate Zone	e.g. Climate zone 2 - warm humid summer, mild winter
Extreme weather conditions likely to impacting the building	e.g. Cyclone; Heavy rain and flooding, fire, extreme heat
State/territory where this project is being undertaken	e.g. Queensland

Building use	e.g. residential home
Environmental conditions	e.g. coastal location; nearby hazards
Building positioning	e.g. North facing position to maximise energy efficiency. Landscaping to support wind protection
NCC Energy efficiency performance requirements to be met	e.g. Participant to summarise NCC Part 2.6 requirements as applicable (Queensland) V2.6.2.2 Verification to meet performance requirement compliance with P2.6.1 in climate zones 1 and 2, a cooling load equal to or less than that of the reference building. Compliance with P2.6.1 is verified when a proposed building— complies with— (A) for building fabric thermal insulation, 3.12.1.1; and (B) for thermal break, 3.12.1.2(c) and 3.12.1.4(d); and (C) for compensating for a loss of ceiling insulation, 3.12.1.2(e); and (D) for floor edge insulation, 3.12.1.5(c) and 3.12.1.5(d); and (E) for building sealing, Part 3.12.3 or V2.6.2.3. The heating loads and cooling loads in (a) must be calculated for the reference building using— (i) internal heat gains from appliances and equipment of 5 W/m2 averaged for 24 hours per day, 7 days per week; and (ii) an infiltration value of 0.6 air changes per hour; and (iii) the modelling criteria in Table V2.6.2.2.

Energy efficiency expectations of the building

e.g.

Item	Description	Criteria to be modelled
1	Roof	Pitched roof (23 degrees) with solar absorptance of 0.6
2	Ceiling	2.4 m high horizontal, 10 mm plasterboard ceiling
3	Roof and ceiling insulation	In accordance with Tables 3.12.1.1a to 3.12.1.1g
4	Roof lights	No roof light, unless required by Part 3.8.4
5	External walls	Masonry veneer with 110 mm thick masonry with a solar absorptance of 0.6
6	Wall insulation	The minimum Total R-Value specified in 3.12.1.4(b)
7	Internal walls	70 mm timber frame with 10 mm internal plaster lining
8	Ground floor	Concrete slab-on-ground, insulated in accordance with 3.12.1.5(c)
9	Glazing	In accordance with Part 3.12.2
10	Air movement	In accordance with Part 3.12.4
11	Artificial lighting	In accordance with the maximum illumination power density allowed by 3.12.5.5 without any increase for a control device illumination power density adjustment factor

Health and Safety Risks associated with occupant indoor activities requiring mitigation	e.g. Harmful gasses from cooking; Mould/allergies due to water vapour; Fire; Smoke inhalation; Slips, trips, falls;
Health and Safety Risks associated with Building construction	e.g. Equipment; machinery, materials; electricity; slips, trips, falls
Greenhouse and Energy Minimum Standard (GEMS) Act Compliance	Response must explain how the project complies with the GEMS Act. e.g. The solar water heater product on the site plan saves energy and does not contribute greenhouse gases by depending mainly on solar energy instead of electricity. Electricity consumes energy and contribute greenhouse gases. GEMs Act's goal is to save energy and reduce greenhouse gases. Therefore, the solar water heater product adheres to GEMS Act.
Minimum Energy Performance Standards (MEPS) Compliance	e.g. The candidate's response must explain how the project complies with MEPS. A sample model answer is provided below: The solar water heater of the site plan saves energy and uses minimum energy levels by depending on solar energy instead of electricity that consumes a lot of energy. MEPS specify the minimum energy levels that products must meet. Therefore, the solar water heater adheres to MEPS guidelines.
Reference to local and international codes for best practice	e.g. Created by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) and approved by the American National Standards Institute (ANSI), this standard contains provisions regarding conditions for environmental thermal acceptability (i.e. evaluation of thermal environments).

Applicable standard to be adhered to (Specifically when referenced by NCC)	e.g. AS/NZS ISO 9972:2015 AS/NZS 2904:1995 AS 4654.1-2012 AS 2047-2014 AS/NZS 4859.1:2018 AS/NZS 5141:2018 AS/NZS 3598
Building science principles applicable to the building	e.g. Using continuous air barriers alongside effective mechanical ventilation Limiting heat bridges and optimising thermal resistance Moisture management Improving air quality levels indoors Use of optimal heating and cooling systems
Supporting websites, documents	e.g.

Products / Materials						
Product / materials	**Product / material / brand selected**	**Embodied energy**	**Energy efficiency**	**Ventilation / indoor air quality**	**Durability / Suitability**	**Operational costs**
Cladding						
Roofing materials						
HVAC systems						
Mechanical ventilation systems and equipment						
Moisture and vapour barriers						

Products / Materials						
Product / materials	**Product / material / brand selected**	**Embodied energy**	**Energy efficiency**	**Ventilation / indoor air quality**	**Durability / Suitability**	**Operational costs**
Glazing						
Lighting						
Internal walls						
Insulation						

Energy loss mitigation (air leakages)	
Area addressed	**Product / materials / method**
Downlights	
Insulation gaps	
Door / window gaps	
Openings for floor or ceiling ducts used to transmit heating or cooling	

Communications methods	
Client	
Suppliers	
Authorities (e.g. local council)	
Workers / Contractors	

Energy Efficiency Assessment Report

Commercial Building

Report researched and documented by	e.g. Participant name
Date	e.g. Insert date of assessment
Building and construction project	e.g. Participant must record the type of project being assessed
Project overview	e.g. Participant must provide a brief overview of the project
Building classification	e.g. The participant must specify the building classification for this project, e.g., Class 1a, Class 1b, etc.
Project site address	e.g. The participant must specify the site address for the project. In this example Brisbane is used
NCC Climate Zone	e.g. Climate zone 2 - warm humid summer, mild winter
Extreme weather conditions likely to impacting the building	e.g. Cyclone; Heavy rain and flooding, fire, extreme heat
State/territory where this project is being undertaken	e.g. Queensland

Building use	e.g. Commercial retail
Environmental conditions	e.g. coastal location; nearby hazards
Building positioning	e.g. North facing position to maximise energy efficiency. Landscaping to support wind protection
NCC Energy efficiency performance requirements to be met	e.g. Participant to summarise NCC Section J requirements as applicable (Queensland)

Energy efficiency expectations of the building	e.g. **Item** / **Description** / **Criteria to be modelled** 1 — Roof — Pitched roof (23 degrees) with solar absorptance of 0.6 2 — Ceiling — 2.4 m high horizontal, 10 mm plasterboard ceiling 3 — Roof and ceiling insulation — In accordance with Tables 3.12.1.1a to 3.12.1.1g 4 — Roof lights — No roof light, unless required by Part 3.8.4 5 — External walls — Masonry veneer with 110 mm thick masonry with a solar absorptance of 0.6 6 — Wall insulation — The minimum Total R-Value specified in 3.12.1.4(b) 7 — Internal walls — 70 mm timber frame with 10 mm internal plaster lining 8 — Ground floor — Concrete slab-on-ground, insulated in accordance with 3.12.1.5(c) 9 — Glazing — In accordance with Part 3.12.2 10 — Air movement — In accordance with Part 3.12.4 11 — Artificial lighting — In accordance with the maximum illumination power density allowed by 3.12.5.5 without any increase for a control device illumination power density adjustment factor

Health and Safety Risks associated with occupant indoor activities requiring mitigation	e.g. Harmful gasses from cooking; Mould/allergies due to water vapour; Fire; Smoke inhalation; Slips, trips, falls;
Health and Safety Risks associated with Building construction	e.g. Equipment; machinery, materials; electricity; slips, trips, falls
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Building science principles applicable to the building	e.g. Using continuous air barriers alongside effective mechanical ventilation Limiting heat bridges and optimising thermal resistance Moisture management Improving air quality levels indoors Use of optimal heating and cooling systems
Supporting websites, documents	e.g.

Products / Materials						
Product / materials	**Product / material / brand selected**	**Embodied energy**	**Energy efficiency**	**Ventilation / indoor air quality**	**Durability / Suitability**	**Operational costs**
Cladding						
Roofing materials						
HVAC systems						
Mechanical ventilation systems and equipment						
Moisture and vapour barriers						

Products / Materials						
Product / materials	**Product / material / brand selected**	**Embodied energy**	**Energy efficiency**	**Ventilation / indoor air quality**	**Durability / Suitability**	**Operational costs**
Glazing						
Lighting						
Internal walls						
Insulation						

Energy loss mitigation (air leakages)	
Area addressed	**Product / materials / method**
Downlights	
Insulation gaps	
Door / window gaps	
Openings for floor or ceiling ducts used to transmit heating or cooling	

Communications methods	
Client	
Suppliers	
Authorities (e.g. local council)	
Workers / Contractors	