Year 11 Physics Assignment: Heat ***SOLUTIONS***

1.
   (a) Both are measurements of the energy in objects. Heat is energy transferred, temperature measures average movement of particles.
   (b) (not only one correct answer, but the explanation must include why it works as well as how it can be used)

2.
   (a) The metal feels colder to touch, because it takes energy from your skin faster.
   (b) *Agree:* The cold air is prevented from entering the house (convection)
   Disagree: The heat is prevented from leaving the house (conduction)
   (c) (not only one correct answer, but explanation must include hot substance rising and cold substance falling)
   (d) (*not only one correct answer, but two examples are:* "When you hold up your hand near a fire, why does your hand feel warm?" "How does the sun's energy get to Earth?"

3. *Used:* Iron wagon wheel tyres are made too small, heated to fit around the wooden wheel, then cooled to 'shrink fit' permanently onto the wheel.
   Worked around: Bridges would buckle with the expansion and contraction caused by temperature change, so 'expansion joints' are added to provide room for the movement.

4.
   (a) (*not only one correct answer, but one example is:* "A u-shaped pipe with water in it. The water will flow in the pipe until the level is the same on both sides.")
   (b) *Agree:* The difference between the drink and room temperature is greater, so the energy transfer rate will be faster.
   Disagree: Although the rate will initially be faster, this will slow as it cools so it will end up taking longer overall.

5. Water has a high specific heat capacity (a lot of energy is required to change its temperature). This makes the region near Price heat up slower during the day and hold this heat for longer at night.

6.
   (a) $Q = mc\Delta T = 0.500 \times 4.18 \times 10^3 \times 50 = 1.0 \times 10^5$ J
   (b) $Q = mc\Delta T$
   $$\therefore c = \frac{Q}{m\Delta T} = \frac{3075}{0.050 \times (100 - 30)} = 880 \text{ J/kg/K}$$
   (c) $Q = mL = 0.0010 \times 2.272 \times 10^6 = 2272$ J
   $Q = mc\Delta T$
   $$\therefore \Delta T = \frac{Q}{mc} = \frac{2272}{0.0090 \times 4.18 \times 10^3} = 60 \text{ K}$$
   Final temperature: $100 - 60 = 40°C$

7.
   (a) This means that only 25% of the energy burnt by the car engine is converted into movement energy of the car. The rest (75%) is wasted, turned into heat and sound.
   (b) $$\eta = \frac{\text{energy output}}{\text{energy input}} \times 100 = \frac{0.99}{11} \times 100 = 9.0\%$$