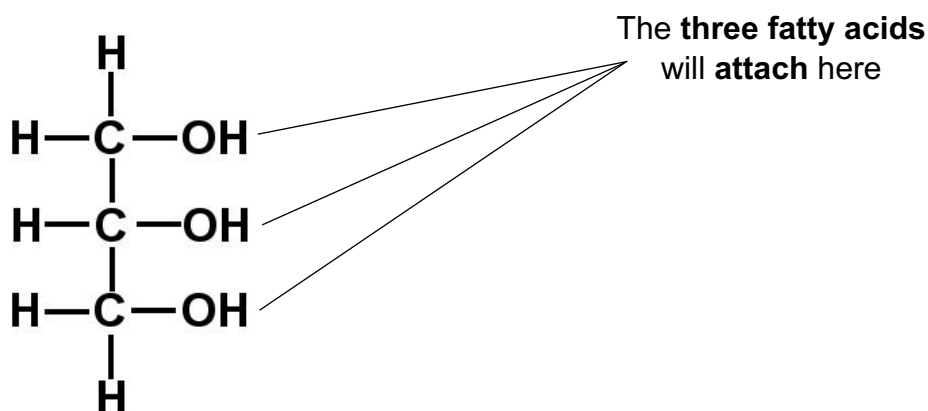


A. GLYCEROL AND FATTY ACIDS

- **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

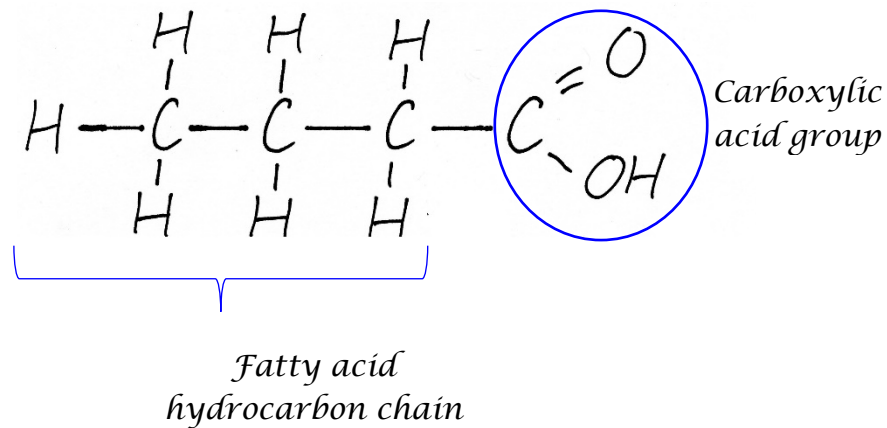


Types of fatty acid

(a) Saturated v unsaturated

Saturated	Unsaturated
<ul style="list-style-type: none"> • No C=C bonds • Contains the maximum number of H atoms ('full up') 	<ul style="list-style-type: none"> • Monounsaturated contain one C=C • Polyunsaturated 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
CO₂H (CH₂)_n CH₃	CO₂H (CH₂)_n (C=C)_n CH₃

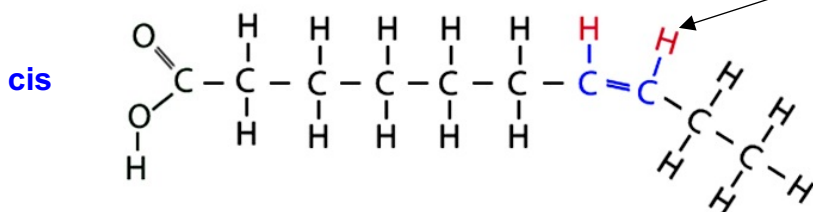
Drawing a saturated fatty acid



(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



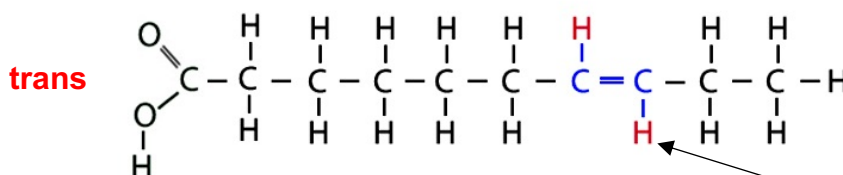
(so) **more bends** in fatty acid chains

(so) **cannot** pack closely together

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

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

HEALTHIER!



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

Height (m) →

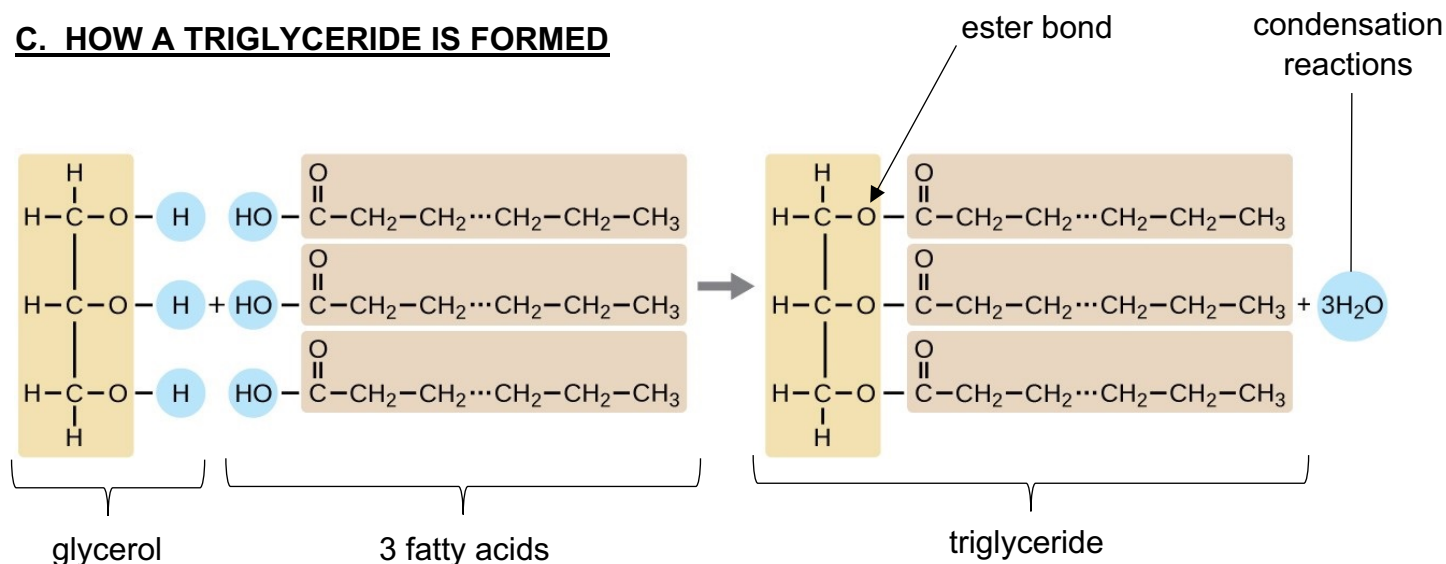
Weight (kg) ↓

	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20
140	71.4	66.6	62.2	58.3	54.7	51.4	48.4	45.7	43.2	40.9	38.8	36.8	35.0	33.3	31.7	30.3	28.9
135	68.9	64.2	60.0	56.2	52.7	49.6	46.7	44.1	41.7	39.4	37.4	35.5	33.8	32.1	30.6	29.2	27.9
130	66.3	61.8	57.8	54.1	50.8	47.8	45.0	42.4	40.1	38.0	36.0	34.2	32.5	30.9	29.5	28.1	26.9
125	63.8	59.5	55.6	52.0	48.8	45.9	43.3	40.8	38.6	36.5	34.6	32.9	31.3	29.7	28.3	27.0	25.8
120	61.2	57.1	53.3	49.9	46.9	44.1	41.5	39.2	37.0	35.1	33.2	31.6	30.0	28.6	27.2	26.0	24.8
115	58.7	54.7	51.1	47.9	44.9	42.2	39.8	37.6	35.5	33.6	31.9	30.2	28.8	27.4	26.1	24.9	23.8
110	56.1	52.3	48.9	45.8	43.0	40.4	38.1	35.9	34.0	32.1	30.5	28.9	27.5	26.2	24.9	23.8	22.7
105	53.6	49.9	46.7	43.7	41.0	38.6	36.3	34.3	32.4	30.7	29.1	27.6	26.3	25.0	23.8	22.7	21.7
100	51.0	47.9	44.4	41.6	39.1	36.7	34.6	32.7	30.9	29.2	27.7	26.3	25.0	23.8	22.7	21.6	20.7
95	48.5	45.2	42.2	39.5	37.1	34.9	32.9	31.0	29.3	27.8	26.3	25.0	23.8	22.6	21.5	20.6	19.6
90	45.9	42.8	40.0	37.2	35.2	33.1	31.1	29.4	27.8	26.3	24.9	23.7	22.5	21.4	20.4	19.5	18.6
85	43.4	40.4	37.8	35.4	33.2	31.2	29.4	27.8	26.2	24.8	23.5	22.4	21.3	20.2	19.3	18.4	17.6
80	40.8	38.0	35.6	33.3	31.3	29.4	27.7	26.1	24.7	23.4	22.2	21.0	20.0	19.0	18.1	17.3	16.5
75	38.3	35.7	33.3	31.2	29.3	27.5	26.0	24.5	23.1	21.9	20.8	19.7	18.8	17.8	17.0	16.2	15.5
70	35.7	33.3	31.1	29.1	27.1	25.7	24.2	22.9	21.6	20.5	19.4	18.4	17.5	16.7	15.9	15.1	14.5
65	33.2	30.9	28.9	27.1	25.4	23.9	22.5	21.2	20.1	19.0	18.0	17.1	16.3	15.5	14.7	14.1	13.4
60	30.6	28.5	26.7	25.0	23.4	22.0	20.8	19.6	18.5	17.5	16.6	15.8	15.0	14.3	13.6	13.0	12.4
55	28.1	26.2	24.4	22.9	21.5	20.2	19.0	18.0	17.0	16.1	15.2	14.5	13.8	13.1	12.5	11.9	11.4
50	25.5	23.8	22.2	20.8	19.5	18.4	17.3	16.3	15.4	14.6	13.9	13.1	12.5	11.9	11.3	10.8	10.3

 Underweight	 Normal Weight	 Overweight
 Obese (Class I)	 Obese (Class II)	 Obese (Class III)

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

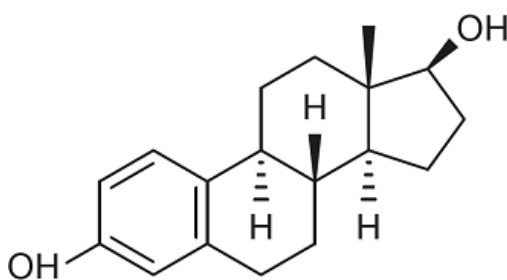


D. HOW A TRIGLYCERIDE IS DIFFERENT TO A PHOSPHOLIPID

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**