Q2 Outline the physiological consequences of therapeutic hypothermia at 32 degrees Celsius (March 2012)

Temperature – average kinetic energy of the atoms/molecules that make up a substance
Thermoregulatory responses maintain ideal human body temperature between 36-38 degrees
Hypothermia – core temperature below 35 degrees
Therapeutic hypothermia – active cooling of the body to 32-34 degrees Celsius with the aim of reducing cell damage

Physiological consequences of therapeutic hypothermia:

- METABOLIC
    - Increase in BMR with shivering
    - Mediated by increases in catecholamines and thyroxine
    - Lactic acidosis can develop due to shivering and decreased tissue perfusion

- CARDIOVASCULAR
    - Tachycardia initially then progressive bradycardia (PR prolongation on ECG)
    - Vasoconstriction peripherally and consequent increase in cardiac output and blood pressure, followed by progressive fall in cardiac output as temperature falls
    - Atrial and ventricular arrhythmias rare above 30 degrees → can lead to systole

- RESPIRATORY
    - Initial tachypnea then progressive decline in minute volume, oxygen consumption and CO2 production
    - O2/Hb dissociation curve moves to the left
    - Decline in hypoxic pulmonary vasoconstriction due to decrease in O2 consumption
    - Increase in pulmonary vascular resistance

- CNS
    - Reduction in cerebral metabolic rate of oxygen (CRMO2) 6% for every 1 degree fall in temperature
    - Reduction in glutamate and oxygen free radical release
    - Inhibition of inflammatory products (cytokines, interleukins etc)
    - Involuntary shivering which fatigues as hypothermia continues
    - Amnesia, apathy, dysarthria, progressive reduction in LOC (unconsciousness tends to occur below 32 degrees)

- HAEMATOLOGICAL
    - Coagulopathy due to reduction in platelet number and function (may also be sequestered in spleen)
    - Coagulation cascade may also be impaired due to enzymatic inhibition by cold

- RENAL
    - Cold diuresis due to decreased solute absorption in LOH
    - Decrease in renal blood flow as cardiac output falls

- GIT
    - Reduction in GIT motility