Gavin O'Hara

Task 1 (P1)

a) **explain the purpose of three different types of lubricant**

Oils

Oil is a substance that is in a viscous liquid state, and is used between two moving surfaces to reduce the friction between them, improving efficiency and reducing wear. They may also have the function of dissolving or transporting foreign particles and of distributing heat.

The single largest applications for lubricants, in the form of motor oil, is to protect the internal combustion engines in motor vehicles and powered equipment.

Greases

Greases are Semi-solid lubricants possessing a higher initial viscosity than oil. Grease consists of oil and/or other fluid lubricant that is mixed with another thickener substance, a soap, to form a solid. The 'soap' is used in the chemical sense, meaning a metallic salt of a fatty acid, which forms an emulsion with the oil.

Greases are used where a mechanism can only be lubricated infrequently and where a lubricating oil would not stay in position. They also act as valuable sealants to prevent ingress of water and dust. Under shear, the viscosity of grease drops to give similar effects of oil, to approximately the same viscosity as the base oil used in the grease. Greases used in axles are made up from a compound of fatty oils to which tar, graphite, or mica is added to increase the durability of the grease and give it a better surface.

Lithium-based greases are the most commonly used. Sodium and lithium based greases have a higher melting point than calcium-based greases but

are not resistant to water. Lithium-based grease has a melting point at 190 °C to 220 °C, However the maximum usable temperature for lithium - based grease is 120 °C.

Solids

Solid lubricants such as graphite, molybdenum disulfide and tungsten disulfide also offer lubrication at temperatures up to 350 °C, higher than liquid and oil-based lubricants are able to operate. PTFE or better known as Teflon is generally used as a coating layer on, for example, cooking utensils to provide a non-stick surface. Its usable temperature range up to 350°C and chemical inertness make it a useful additive in special greases. Under extreme pressures, Teflon powder or solids is of little value as it is soft and flows away from the area of contact. Ceramic or metal or alloy lubricants must be used then.

Graphite, hexagonal boron nitride, molybdenum disulfide and tungsten disulfide are examples of materials that can be used as solid lubricants, often to very high temperature. The use of some such material s is sometimes restricted by their poor resistance to oxidation. Molybdenum disulfide can only be used up to 350°C in air, but 1100°C in reducing environments.

b) For the three types of lubricant describe and application in which they would be used.

Solids

The three most commonly used solid lubricants in industry are:

Graphite - Used in air compressors, foodstuff industry, railway track joints, open gear, machine-shop works etc.

Molybdenum disulfide - Used in space vehicles.

Hexagonal boron nitride - Used in space vehicles. Also know as white graphite.

Solid lubricants vary considerably from liquid lubricants. Liquid lubricants reduce friction due to their fluidity and viscosity. While solid lubricants have neither of these properties, they are still capable of reducing friction and wear.
Solid and dry lubricants work in situations where liquid lubricators have no practical value. For instance, a solid lubricant may be sprayed on the outer hull of a boat to improve water resistance. Similarly, some of your kitchen pans also feature solid lubricants, namely in the form of Teflon®, to minimize interaction between the food you are cooking and the pan itself.

Greases

Grease is used when it is not practical to use oil. High quality greases can lubricate relatively inaccessible components, without frequent replenishing. They are used in sealed-for-life applications, such as electrical motors, and gearboxes. Grease can also extend the life of worn parts, which were previously oil lubricated, because it maintains a thicker film. Thicker grease films also provide noise isolation.

Oils

Motor oil, or engine oil, is used for lubrication of various internal combustion engines. While the main function is to lubricate moving parts, motor oil also cleans, inhibits corrosion, improves sealing and cools the engine by carrying heat away from moving parts. These include motor or road vehicles such as cars and motorcycles, heavier vehicles such as buses and commercial vehicles

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Task 2 (P2)

Describe the operation and maintenance of the different lubrication systems listed below:-

Forced feed system

In the combination system, oil is delivered to some parts by means of splash and to other parts through oil passages, under pressure from a pump in the crankcase. The main and the camshaft bearings are usually the items that are force fed while the connecting rods are fitted with dippers that supply oil to the rest of the engine by splash. Some configurations use small troughs under each connecting rod, kept full by small nozzles that deliver oil under pressure from the oil pump.

These oil nozzles deliver an increasingly heavy stream as speed increases. At very high speeds, these oil streams are powerful enough to strike the dippers directly. This causes a much heavier splash so that adequate lubrication of the pistons and the connecting rod bearings is provided at higher speeds. If a combination system is used on an overhead valve engine, the upper valve train is lubricated by pressure from the oil pump.

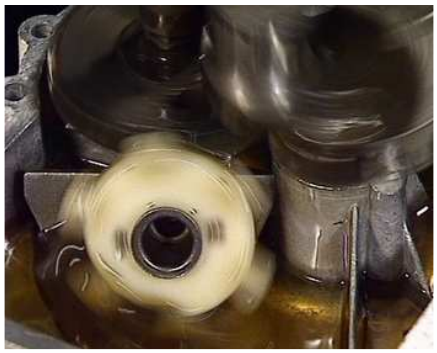
Compressed gas

Gas lubricated bearings have numerous advantages over liqu id and solid lubricated bearings for a wide range of applications. A gas bearing is virtually frictionless, silent, and vibration free. Gas bearings can be used for extremely large surface velocities. A gas bearing can eliminate the risk of contaminating a process with lubricant.
A gas bearing can be hydrodynamic or hydrostatic. In hydrodynamic bearings the gas is introduced into the bearing surfaces by the action of the bearing. In hydrostatic bearing the gas is introduced under pre ssure

from an external source. Air bearings are also widely used to allow frictionless movement of large heavy items over flat surfaces using air pads.

Splash lubrication

Splash lubrication a type of lubrication used in enclosed gear drives. In splash lubrication, the gear tooth dips into a tray of lubricant and transfers the lubricant to the meshing gear as it rotates.
Splash lubrication like in small engines uses a dipper connected to the crank that dips into the oil on the down stroke and splashes it up and onto the engine parts on the upstroke.



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Task 3 (D1)

Gearbox lubrication on a centre lathe is essential in order to prevent wear, increase efficiency and prevent damage to gear wheels. Investigate both the type of lubricant and lubrication systems used in gearbox lubrication and justify why they are suited to this particular application.

The most common method of lubrication in a standard centre lathe is splash lubrication. It is used in enclosed gear drives and gear tooth dips, into a tray of lubricant and transfers the lubricant to the meshing gear as it rotates. It is necessary to keep all working parts properly lubricated as neglect means a rapid decrease in efficiency. The oil should have a low viscosity, and be of the best quality possible. Heating indicates friction due to lack of oiling, poor bearing alignment or too tight adjustment.

When used in a gearbox the lubricant provides two primary two benefits: To lubricate the teeth and to remove heat generated from the gear operation. The lubricant is also often used for lubricating the various bearing found in the gearbox. If the correct lubricant is selected for use in a gear system it will provide slip-free power transmission at high mechanical efficiency, with good reliability, low maintenance, and long life.

Surface fatigue occurs when the lubricant film on the gear wheel teeth is inadequate to protect the surfaces from the stress, resulting in pitting forming in the contact area. Scuffing can result if the lubricant film is not maintained properly, with the consequent increase in temperature causing distress and wear of the material surface. The lowest practical viscosity oil should be selected to minimise friction losses and churning, However for low speed units with high tooth loading higher viscosity oils may be necessary