



SouthZEB WP3, D3.3

**Deliverable 3.3: SouthZEB
assessment exams**

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WP3-D3.3



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EXECUTIVE SUMMARY

The objective of this document is to present the procedure followed for the development of the assessment exams and indicative examples. These exams based on the 10 different training modules developed during the WP3 (Task 2 and 3). The assessment exams will be a useful tool in order to assess the skills acquired by the trainees during the “train the trainer workshops” and the training sessions (WP5). In that way, the exams will lead to training certificates.

The present document is an output of WP3, Task 4 (D3.3).

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1. INTRODUCTION

The SouthZEB consortium developed ten different training modules during the WP3 (Task 2 and 3). The next step was the preparation of the assessment exams for each training module. The assessment exams will be a useful tool in order to assess the skills acquired by the trainees during the “train the trainer workshops” and the training sessions (WP5). In that way, the exams will lead to training certificates.

The assessment exams are available as a set of multiple-choice questions that will be selected by partners from each target country when the actual exams take place. The participants will take a written exam for each module and will be certified. For each training module, 100 multiple-choice questions have been prepared and for each actual exam 30 questions will be selected. It is noted that 2-3 maximum errors will be allowed.

Concerning the certifications awarded to participants, the successful completion of four training modules will lead to “nZEB designer” certificate. In the same way, a “nZEB trainer” certificate will be awarded to the trainers that successfully complete a set of 4 specific workshops. During each workshop, one training module will be delivered.

In the following sections, some indicative examples of the developed assessment exams of the modules 1, 2, 3, 4, 7, 8 and 10 are presented.

2. PROCEDURE

Assessment is an integral part of instruction, as it determines whether or not the goals of education are being met. Assessment affects decisions about grades, placement, advancement, instructional needs, curriculum, and, in some cases, funding.

The assessment exams were based on the 10 training modules developed by the SouthZEB consortium. Table 1 presents the developed modules and the respective partner-leader.

Table 1: Developed modules and leaders

Module	Partner
1- nZEB Basic module	CUT
2- nZEB Advanced module	DTTN
3- Thermal bridging	BRE
4- Thermal comfort	UMinho
5- SouthZEB framework module and local architectural regulations	BRE
6- nZEB simulation and design softwares	IST-ID
7- Low carbon technology and automation for nZEB	BRE
8- Retrofitting towards nZEB	UMinho
9- Construction management and field supervision of nZEB	GARNET
10- Preparation of funding schemes and other incentives for nZEB	BRE

Partner responsible for each training module provided KEK (Leader of Task 4, WP3) with the relative material in order to prepare the assessment exams. Moreover, it was requested from partners-leaders who developed the training modules to propose the most important topics for the exams. For this reason, an extra slide was prepared as guidance. An example of this slide is appeared below for Module 8, session 1 (Fig. 1).

Topic for exams	Slide numbers
nZEB concept	4, 5
Different approaches of nZEB concept:	6 - 9
Global Context	10 - 23
Social understanding	24
Fuel poverty	25, 26
IEQ and health	27 - 29
Political understanding	30
nZEB in building renovation	31 - 36



Figure 1: Indicative slide with specific topics to be covered for the exams.

Moreover, the development of the assessment exams was based on the training essay plans. The learning objectives and outcomes of each training module were taken into consideration.

Specifically, the development of the assessment exams for the training modules covers the following topics:

Module 1: nZEB Basic module

- Definition of Near Zero Energy Buildings
- European Directives and National Legislation
- Basic physics of Buildings
- Building Envelope
- Thermal Losses Mechanisms
- Thermal Insulation
- HVAC Systems
- Building automation
- RES technologies and minimum requirements

Module 2: nZEB Advanced module

- nZEB design
- Bioclimatic design
- Passive systems for heating/cooling
- Green buildings materials
- Natural ventilation
- Passive solar systems
- Systems and techniques for natural lighting
- Renewable technologies resources
- Energy efficiency and renewable energy measures

Module 3: Thermal bridging

- Thermal Performance of Building Envelope
- U-values
- Thermal bridging
- Impacts of building fabric
- Fabric performance and ZEBs
- Commissioning of building fabric

Module 4: Thermal comfort

- Thermal Comfort Concept
- Impact of building fabric on thermal comfort and energy use
- Range of temperatures associated to thermal comfort and their impact on buildings energy performance
- Relationship of thermal comfort with human health, well-being and productivity
- Thermo-regulatory system
- Heat balance
- Factors influencing thermal comfort
- Local thermal comfort/discomfort
- Natural ventilation and thermal comfort
- Thermal comfort predictive models
- Thermal Comfort assessment procedures

Module 5: SouthZEB framework module and local architectural regulations

- Local architecture and nZEB
- Planning for nZEB – the obstacles, legislation and opportunities
- Building regulations – overview of country situation and specifics of energy regulations
- nZEB and EPBD requirements
- Country specific issues with regards to the design, construction and operation of nZEB
- Examples of nZEB

Module 6: nZEB simulation and design softwares

- Energy modeling
- nZEB modeling
- EnergyPlus simulation program

Module 7: Low carbon technology and automation for nZEB

- PV
- Wind turbine systems
- Solar thermal
- Energy Storage
- Cost Optimality
- Building energy management systems

Module 8: Retrofitting towards nZEB

- nZEB concept in building renovation
- nZEB renovation strategies
- Passive and active renovation solutions towards nZEB
- Integration of renewable energy systems
- Cost optimal methodology applied to the renovation of buildings
- Life cycle costs assessment
- Difference between cost optimal solutions and net zero energy solutions
- Cost optimal renovation solutions according to the local context

Module 9: Construction management and field supervision of nZEB

- Sustainable Construction Management in nZEB
- EPBD and RED directives
- National legislation, building codes, regulations and guidelines
- Building information modelling
- Construction Management and Field Supervision for the various building envelope
- Components
- MEP Systems
- Renewable Energy & Energy Storage
- Building Automation in nZEB

Module 10: Preparation of funding schemes and other incentives for nZEB

- History, drivers, legislation and potential impact of green investment / funding schemes and incentives
- Overview of a wide range of existing green investment / funding schemes and incentives
- Applicability of funding schemes and incentives for specific country / regional requirements

It is, also, noted that during the development of the assessment exams, partners informed the leader of this task about any changes applied in the training modules. In such cases, correction actions were performed and assessment exams were updated.

The last step was the review of the 1000 multiple-choice questions by all partners in order to finalize the procedure.

3. CONCLUSIONS

The main objective of Task 4 of WP3 was the development of 1000 multiple-choice questions. For each one of the 10 training modules, 100 questions were prepared and reviewed by partners.

These questions will be also available in Greek, Italian and Portuguese and there is a strong belief that they could be translated in any language after the completion of the project.

The developed assessment exams are of great importance and a useful tool to assess the skills acquired by the trainees.

Each module will be assessed in a separate exam consisting of 30 questions out of the total of 100 questions delivered for that module. All exams will lead to training certificates. Furthermore, the successful completion of four training modules will lead to “nZEB designer” certificate. In the same way, a “nZEB trainer” certificate will be awarded to the trainers that successfully complete a set of 4 specific workshops. During each workshop, one training module will be delivered.

Below is presented an indicative sample of the developed assessment exams. The complete package of the assessment exams has been distributed to all SouthZEB partners.

4. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 1

1. What is nZeb:
 - a. A building with zero energy consumption
 - b. A building with near zero energy consumption**
 - c. A building with high energy consumption
 - d. A building with costly energy consumption

2. What kind of energy consumption is required for the building's consumption:
 - a. Renewable energy**
 - b. Oil
 - c. Natural gas
 - d. Lignite energy

3. Why the use of nZeb is so important:
 - a. Because it reduces total energy demand and CO₂ as well as it secures energy supply and prices in the future**
 - b. Because it reduces total energy demand and oil consumption both in buildings and residential buildings
 - c. Because it reduces electrical appliance energy use that it is prudent to conserve energy
 - d. Because it determines the price of a property on the market

4. The evolution of building energy use occurred in:
 - a. 1970
 - b. 1980
 - c. 1990
 - d. 2000**

5. According to which EU Directive the Government of each country is responsible to define the nZEB building and the subsequent minimum energy requirements for its function:
 - a. 2010/31/EU**
 - b. 2009/28/EC
 - c. 2002/91/EC
 - d. 2010/21/EU

6. Which of the following driving factors of RCS Directive is false:
 - a. Reduction by 2020 of overall greenhouse gas emissions by at least 20% below 1990 levels
 - b. Creation of employment opportunities and regional development in rural areas
 - c. Reduction of energy consumption in the Union and maintenance of global temperature rise below 4°C**
 - d. Compliance with the Kyoto Protocol to the UNFCCC and promotion of the security of energy supply

7. The European Council emphasized the need to increase energy efficiency in the Union so as to achieve the objective of:
- A 20% share of renewable energy in the gross final energy consumption
 - A 10% share of energy from renewable sources in transport by 2020
 - Both 20% share of renewable energy in the gross final energy consumption and energy from renewable sources in transport by 2020.
 - A 10% share of energy from renewable sources in transport by 2020 and a 20% share of renewable energy in the gross final energy consumption**
8. The recast EU's Energy Performance of Buildings Directive (Directive 2010/31/EU) (EPBD) is a vital instrument in the built environment. In particular countries are required to take into account the following:
- Outdoor climatic and local conditions
 - Indoor climate requirements
 - Cost effectiveness
 - All of the above**
9. The EPBD can be applied to:
- New and existing buildings that are subject to renovation, building elements that have a significant impact on building's energy performance when they are retrofitted or replaced as well as technical building systems whenever they are installed, replaced or upgraded.**
 - Only to new buildings as they do not need any kind of renovation.
 - Only to existing buildings that are subject to renovation
 - Only to building elements and systems that have a significant impact on building's energy performance when they are retrofitted or replaced
10. What kind of inspections are required for the application of EPBD:
- Inspections of electrical systems in buildings
 - Inspection of heating and air conditioning systems in buildings**
 - Inspections of lift systems in buildings
 - All of the above
11. According to the National Legislation in Cyprus, the inspection of boiler-based heating systems of nominal capacity 20-100 kW and use of solid, liquid or gaseous fuel, should be performed every:
- 5 years**
 - 4 years
 - 3 years
 - 2 years.
12. According to the National Legislation in Cyprus, the inspection of boiler-based heating systems of nominal capacity > 100 kW and use of solid or liquid fuel, should be performed every:
- 5 years
 - 4 years

- c. 3 years
d. 2 years.
13. According to the National Legislation in Cyprus, the inspection of systems with gas boiler of nominal capacity > 100 kW, should be performed every:
- 5 years
 - 4 years**
 - 3 years
 - 2 years
14. The inspection of HVAC systems of nominal capacity 12-250 kW, should be performed every:
- 5 years after their installation date**
 - 4 years after their installation date
 - 3 years after their installation date
 - 2 years after their installation date
15. The inspection of HVAC systems of nominal capacity >250 kW, should be performed every:
- 5 years after their installation date
 - 4 years after their installation date
 - 3 years after their installation date**
 - 2 years after their installation date
16. The inspection of HVAC systems of nominal capacity less than 12 kW but with the overall capacity installed in the building exceeding 50 kW, should be performed every:
- 5 years after their installation date**
 - 4 years after their installation date
 - 3 years after their installation date
 - 2 years after their installation date
17. The Energy Performance Certification (EPC) of buildings is assessed based on the corresponding national methodology. A valid EPC is required for:
- Any building including commercial purposes such as sale, rent etc.**
 - New buildings only
 - Old buildings only that are subject to renovation
 - Only for commercial purposes

18. Who is qualified to issue the EPC in Cyprus:
- All Engineers registered in the records of the Cyprus Scientific and Technical Chamber (ETEK)
 - Qualified experts registered in the records of the Cyprus Energy Service**
 - Only Civil Engineers registered in the records of the Cyprus Scientific and Technical Chamber (ETEK)
 - Only Environmental Engineers registered in the records of the Cyprus Scientific and Technical Chamber (ETEK)
19. A Building Shell is defined as:
- The part of the building which adjoins internal environment
 - The part of the building which adjoins conditioned space
 - The part of the building which adjoins external environment**
 - The part of the building which adjoins ground.
20. Which of the following has the min. thermal losses:
- Ground
 - Draughts due to insufficient air-tightness
 - Insulated walls**
 - Rooftop

5. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 2

1. A Building Envelope is defined as:
- Every element of the building that connects the building's conditioned spaces with the external environment**
 - Every element of the building that connects the building's unconditioned spaces with the external environment
 - Every element of the building that connects the building's conditioned spaces with the internal environment.
 - Every element of the building that connects the building's unconditioned spaces with the internal environment.
2. Indicate which of the following is considered to be a vertical structural building element:
- Walls and columns**
 - Rooftops and floors
 - Doors and windows
 - Shading systems
3. An insulating material is considered to be:
- Any material that limits heat transfer from an environment of low temperature to an environment of higher temperature
 - Any material that limits heat transfer from an environment of high humidity to an environment of lower humidity.

- c. **Any material that limits heat transfer (primarily by conduction) from an environment of high temperature to an environment of lower temperature**
 - d. Any material that limits heat transfer from an environment of low humidity to an environment of higher humidity
4. Which of the following insulation materials is a combined one :
 - a. Fibrous.
 - b. **Gypsoum foam**
 - c. Foamy
 - d. Foamy expanded
5. Main thermal property for insulating material classification is the thermal conductivity (k or λ). As a rule of thumb, any material with a thermal conductivity can be classified as an insulating material:
 - a. **$k \leq 0.1$ W/mK**
 - b. $k \geq 0.1$ W/mK
 - c. $k \leq 0.2$ W/mK
 - d. $k \geq 0.2$ W/mK
6. State which of the following statements is false:
 - a. HVAC is the technology of indoor and vehicular environment comfort. Its goal is to provide thermal comfort and acceptable indoor air quality.
 - b. HVAC is important in the design of medium to large industrial and office buildings as well as in marine environments, where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors
 - c. Most common HVAC system circulates air through or around heating and cooling devices. A fan forces air into ducts. Supply ducts transport conditioned air into building through diffusers or supply registers.
 - d. **HVAC system design is a sub-discipline of mechanical engineering, based on the principles of thermodynamics, fluid dynamics, and internal energy**
7. Which of the following is not an HVAC application:
 - a. Thermal storage - isolation of storage tank
 - b. Heating portable hot water (instantaneous heater)
 - c. **Insulation optimization**
 - d. Waste heat recovery from condenser water
8. Which of the following is not an HVAC component:
 - a. Furnace
 - b. **Electrical resistance**
 - c. Evaporator coils
 - d. Condensing unit

9. Convection is the:
- Collective movement of groups of molecules within fluids, through diffusion**
 - Transfer of internal energy by microscopic diffusion and collision of particles within a body due to a temperature gradient
 - Transfer of heat energy by microscopic diffusion and collisions of particles or quasi-particles within a body due to a temperature gradient
 - Emission or transmission of energy in the form of waves or particles through space or through a material medium
10. State which of the following is not a part of an Air Conditioner:
- Expansion valve
 - Two fans
 - Control unit
 - Chilled coil (on the outside)**
11. According to Article 9 of the 2010 EPBD recast (Directive 2010/31/EU) on nearly zero energy buildings, Member states shall:
- Ensure that by 31 December 2020, all new buildings are nearly zero energy buildings**
 - Ensure that after 31 December 2020, new buildings occupied and owned by public authorities are nearly zero-energy buildings
 - Encourage the introduction of intelligent metering systems whenever a building is constructed or undergoes major renovation
 - Take account of the cost-optimal levels of energy performance when providing incentives for the construction or major renovation of buildings
12. Which statement is false:
- A nZEB building is a building with greatly reduced energy demand that allows the energy demand to be balanced by an equivalent generation of electricity (or other energy carriers) from renewable sources
 - A nZEB building is connected to only one energy infrastructure; electricity grid, district heating and cooling system, gas pipe network, biomass and biofuels distribution networks**
 - When the generation is greater than the building's loads, excess electricity and heat is exported to the utility grid
 - Excess renewable energy production can offset fossil fuel energy use
13. According to Torcellini et al (2006a) "Net Zero Site Energy" means that:
- The building/site nZeb produces at least as much renewable energy as that used in a year, when accounted for at the building/site**
 - The building/site nZEB produces at least as much renewable energy as that used per annum when accounted for at the source
 - The building/site nZEB produces an equivalent amount of energy as that used per annum when accounted for at the source
 - The building/site nZEB produces an equivalent amount of energy as that used in a year, when accounted for at the building/site

14. Which of the following principles behind nZeb is false:
- Energy Demand
 - Renewable Energy Share
 - CO2 Emissions
 - Energy Systems**
15. Which of the following is not a principle against heat loss during winter:
- Double skin facade
 - Interior shading devices**
 - Air tightness
 - Glazing
16. Which of the following is not a principle to avoid overheating during summer:
- Passive cooling systems
 - Natural ventilation flow
 - Interior shading devices
 - Thermal bridges**
17. A Passive House is a comprehensive system. Which of the following is not valid:
- Any remaining heat demand is provided by an extremely small source
 - Avoidance of heat loss through shading and window orientation also helps to limit the cooling load, which is similarly minimized**
 - An energy recovery ventilator provides a constant, balanced fresh air supply
 - It is a very well-insulated, virtually air-tight building that is primarily heated by passive solar gain and by internal gains from people, electrical equipment, etc.
18. State which of the following is not facilitated by the passive house:
- Thermal insulation of the components and opaque windows, shading
 - Controlled mechanical ventilation with heat recovery
 - Minimized environmental impact through the use of heating and cooling alternative systems
 - Cooling and heating system**
19. State which of the following is not valid:
- As far as the appearance is concerned, a passive house is not different from a traditional one
 - The house construction is based on standard building materials but used in a different manner to standard methodology
 - Energy consumption in passive houses is lower than in conventional buildings
 - A comfortable interior climate cannot be maintained without the contribution of active heating and cooling systems.**

20. The Passivhaus standard was first established in 1995. Which of the following points is not true:
- Useful energy for space heating ≥ 15 kWh/m² year**
 - Primary energy demand for all energy services (including domestic electricity) ≤ 120 kWh/m² year
 - Air tightness: building envelope such that pressurization test result ≤ 0.6 h⁻¹ year
 - Comfort operative room temperatures $\geq 20^{\circ}\text{C}$ in winter

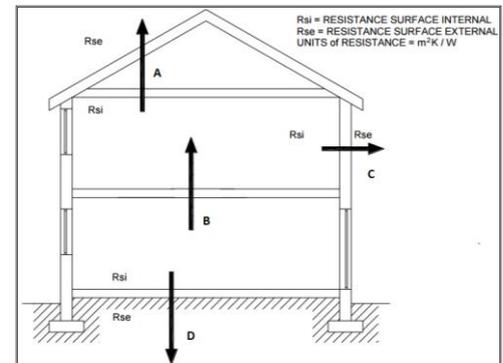
6. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 3

- The Building Regulations 2015 include Drivers for:
 - Energy Conservation – tackling the fuel crisis
 - Cost effectiveness and fuel poverty
 - Reducing greenhouse gas emissions (GHGs)
 - All of the above**
- BREEAM sets the standard for best practice in sustainable building design and operation. A BREEAM assessment used measures covering many aspects related to:
 - Energy and water use
 - Internal environment
 - Insulation
 - All of the above**
- The building fabric does not refer to:
 - Ceiling of a building
 - Windows of a building
 - Doors of a building
 - HVAC systems**
- Optimum design of building fabric:
 - Can minimize potential heating and cooling requirements
 - Can downsize heating and cooling systems
 - Can eliminate the need for heating and cooling systems
 - All of the above**
- When is the best time for the upgrade of building's fabric:
 - During major refurbishment**
 - During minor renovation
 - During sunny days
 - During cold days
- Simply by building and refurbishing our buildings to much higher insulation and airtightness standards could lead to at least an:
 - 80% reduction in cooling demand
 - 80% reduction in space heating demand**

- c. 80% reduction in both heating and cooling demand
d. None of the above
7. Which Part of Building Regulations refers to the energy efficiency requirements:
a. **Part L**
b. Part F
c. Part C
d. None of the above
8. Which of the following topics is not included in Section 6 of Scottish Building Standards:
a. Limiting heat loss through thermal bridging
b. Maximum U-values
c. **Continuity of insulation**
d. Limiting air infiltration
9. The U-value is a measure of how effective a is in restricting heat loss:
a. **Building element**
b. Heating system
c. Cooling system
d. Ventilation system
10. U-value can be defined as:
a. **A measurement of how effective a building element such as wall, roof etc. is in restricting heat loss**
b. A measurement of how effective a building element is in consuming electrical energy
c. A measurement of how effective a building element is in absorbing solar heat
d. All of the above
11. Which of the following statements is false:
a. **Less insulation = High U-value**
b. Less insulation = Low U-value
c. More insulation = High U-value
d. Less insulation = Low heat loss
12. Circle the material with the highest thermal resistance:
a. Polyurethane
b. **Cement**
c. Aerogel
d. Extruded polystyrene
13. Circle the material with the lowest thermal resistance:
a. Bricks
b. Cement
c. Aluminium frame
d. **VIPs**

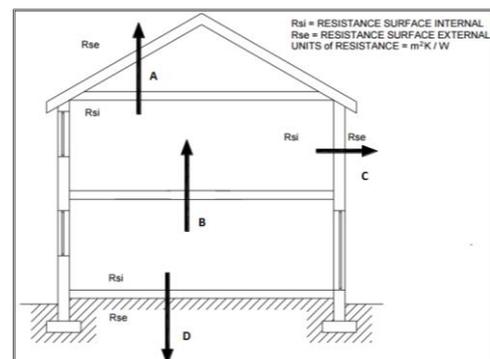
14. Thermal resistance is defined as the difference at state between two defined surfaces of a material construction that induces a unit heat flow rate through a unit area :
- temperature, steady**
 - pressure, steady
 - temperature, unstable
 - pressure, unstable
15. Thermal resistance is proportional to its:
- Density of the material
 - Mass of the material
 - Thickness of the material**
 - Temperature of the material
16. Thermal resistance is inversely proportional to its:
- Thermal conductivity**
 - Density
 - Temperature
 - Thickness
17. Thermal resistance is measured in:
- W/mK
 - m K/W
 - K/W
 - m² K/W**

18. According to Table of EN ISO:6946:2007 (Building Components and Building Elements - Thermal Resistance and Thermal Transmittance - Calculation Method), from the figure below indicate the point(s) with the highest internal Surface Resistance (R_{si}):



- A
- B
- C
- D**

19. According to Table of EN ISO:6946:2007 (Building Components and Building Elements - Thermal Resistance and Thermal Transmittance - Calculation Method), from the figure below indicate the point(s) with the lowest internal Surface Resistance (R_{si}):

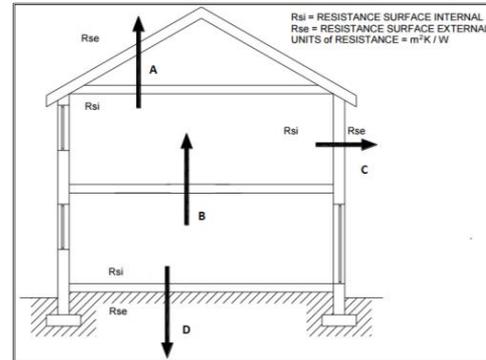


- A**
- B
- C

d. D

20. According to Table of EN ISO:6946:2007 (Building Components and Building Elements - Thermal Resistance and Thermal Transmittance - Calculation Method), from the figure below indicate the point(s) with the same external Surface Resistance (R_{se}):

- A, C, D
- A, B, C
- B, C, D
- A, B, C, D



7. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 4

- Which of the following statements is not correct:
 - Heat is energy in transfer other than as work or by transfer of matter
 - When there is a suitable physical pathway, heat flows from a hotter body to a colder one
 - Heat refers to a property of a system**
 - Heat also refers to a process of transfer
- What is thermal comfort:
 - The condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation when the minimum energy of the human system is consumed**
 - The condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation when the maximum energy of the human system is consumed
 - When the human system is unable to emit the excess of produced heat
 - When the temperature of human body cannot remain stable
- Which of the following is not considered to be a basic factor influencing thermal comfort:
 - Air temperature
 - Radiant temperature
 - Metabolic heat
 - Density**
- Thermodynamics is a branch of physics concerned with:
 - Heat temperature and their relation to energy and work**
 - Temperature variation
 - Heat variation only
 - Pressure variation

5. Climate change is correlated to:
 - a. Ambient temperature
 - b. Carbon dioxide concentration
 - c. Sea temperature
 - d. **All of the above**

6. As per EN ISO 7730:2005/par. 7:
 - a. It is possible to specify a thermal environment that satisfies everybody. It is also possible to specify environments predicted to be acceptable by a certain percentage of the occupants
 - b. **It is impossible to specify a thermal environment that satisfies everybody. It is possible to specify environments predicted to be acceptable by a certain percentage of the occupants**
 - c. It is possible to specify a thermal environment that satisfies everybody. It is impossible to specify environments predicted to be acceptable by a certain percentage of the occupants
 - d. It is impossible to specify a thermal environment that satisfies everybody. It is also possible to specify environments predicted to be acceptable by a certain percentage of the occupants

7. Subjective parameters of thermal comfort are:
 - a. Change over timeline
 - b. Variable for each region separately
 - c. **Stable over timeline**
 - d. Variable over period of time

8. Objective parameters of thermal comfort are:
 - a. Stable over timeline
 - b. **Change over timeline**
 - c. Stable for each region
 - d. Stable over period of time

9. Which Directive of the European Parliament has replaced the 2002/91EC one and promotes the improvement of the energy performance of buildings within the community taking into account the outdoor climatic, local conditions as well as indoor climate requirements and cost effectiveness:
 - a. **Directive 2010/31/EC**
 - b. Directive 2009/28/EC
 - c. Directive 2012/27/EU
 - d. None of the above

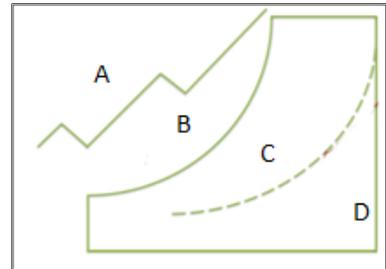
10. The macroscopic description in classical thermodynamics considers the system as a whole. The system is characterized in equilibrium, by a relatively small number of variables. Which of the following does not fit in here:
 - a. Pressure

- b. Temperature
c. Entropy
d. **None of the above**
11. Which of the following elements occupies the highest percentage in air composition:
a. O₂
b. **N₂**
c. Ar
d. Ne
12. In psychrometry, the most common system of interest is the mixture of water vapor and air. Which of the following is not considered to be an application of the above mentioned:
a. Meteorology
b. Heating
c. **Insulation**
d. Ventilating
13. Relative humidity RH (q) is the of the partial pressure of water vapor the equilibrium vapor pressure of water at the same temperature:
a. **Ratio, to**
b. Sum, with
c. Subtract, from
d. Multiplication, with
14. Wet bulb temperature is:
a. The temperature of air measured by a thermometer freely exposed to the air but shielded from radiation and moisture
b. **A parcel of air would have if it were cooled to saturation (100% relative humidity) by the evaporation of water into it**
c. The temperature at which the water vapor in a sample of air at constant barometric pressure condenses into liquid water at the same rate at which it evaporates
d. The temperature of air measured by a thermometer freely exposed to the air, radiation and moisture
15. Latent heat is the heat that:
a. Changes the temperature of a substance when added to or abstracted from it
b. **Does not affect the temperature but changes the state of substance when added to or abstracted from it**
c. Changes the temperature and the state of a substance when added to or abstracted from it
d. Does not affect the pressure and state of a substance when added to or abstracted from it
16. Enthalpy (h) does not depend on:
a. Volume
b. Pressure

- c. Internal energy
- d. **Temperature**

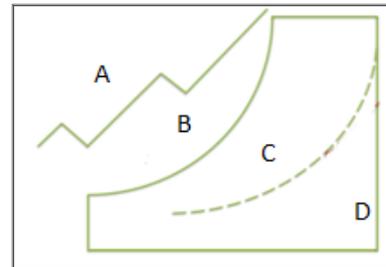
17. Which line of the psychrometric chart is the saturation one:

- a. A
- b. **B**
- c. C
- d. D



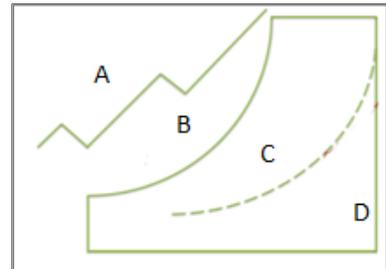
18. Which line of the psychrometric chart is the specific enthalpy one:

- a. **A**
- b. B
- c. C
- d. D.



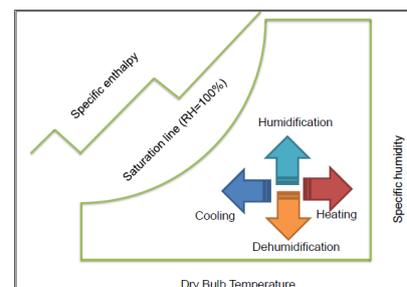
19. Which line of the psychrometric chart is the relative humidity one:

- a. A
- b. B.
- c. **C**
- d. D



20. In the following psychrometric chart, when the dry bulb temperature increases results in:

- a. Cooling
- b. **Heating**
- c. Dehumidification
- d. Humidification



8. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 7

1. What is nZeb?
 - e. A building with zero energy consumption
 - f. **A building with near zero energy consumption**
 - g. A building with high energy consumption
 - h. A building with costly energy consumption

2. What kind of energy consumption is required for an nZEB?
 - e. **Renewable energy**

- f. Energy from Oil burning
 - g. Natural gas
 - h. Lignite energy
3. In which EPBD Directive all EU countries were required to enhance their building regulations and to introduce energy certification schemes for buildings:
- a. Directive 2010/31/EU
 - b. Directive 2009/28/EC
 - c. **Directive 2002/91/EC**
 - d. None of the above
4. Which of the following is not considered to be a strategy that can help achieve nZEB:
- a. Load reduction - via passive design
 - b. Regenerative systems - use waste energy
 - c. System efficiency - meet remaining loads as efficiently as possible
 - d. **Ecological materials**
5. In site analysis of nZEB energy strategy, which of the following opportunities and constraints is not correct:
- a. Site layout and shape
 - b. **Location of building**
 - c. Ground conditions
 - d. Wind resources
6. In site analysis of nZEB energy strategy, solar access refers to:
- a. **Visible sky angles / neighboring buildings**
 - b. Dimensions of the windows
 - c. Shelter / trees
 - d. Natural ventilation
7. Determine the technology with low carbon dioxide savings:
- a. CHP (Combined heat and power) filled by biomass
 - b. CHP (Combined heat and power) filled by gas
 - c. **Photovoltaics (PVs)**
 - d. District heating and cooling
8. Determine the technology with medium-high load impact:
- a. Solar thermal systems
 - b. Ground water cooling
 - c. Biomass boiler
 - d. **Window power**
9. Indicate which of the following contributes to an easier nZEB:
- a. Off-grid connected nZEBs have to rely on expensive storage technology to balance the annual energy requirements
 - b. **Energy efficiency devices/appliances become essential**

- c. Off-site generation has more permanence with the building
 - d. On-site generators may be less concerned with the needs of their customers
10. Indicate which of the following is not a low carbon emitting renewable technology:
- a. Photovoltaics (PV)
 - b. Solar thermal
 - c. Small scale wind turbine
 - d. **Oil boiler**
11. The main source of energy used in buildings of South European climate is:
- a. **Electricity**
 - b. Solar
 - c. Hydroelectric
 - d. Wind
12. In non domestic buildings of South European countries, which of the following end user consumes the highest percentage of energy:
- a. Computers / plug loads
 - b. Artificial lighting
 - c. Lift system
 - d. **HVAC systems**
13. In order to improve the energy efficiency of a building, determine the first priority action:
- a. Installation of small wind turbine
 - b. Replacement of boiler
 - c. **Fabric improvements**
 - d. Installation of PV systems
14. Which of the following is the most popular and favoured of all renewable technologies for venture capital and private equity investment:
- a. Small hydro
 - b. **PV**
 - c. Geothermal
 - d. Wind
15. When were solar panels used for the first time in order to generate electrical power (0.1 W) for the US Vanguard spacecraft:
- a. 1955
 - b. **1958**
 - c. 1965
 - d. 1968
16. According to the Centre for Alternative Technology and BP Solar, identify the phrase that is not correct regarding Solar Power:
- a. Earth receives approximately 100.000 Terawatts energy
 - b. About 2.000 Terawatts received is estimated to be recovered
 - c. Globally humans use approximately 20 Terawatts annually

- d. **If all roofs in UK were covered with solar panels, we would generate sufficient power without using power stations**
17. Which element is most commonly used for world's energy consumption:
- Coal
 - Natural gas
 - Oil**
 - Hydro
18. In a photovoltaic plant which is located in the South hemisphere, which are the 1) optimal pitch and 2) optimal orientation:
- 1 = the degrees of the latitude of the installation place, 2 = South**
 - 1 = the degrees of the latitude of the installation place, 2 = East
 - 1 = 25°, 2 = South
 - 1 = 25°, 2 = East
19. Which is the range of efficiency (per cent) and durability (yrs) of the Monocrystalline PV Module type:
- 9% - 12% and 15 to 20 years
 - 10% - 13% and 20 to 25 years
 - 12% - 15% and 25 to 30 years**
 - 18% - 21% and more than 30 years
20. Which is the range of efficiency (per cent) and durability (yrs) of the Polycrystalline PV Module type:
- 9% - 12% and 15 to 20 years
 - 10% - 13% and 20 to 25 years**
 - 12% - 15% and 25 to 30 years
 - 18% - 21% and more than 30 years

9. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 8

1. Energy performance of a building (EPBD) means the:
- Highest calculated amount of energy needed for heating, cooling, ventilation, hot water and lighting of a building
 - Measured or calculated amount of energy needed for a typical use of the building which includes amongst others heating, cooling, ventilation, hot water and lighting**
 - Produced amount of renewable energy needed for a typical use of the building which includes amongst others heating, cooling, ventilation, hot water and lighting
 - Highest calculated amount of energy needed for minimum use of heating, cooling, ventilation, hot water and lighting of a building

2. According to EN 15603/2008, the energy rating calculation should be obligatory and include:
 - a. Energy produced from occupant behaviour
 - b. Energy gains from actual weather conditions
 - c. Energy gains from environmental and indoor conditions
 - d. **Energy used for HVAC systems**

3. Regarding renewable energy supply options as part of different approaches of nZEB concept, which of the following is considered to be an example for purchase off-site:
 - a. **Utility based PV and wind farms**
 - b. Solar thermal system for hot water
 - c. Biomass imported from off site
 - d. All of the above

4. The 2010 Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive are the EU's main legislation when it comes to reducing the energy consumption of buildings. Under the Energy Performance of Buildings Directive :
 - a. EU countries make energy efficient renovations to at least 3% of buildings owned and occupied by central government
 - b. EU countries must draw-up long term national building renovation strategies which can be included in their national energy efficiency action plans
 - c. **EU countries must establish inspection systems schemes for heating and air conditioning systems or put in place measures with equivalent effect**
 - d. All of the above

5. Fuel poverty will have greater impact on the health of:
 - a. Young people
 - b. **Elderly people**
 - c. Middle aged people
 - d. All of them

6. Which of the following could be an outcome of fuel poverty:
 - a. Mortality
 - b. Childhood asthma
 - c. Mental health
 - d. **All of the above**

7. European Directive 2009/72/EC acknowledges existence of fuel poverty and mentions the existence of to be included in national legislations:
 - a. **Vulnerable customers**
 - b. Vulnerable groups
 - c. Vulnerable citizens
 - d. Vulnerable individuals

8. Due to the fact that there is not a common definition regarding the concept "Fuel Poverty", different approaches have been also considered. Which of the following definition does not refer to the above mentioned concept:
- Anyone who meets in its housing particular difficulties to have the necessary energy to meet its basic energy needs because of the inadequacy of its resources or of its housing conditions is considered to be in fuel poverty
 - Fuel poverty has been described as the inability to afford adequate warmth in a home, or the inability to achieve adequate warmth because of the energy efficiency of the home
 - The lack of access to basic energy services such as electricity, heat or other forms of power, where the well being of a large number of people in developing countries is negatively affected by very low consumption of energy**
 - None of the above
9. Which is the main factor that causes energy poverty:
- Under development / lack of advancement**
 - Low household income
 - High energy costs
 - Under occupancy of the home
10. Which European Directive defines nZEB building:
- 2012/27/EU
 - 2002/91/EC
 - 2009/28/EC
 - 2010/31/EU**
11. The EPBD recast 2010/31/EU defines the term 'major renovation' as the renovation of a building where:
- The total cost of the renovation relating to the building envelope or the technical building systems is higher than 25% of the value of the building, excluding the value of the land upon which the building is situated**
 - The total cost of the renovation relating to the building envelope or the technical building systems is lower than 25% of the value of the building, excluding the value of the land upon which the building is situated
 - The total cost of the renovation relating to the building envelope or the technical building systems is higher than 25% of the value of the building, including the value of the land upon which the building is situated
 - The total cost of the renovation relating to the building envelope or the technical building systems is higher than 30% of the value of the building, excluding the value of the land upon which the building is situated
12. According to the EPBD recast 2010/31/EU of the surface of the building envelope undergoes renovation:
- more than 30%
 - less than 30%

- c. **more than 25%**
 - d. less than 25%
13. According to the Energy Efficiency Directive 2012/27/EU each Member State shall ensure that:
- a. **As from 01/01/2014, 3% of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU**
 - b. As from 01/01/2014, 5% of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU
 - c. As from 01/01/2014, 3% of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated every two years to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU
 - d. As from 01/01/2014, 5% of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated every two years to meet at least the minimum energy performance requirements that it has set in application of Article 4 of Directive 2010/31/EU
14. According to Energy Efficiency Directive 2012/27/EU which buildings should be prioritized for energy performance measures:
- a. Residential buildings with the poorest energy performance
 - b. **Government buildings with the poorest energy performance**
 - c. Both government and residential buildings with the poorest energy performance
 - d. Both government and residential buildings with the low energy performance
15. According to Energy Efficiency Directive 2012/27/EU which is the reason why Member States shall ensure that central government purchase only products, services and buildings with high energy-efficiency performance:
- a. It is consistent with sufficient competition
 - b. It is consistent with economical feasibility
 - c. It is consistent with technical suitability
 - d. **All of the above**
16. Which of the following standards refers to the renovation:
- a. EN 15450
 - b. EN 15242
 - c. CR 1752
 - d. **None of the above**
17. EUROCODES are set of harmonized technical rules developed by the European Committee. Which of the following purpose does not fit in here :

- a. EUROCODES are a means to prove compliance with the requirements for mechanical strength, stability and safety in case of fire established by EU law
 - b. **EUROCODES are a means to secure ecologically sustainable development and use of natural resources**
 - c. EUROCODES are a basis for construction and engineering contract specifications
 - d. EUROCODES are a framework for creating harmonized technical specifications for building products
18. Which of the following Greek laws refer to "Measures to reduce energy consumption in buildings and other provisions" which also integrates the Directive 2002/91/EC:
- a. 3851/2010
 - b. 3889/2010
 - c. **3661/2008**
 - d. None of the above
19. Which is the main topic of the law 3661/2008:
- a. The protection of the climate through the promotion of electrical energy production from R.E.S.
 - b. The general safety of the installation and related equipment of the system and the network
 - c. Energy performance of a building
 - d. **Minimum requirements for the new buildings and buildings that undergo major renovations**
20. According to building Greek Code law 4067/2012 Article 25, which of the following is not an incentive for minimal energy consumption buildings:
- a. A⁺ buildings including maximum energy efficiency, CHP and RES receive 5% increase of the building coefficient
 - b. Energy performance of a building
 - c. **Buildings with total consumption > 10kWh/m²/year receive 10% increase of the building coefficient**
 - d. Buildings with total consumption < 10kWh/m²/year receive 10% increase of the building coefficient

10. EXAMPLES OF THE ASSESSMENT EXAMS – MODULE 10

1. By 2020, the EU aims to:
 - i. Reduce its greenhouse gas emissions by at least 40%
 - j. Increase the share of renewable energy to at least 40%
 - k. **Achieve energy savings of 20% or more**
 - l. All of the above
2. The EU committed itself to the reduction of its Greenhouse Gas (GHG) emissions by between by 2050:

- a. **80% - 95%**
 - b. 65% - 80%
 - c. 60% - 75%
 - d. 50% - 65%
3. Which of the following is considered to be an inherent co-benefit of energy-savings:
- a. Saving money
 - b. Creating jobs
 - c. Improving competitiveness
 - d. **Improvement of energy security**
4. Better construction and use of buildings in the EU would influence:
- a. A 50% of final energy consumption
 - b. Up to 40% of water consumption
 - c. **More than 50% of all extracted material**
 - d. All of the above
5. The interim and intended carbon budgets recommended by the Committee on Climate Change require:
- a. **The interim budgets require an emissions reduction of 34% in 2020 relative to 1990**
 - b. The interim budgets require an emissions reduction of 52% in 2020 relative to 1990
 - c. The intended budgets require an emissions reduction of 34% in 2020 relative to 1990
 - d. The intended budgets require an emissions reduction of 52% in 2020 relative to 1990
6. As part of the Renewable Energy Strategy 2009, UK is engaged in meeting the 15% target of:
- a. **Energy consumption from renewable sources by 2020**
 - b. Reducing emissions by improving the energy efficiency of properties by 2020
 - c. Reducing greenhouse emissions from agriculture by 2020
 - d. All of the above
7. Which sectors represent a substantial energy-saving potential:
- a. Buildings and industrial process
 - b. **Buildings and transport**
 - c. Agriculture and transport
 - d. Agriculture and buildings
8. account for over 45% of UK carbon emissions:
- a. Industrial process
 - b. Transport
 - c. **Domestic and non domestic buildings**
 - d. Agriculture

9. Which term is used to cover a wide variety of contracting and financing techniques for energy efficiency and renewable energy projects:
- Third Party Financing (TPF)
 - Energy Performance Contracting (EnPC)
 - Contract Energy Management (CEM)
 - All of the above**
10. The aim of the Carbon Emission Reduction Target (CERT) in the UK was to:
- Boost the number of heat and electricity microgeneration installations in the United Kingdom
 - To help cut carbon emissions
 - To reduce fuel poverty
 - All of the above**
11. The Carbon Emissions Reduction Target (CERT) in the United Kingdom (formerly the Energy Efficiency Commitment) is a target imposed on:
- Gas suppliers with over 250,000 customers
 - Electricity domestic suppliers with fewer than 250,000 customers
 - All suppliers with over 250,000 gas and/or electricity domestic customers**
 - All suppliers with fewer than 250,000 gas and/or electricity domestic customers
12. According to the UK's Carbon Emissions Reduction Target (CERT) 2008-2012 on domestic properties, suppliers had to:
- Reduce carbon emissions by 200 million lifetime tonnes CO₂
 - Achieve 50% of these savings in the Priority Group
 - Achieve 60 million lifetime tonnes of CO₂ via professionally installed insulation measures
 - Promote 16.2 million tonnes worth of carbon savings to those on certain qualifying benefits**
13. What was included in the Carbon Emissions Reduction Target (CERT) program (2008–2012):
- All electricity and gas suppliers with 15,000 or more domestic customers must achieve a combined energy saving of 62 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes
 - All electricity and gas suppliers with at least 50,000 domestic customers (including affiliated licenses) must achieve a combined energy saving of 130 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes
 - All electricity and gas suppliers must achieve a combined energy saving of 154 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes
 - All electricity and gas suppliers with over 250,000 domestic customers must achieve a combined energy saving of 293 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes**

14. The Carbon Emissions Reduction Target (CERT) was an obligation on large UK energy companies to deliver energy saving measures to:
- Households in receipt of certain income-related benefits or tax credits**
 - High income households
 - Any kind of household despite the amount of income earned
 - Households with single-occupant in rural geographical areas
15. According to the UK's Carbon Emissions Reduction Target (CERT) 2008-2012 on domestic properties, the priority group includes:
- Those aged 70 and over and those on a wider set of qualifying benefits**
 - Those aged 60 and over and those on a wider set of qualifying benefits
 - Those on a wider set of qualifying benefits regardless of their age
 - Children and unemployed
16. As part of the UK's Carbon Emissions Reduction Target (CERT), a whole-house approach means:
- Installing as many energy efficiency improvement measures as possible and appropriate within a home in a single decision making**
 - Installing as many energy efficiency improvement measures as possible and appropriate within a home in a series of decisions
 - Installing solely insulation improvement measures within a home in a single decision making
 - Installing solely insulation improvement measures within a home in a series of decisions
17. The UK's Carbon Emissions Reduction Target (CERT) extension (phase 2) introduced a number of changes that each supplier had to adjust on their approach. Which measure does not fit in here:
- Significant restrictions on lighting measures
 - The insulation obligation
 - The SPG (Super Priority Group) obligation
 - The appliances obligation**
18. Which of the following measure types achieved the highest percentage of carbon savings over the five years of the Carbon Emissions Reduction Target (CERT):
- Lighting measures
 - Insulation measures including Insulation obligation**
 - Heating measures
 - Appliances
19. Which of the following measure types achieved the lowest percentage of carbon savings over the five years of the Carbon Emissions Reduction Target (CERT):
- Heating measures
 - Appliances
 - Microgeneration & CHP**
 - Behavioral measures

20. What was included in the original Energy Efficiency Commitment 1 (2002–2005) program:
- a. **All electricity and gas suppliers with 15,000 or more domestic customers must achieve a combined energy saving of 62 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes**
 - b. All electricity and gas suppliers with at least 50,000 domestic customers (including affiliated licenses) must achieve a combined energy saving of 130 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes
 - c. All electricity and gas suppliers must achieve a combined energy saving of 154 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes
 - d. All electricity and gas suppliers must achieve a combined energy saving of 293 TWh by 2005 by assisting their customers to take energy-efficiency measures in their homes