Q1 Describe the physiological consequences that follow an intravenous bolus of 50mls of 50% glucose (Sept 2011)

50ml of 50% dextrose

- Hyperosmolar solution containing 25g of glucose
- Causes transient hyperglycaemia

Physiological response:

- Glucose is taken up by GLUT-2 transporters on the surface of the pancreatic beta cells.
- Glucose is metabolized and phosphorylated by glucokinase, increasing the ATP in the cytoplasm and causing ATP-sensitive potassium channels to close. This depolarises the cell, allowing voltage-gated calcium channels to open, producing an influx of calcium. Exocytosis of the secretory granules of the β cells then occurs.
- Insulin release is biphasic, with the first release occurring within 3-5 minutes and the second release commencing at 15 minutes and reaching a plateau at 2-3 hours.
- Effects of insulin:

  CHO →

  - Stimulates GLUT 4 receptors to move to the surface of muscle and adipose tissue cells to increase glucose uptake (this does not happen in RBC, brain tissue, intestinal mucosal cells or renal tubule cells).
  - Upregulates Glycogen Synthase to increase glycogen production
  - Upregulates glucokinase in hepatocytes to trap glucose in cells by phosphorylating it
  - Decreases gluconeogenesis and glycogenolysis (by inhibiting glucose-6-phosphatase)

  Proteins →

  - Upregulates amino acid uptake, enhances protein synthesis, and inhibits protein degradation in muscle and other tissues, thereby decreasing the plasma concentrations of most amino acids

  Lipids →

  - Upregulates Pyruvate Dehydrogenase, Lipoprotein Lipase and Fatty Acid Synthase to facilitate the breakdown of TAGs to fatty acids for uptake by adipose tissue cells
  - Inhibits Hormone Sensitive lipase to decrease the hydrolysis of triglycerides stored in the adipocyte

- Increase in BGL exceeds the renal glomerulus capacity for glucose reabsorption and transient glycosuria occurs
- Excretion of the osmotically active glucose molecule produces a diuresis

  → Overall effect is a decrease in BSL to normal levels, which causes negative feedback and reduces insulin secretion