Describe of its surface when external stresses are

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Describewith the aid of sketches/images and graphs, the relevant principles andappearance of: Ductile fracture A ductile fracture occurs when a material is pulled apart. Uponconstant stress being applied to the material, necking will begin. Neckingtends to occur prior to the fracture itself. Brittle fracture A brittlefracture is the failure ofa material with minimal amounts of necking deformation. If the broken pieces ofa brittle fracture are fitted backtogether, the original shape and dimensions of the specimen would be restored.

Brittle fractures are defined as fractures which occurs at or below the elastic limit of amaterial. Fatigue failure Fatigue failure occurs when the surface of a material progressivelycracks due to the brittleness of its surface when external stresses areapplied. The degree of impact of the fatigue depends on the intensity andfrequency of the stresses applied to the material. Creep failure A creep failure refers to the progressive deformation of amaterial when put under constant stress, this could be high temperature andheavy applied loads on the material. Creep failures tend to happen slowly, however the result is permanent. The graph below shows the strain on thematerial increases quickly when the load is first applied, then the creep rateincreases at a steady rate before increasing rapidly up until the fractureoccurs. Task 2 (P8) Explainusing sketches/images where appropriate, the different processes of degradationfor each of the following material types: Metals Metalsare susceptible to corrosion and degradation which leads to the componentweakening. Aqueous corrosion is an electrochemical reaction of materials in awet environment, this results in a deterioration of the material properties.

Galvanic corrosion is a process when a metal corrodes when it is in electricalcontact with another with the presence of an electrolyte. A type of corrosionis rusting, this occurs when the metal reacts with the oxygen in the air. Somemetals like iron are more susceptible to corrosion than others, Aluminium is anexample of corrosion resistant material as it has a natural layer of aluminiumoxide. Polymers Polymer degradation changes the properties of the material. Polymers normally degrade by disintegration, oxidation, hydrolysis andradiation.

Polymeric molecules are very large and any loss in chain lengthlowers the tensile strength of the material and is a primary cause of prematurecracking. Polymers tend to discolour, the tensile strength will lessen and theshape of the polymer may also change slightly when they come into contact withlight, heat, acids, alkalis and some salts. The degradation of polymers is usefulwhen it comes to recycling, however is more likely to have undesirable effects. Ceramics Ceramicsreact humidity and frost. When ceramics are exposed to humid atmospheres, mouldbegins to form on the material.

This causes a discolouration, making theceramic look unsightly. High temperatures cause ceramics to warp and thephysical properties of the material would be affected. As ceramics have largepores frost can also have an effect on the material. In wet conditions, watercan seep into the pores of the ceramic and when it freezes, the water expandsand makes the ceramic prone to cracks and breaks. Ceramics are very delicate, so their surface can easily be chipped or scratched.

A damaged surface wouldleave the underneath of the material vulnerable to water and chemical damage. Task3 (M3) Explain, using sketches/images, how and why a harsh marine environment might affect the behaviour of steelsused for the manufacturer of ships (i. e. the hulls). Salt water accelerates the rusting process.

This is because theelectrons in salt water move more freely than those in fresh water. This meanselectrolysis reactions happen more frequently so corrosion occurs at a fasterrate. Galvanic reactions happen when there are two metals in contact with saltwater (electrolyte), in effect this creates a battery and speeds up thecorrosion rate of the metals. Harsh marine environments with lots of moisturein the air and with the presence of water vapour have much faster rust ratesthan dry areas.

In order for rust to occur there must be the presence ofoxygen. As the hull of a ship is exposed to water constantly, the steel andoxygen is always in contact which means the oxygen in the water reacts with thesteel much faster than if it were to be on dry land. When steel rusts, thematerial weakens and the properties of the metal are detrimentally affected. Toslow the rate at which corrosion occurs, waxes and oils can be applied to thesurface of the hull.

These act as a barrier and do not allow the water vapourto come into contact with the hulls surface. As a result, the elements cannotexchange electrons as freely and easily, meaning minimal amounts of rust occur. Another way to prevent rusting, a zinc coating can be applied to the surface ofthe ship. Zinc reacts very slowly with water, therefore any corrosion that doesoccur is

affecting the zinc coating and protects the hulls material. Explain, using sketches/imageswhere appropriate, how exposure of thermoplastics to certain chemicals affectstheir behaviour. Thermoplasticmaterials are types of plastic that become soft when they are heated and hardwhen they the cool down. Upon cooling, the properties of the material changeconsiderably.

When thermoplastics are exposed to ozone 3, thermoplastics willdisintegrate and the properties of the material and the molecular weight willchange vastly. As a result, the material would begin to fall apart, this isknown as ozonolysis. Thermoplastics are also susceptible to chlorine gas. Uponexposure, the material will crack.

Chlorine attacks the weakest part of thechain molecules and causes chain cleavage, this leaves a brittle crack on thematerial.