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# Arnaud Bastian: responses from T313\_1

## Energy in buildings

### End-of-course quiz

#### Question 1

What are the three main modes of heat loss from a house?

The main three losses are: fabric heat loss, ventilation loss, flue heat loss

As described in Section 2.1 they are:

- fabric heat losses – those through the building fabric itself, i.e. the walls, roof, floor and windows
- ventilation losses due to air moving through the building
- flue heat losses since the heating system is not 100% efficient

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#### Question 2

What can be done to cut each of these three heat losses?

In order:

- Improve insulation
- Creating an airtight environment
- Improving heating systems efficiency

As described in Section 2.1:

- Fabric losses can be cut by the use of insulation

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- Ventilation losses can be cut by making the building more airtight (and possibly using mechanical ventilation with heat recovery)
  - Flue losses can be cut by installing a more efficient heating system

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### Question 3

What are the three important mechanisms involved in the transmission of heat, particularly in windows?

Conduction, convection, radiation

As described in Section 2.2 they are:

- Conduction
- Convection
- Radiation

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### Question 4

Why are low-e coatings used in double and triple glazed windows?

To limit the radiated heat from a material

As described in Section 2.2.1 they are used to reduce the heat *radiated* from an inner pane to an outer one.

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### Question 5

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Which building element is likely to have the best insulation performance – one with a high  $U$ -value or one with a low  $U$ -value?

The low  $U$ -value one.

As described in Section 2.2.2, the lower the  $U$ -value, the better the insulation performance.

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### Question 6

Which type of insulation is strong enough to be used for shuttering for making concrete buildings?

Polystyrene insulation may be used

As described in Section 2.2.3 and shown in Figure 8, polystyrene insulation can be used for making concrete buildings.

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### Question 7

Briefly describe two ways of internally insulating or 'dry lining' a solid brick wall.

Foam-back plasterboard or battens to maintain on layer of insulated material between the wall outside and the inside wall

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As described in Section 2.2.5 and shown in Figure 13:

1. Sheets of foam-backed plasterboard can be glued to the wall
2. Insulated battens can be screwed to the wall with a layer of insulation between them and covered with a surface layer of plasterboard.

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### Question 8

Give three reasons why ventilation is needed in a building.

- Keep the building from building-up air humidity
- Carbon monoxide/dioxide evacuation
- Temperature regulation

As described in Section 2.3 ventilation is needed

- to provide combustion air in winter for boilers, fires and gas cookers (although it is not necessary for heating systems with balanced flues or for electric fires)
- to remove moisture from kitchens, toilets and bathrooms
- to provide fresh air for occupants and to keep them cool in summer.

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### Question 9

Why is a condensing gas boiler more efficient than a non-condensing one?

Because the condensation phase transition of the water releases heat energy

As described in Section 3.2 a condensing gas boiler recovers the latent heat of vaporization of the water vapour produced when natural gas burns.

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### Question 10

Explain why in the past the use of electricity as a heating fuel has involved far higher CO<sub>2</sub> emissions than using natural gas in a efficient boiler, but this isn't true now.

Because we can now use sources of electricity production that emit less CO<sub>2</sub>

As explained in Section 3.5, and shown in Table 11, the CO<sub>2</sub> emission factor for electricity has been particularly high because of the large heat losses that take place at conventional fossil fuel power stations. However, the increasing proportion of UK electricity coming from renewable energy since 2013 has dramatically reduced the emission factor.

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### Question 11

Light emitting diode (LED) lamps have been heavily promoted in the UK since 2015. What other low energy lighting technologies do they compete with?

The compete with compact fluorescent lamps

As described in Section 4.2.1 low energy compact fluorescent lamps (CFLs) have been available for domestic use. Tungsten halogen lamps are also available but these are only 30% more efficient than conventional incandescent lamps, and their sale is now being phased out.

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### Question 12

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What two ratings appear on a home Energy Performance Certificate?

Energy efficiency and environment impact

As described in Section 5:

1. An Energy Efficiency or SAP rating concerned with energy costs
2. An Environment Impact Rating (EIR) concerned with CO<sub>2</sub> emissions

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