

# MATERIALS

## LEVEL 4 PLASTICS

**UNIT 1 THE ORIGINS,  
PROPERTIES,ADVANTAGES AND  
TYPES OF PLASTICS**

**WHAT ARE PLASTICS?**

PLASTICS ARE POLYMERS . POLYMERS ARE MADE OF A LINK FORMING A CHAIN OF HYDROCARBONS MONOMERS AND MONOMERS ARE MOLECULES THAT ARE CHEMICALLY BOUND TOGETHER. A HYDROCARBON IS A COMPOUND MADE OF HYDROGEN AND CARBON.

PLASTIC DOESN'T EASILY REACT WITH OTHER SUBSTANCES MAKING IT POSSIBLE TO STORE ACID, ALCOHOL,SOAP,PETROL WITHOUT IT RUINING THE CONTAINER

**TYPES OF POLYMERS**

1) NATURAL POLYMERS

- \* TAR
- \* TORTOISE SHELL
- \* ANIMAL HORN

2) SYNTHETIC (MAN MADE) POLYMERS

- \* BOTTLES AND JAR
- \* SILICONE
- \* CELLULOID

# PROPERTIES OF PLASTIC

PROPERTY	DESCRIPTION
LOW ELASTIC MODULUS (elastic modulus = stiffness)	Low elastic modulus are floppy and stretch when pulled/squash when pushed. The higher the modulus the stiffer the material the lower the modulus the more flexible it is.
HIGH CREEP (creep = deformation)	This can be permanent deformation or a slight change in solid material caused by stress/load applied and temperature, temperature accelerates the process
HIGH COEFFICIENT OF EXPANSION (Expansion of material due to temperature)	Temperature has a huge effect on plastic, plastic tends to expand. The measure of how much a part changes in size in response to a change in temperature is Thermal coefficient of expansion.

# PROPERTIES OF PLASTIC [cont.]

PROPERTY	DESCRIPTION
DEGRADATION IN ULTRAVIOLET (UV) LIGHT (SUNLIGHT)	UV light resistance should be considered if plastic will be used at places its exposed to sunlight. Plastics exposed colours, strength, and durability gets affected. The effect of UV degradation is discolouration, especially yellowing or whitening and a loss of physical properties such as impact strength, tensile strength and elongation
LOW DENSITY	LDPE=low-density polyethylene is not very strong. HDPE =high-density polyethylene PEHD=polyethylene high- density HDPE & PEHD = is made from petroleum, has higher tensile strength than LDPE and harder, more opaque and can withstand higher temperatures

# PROPERTIES OF PLASTIC

PROPERTY	DESCRIPTION
COMBUSTIBILITY	Hydrocarbon compounds, similar to fuel oil, kerosene and natural gas. as a general rule, the higher the temperature of combustion, the lower the products of incomplete combustion escaping in the form of air emissions or simply put air pollution different plastics show different combustibility rates.
ELECTRICAL INSULATION	Commercial plastics are good insulators as they high resistors of current flow. Environmental conditions that affect electrical properties are moisture and temperature.

# ADVANTAGES OF PLASTIC

Plastics :

- ❖ Are recyclable
- ❖ Can withstand corrosion if treated properly
- ❖ Are quick and easy to manufacture
- ❖ Easy to assemble in construction
- ❖ Have a manufacturing process that requires less energy than other materials
- ❖ Have a high strength-to-mass ratio
- ❖ Allow designers to be flexible and innovative
- ❖ Replaced the demand for natural products
- ❖ Pave way for new industries

# THERMOSETTING AND THERMOPLASTICS

Two main types of plastics based on how they behave when heated:

## □ Thermosetting (Thermosets) plastic

- They become hard permanently after heating when cooled
- They won't soften when reheated but instead they will burn
- They are stronger, harder, more brittle than thermoplastics
- Examples: 1) Polyester – safety belt, car tyre reinforcements  
2) Epoxies - Air craft parts , flooring panels  
3) Polyurethane - plugs, switches, plastic tableware

## □ Thermoplastics

- They soften when heated and harden when cooled this process can be repeated
- They are recyclable
- They can easily be moulded
- Examples: 1) Clothing                      2) Pipe fittings                      3) Gears  
4) Toys    5) Packaging materials                      6) PVC

# THERMOSETTING AND THERMOPLASTICS

Distinguishing between thermosetting and thermoplastic plastics

- Two ways to check the type of plastic

1) By cutting through plastic with knife

Outcomes: Thermoplastics - You can cut off the sliver

Thermosetting – You cant cut a sliver

2) By heating up the plastic

Outcomes: Thermoplastics – It melts

Thermosetting – It burns immediately



# ACTIVITY

- 1.1 Discuss what plastic is made out of ,the types of polymers with examples [8]
- 1.2 Describe and demonstrate common physical properties of plastics and give examples [26]
- 1.3 Discuss the advantages of using plastics [8]
- 1.4 Define and distinguish between thermosetting and thermoplastics plastics [4]
- 1.5 What tests are done to distinguish a thermoset from thermoplastic material [4]

Total 50

**DUE 20 April 2020 @ 12 : 00pm (Afternoon)**