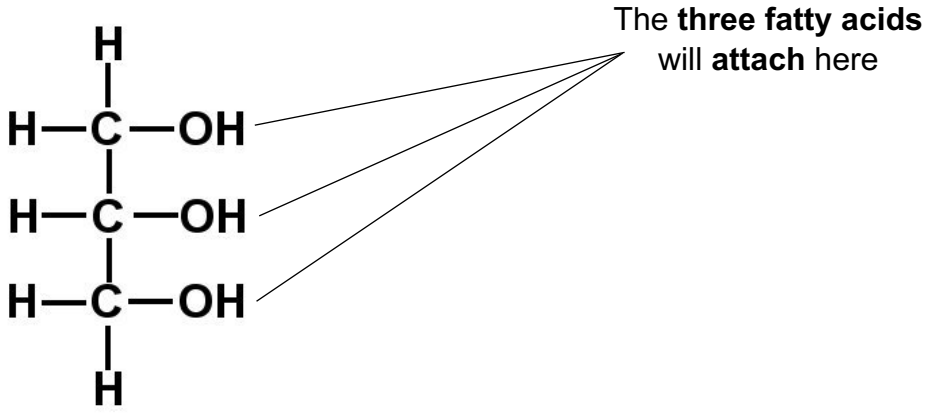
A. GLYCEROL AND FATTY ACIDS

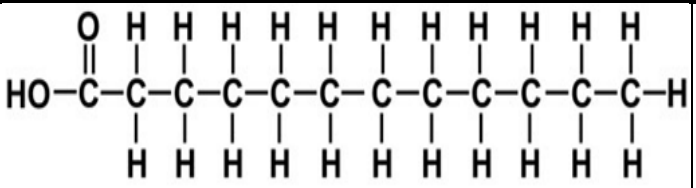
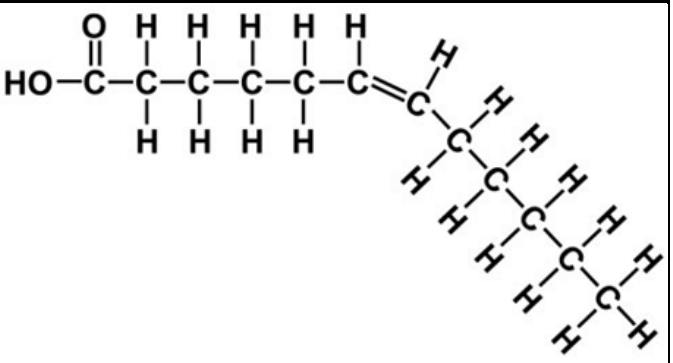
- **Glycerol** is **joined** to **three fatty acids** by **condensation** reactions to form a **triglyceride**
- **Triglycerides** are the **largest** class of lipids and function primarily as **long-term energy storage** molecules
- **Animals** tend to **store triglycerides** as **fats (solid)**, while **plants** tend to **store triglycerides** as **oils (liquid)**

Structure of glycerol

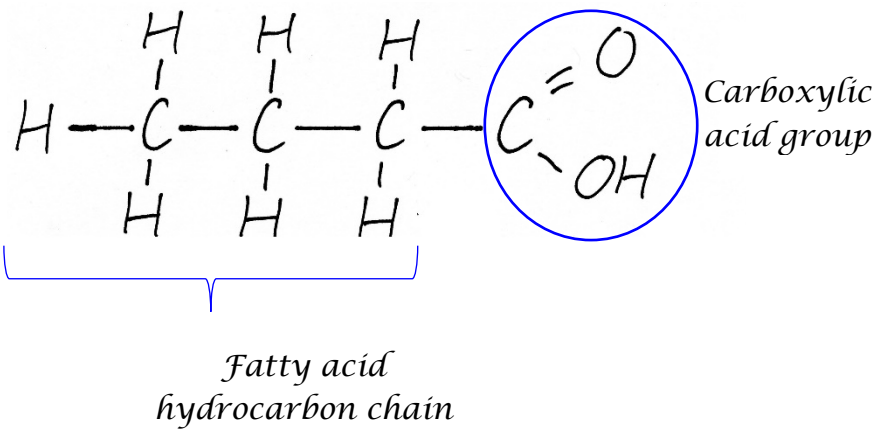


Types of fatty acid

(a) Saturated v unsaturated

Saturated	Unsaturated
	
• **No C=C** bonds • Contains the **maximum number** of **H** atoms (‘full up’)	• **Mono**unsaturated contain **one C=C** • **Poly**unsaturated contain **two or more C=C** • Do **not** contain the **maximum number** of **H** atoms (not ‘full up’)
You need to be able to draw these	**You need to be able to recognise these**
$CO_2H\ (CH_2)_n\ CH_3$	**$CO_2H\ (CH_2)_n\ (C=C)n\ CH_3$**

Drawing a saturated fatty acid

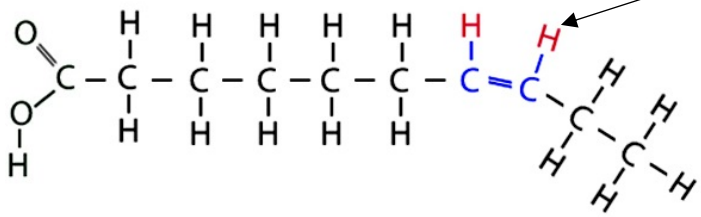


(b) CIS unsaturated v TRANS UNSATURATED fatty acids

- Remember, that this only applies to **unsaturated** fatty acids
- You only need to look at the **C=C** for this

hydrogen atoms are bonded to **carbons** on the **same side** of a **double bond**

cis



(so) **more bends** in fatty acid chains

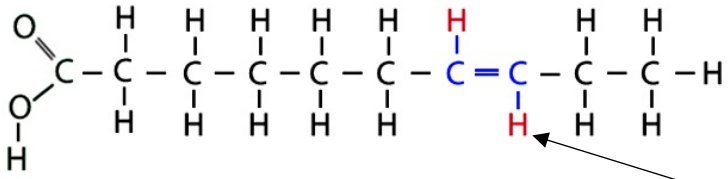
(so) **cannot** pack closely together

(so) **weaker** attractive forces between chains

(so) more likely to be **liquids (oils)**

HEALTHIER!

trans



hydrogen atoms are bonded to **carbons** on **opposite sides** of a **double bond**

(so) **less bends** in fatty acid chains

(so) **can** pack closely together

(so) **stronger** attractive forces between chains

(so) more likely to be **solids (fats)**

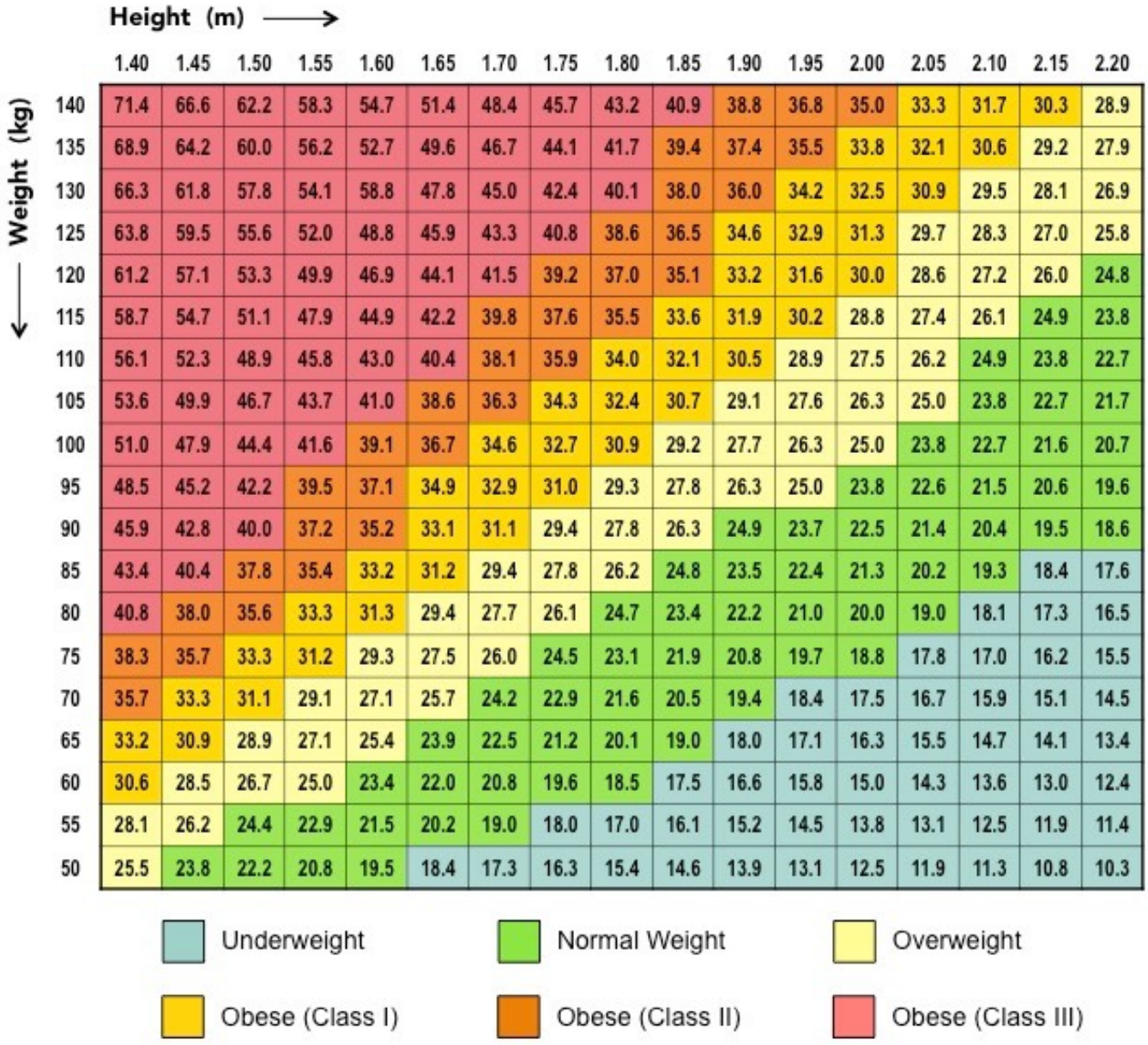
LESS HEALTHY!

- Intake of **SATURATED FATS** and **TRANS-UNSATURATED FATS** have been **positively correlated** with rates of **coronary heart disease** (CHD).

B. DETERMINATION OF BODY MASS INDEX BY CALCULATION OR A NOMOGRAM

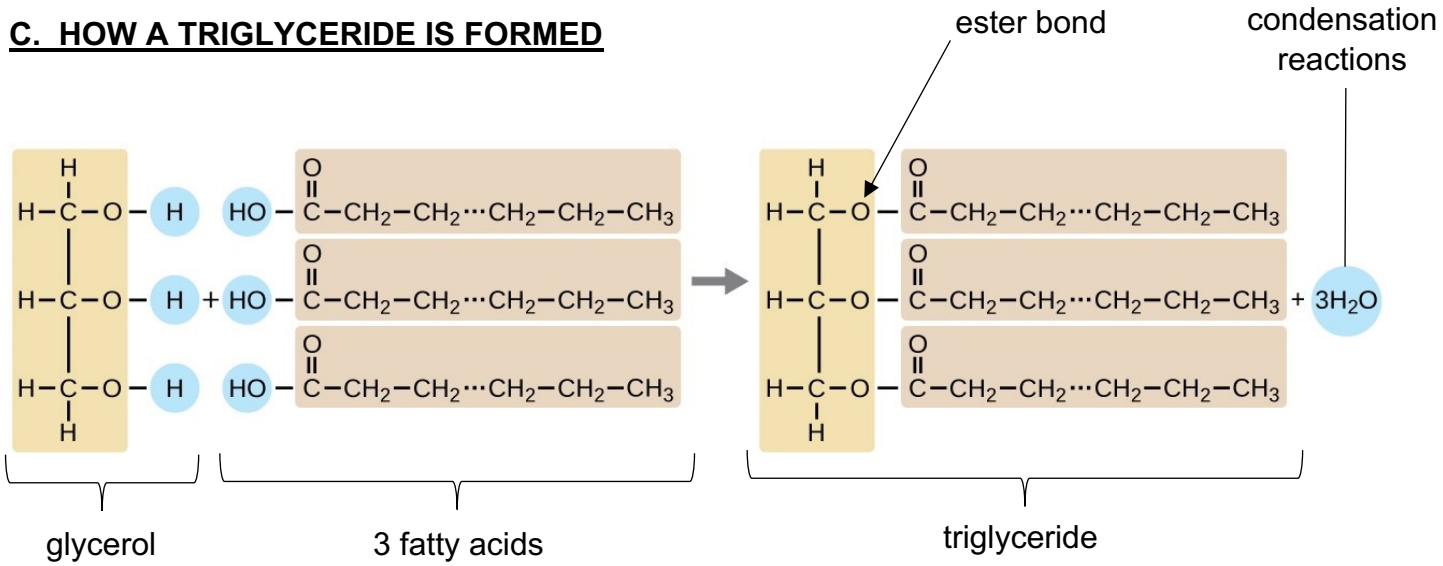
$$\text{BMI} = \frac{\text{mass (kg)}}{\text{height}^2 \text{ (m)}}$$

BMI	Conclusion
Below 18.5	Underweight
18.5 to 24.9	Normal weight
25.0 to 29.9	Overweight
30.0 or more	Obese



The amount of **energy released** in respiration **per gram of fat** (**lipid**) is **DOUBLE** compared to **per gram of carbohydrate**

C. HOW A TRIGLYCERIDE IS FORMED

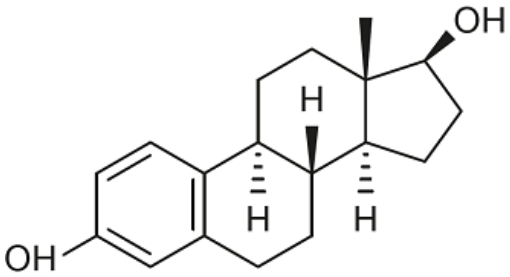


D. HOW A TRIGLYCERIDE IS DIFFERENT TO A PHOSPHOLIPID

Triglyceride	Phospholipid
Has **three** fatty acids	Has **two** fatty acids
Does **not** contain **phosphate**	A **phosphate** replaces the **third fatty acid**
Fully hydrophobic	**Partly** hydrophobic (the tail)

E. STEROIDS

- You are **not** expected to **learn their structure** but **are** expected to **recognise** them as a **type** of **fat** (**lipid**) that has **four joined rings**.



Fats have a **very low** proportion of **oxygen** to **carbon**

The amount of **energy released** in respiration **per gram of fat** (**lipid**) is **DOUBLE** compared to **per gram of carbohydrate**

Fats, **carbohydrates** and **proteins** **ALL** contain the elements **C**, **H**, and **O**

Proteins **also** contain the **extra** element **N**