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| **ASSIGNMENT** | |
| **Course Code** |  |
| **Course Name** | Enviormental science |
| **Programme** |  |
| **Department** |  |
| **Faculty** |  |

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| --- | --- | --- |
| **Symbol** | **Description** | **Units** |
| A | Current | Amp |
| g | Acceleration due to gravity - 9.81 | m/s2 |
| V | Voltage | Volts |
| w | Width | mm |
|  |  |  |

< Arrange in alphabetical order>

# **Question No. 1**

**Solution to Question No. 1:**

## Advantages and disadvantages of concrete:

Concrete is considered as a chemically combined mass where the inert material acts as a filler and the binding materials act as a binder. The most important binding materials are [cement](https://civiltoday.com/civil-engineering-materials/cement/10-cement-ingradients-with-functions) and lime. Inert materials used in concrete are termed as [aggregates](http://en.wikipedia.org/wiki/Construction_aggregate). Most common aggregates are sand, brick chips, stone chips, [gravels](http://en.wikipedia.org/wiki/Gravel), shells etc. The concrete plays a very important role in all branches of [civil engineering](http://civiltoday.com).

**Advantages of concrete :**

1. Ingredients of concrete are easily available in most of the places.
2. Unlike natural stones, Concrete is free from defects and flaws.
3. Concrete can be manufactured to desired strength with an economy.
4. The [durability of concrete](http://www.cement.org/for-concrete-books-learning/concrete-technology/durability) is very high.

5) It can be cast to any desired shape.

6)The casting of concrete can be done in the working site which makes it economical.

7) Maintenance cost of concrete is almost negligible.

8 )The deterioration of concrete is not appreciable with age.

9) Concrete makes a building fire-safe due to its noncombustible nature.

10)Concrete can withstand high temperatures.

11) Concrete is resistant to wind and water. Therefore, it is a very useful in storm shelters.

12) As a sound proofing material cinder concrete could be used.

13) The monolithic character of concrete gives it better appearance and much rigidity to the structure.

14)The property of concrete to possess high compressive strength makes a concrete structure more economical than steel structure.

**Disadvantages of concrete:**

1. Concrete possess low tensile strength. Therefore concrete is required to be reinforced to avoid cracks.
2. In long structures, expansion joints are required to be provided if there is large temperature variance in the area.
3. Due to drying shrinkage and moisture expansion concrete may crack. Therefore construction joints are provided to avoid these types of cracks.
4. If soluble salt is present in concrete then it may lead to efflorescence when comes in contact with moisture.
5. Concrete made with ordinary Portland cement, gets integrated in the presence of alkalies, sulphates etc.
6. Sustained loads develop creep in structures.

## Effect of concrete on the Environment:

The concrete industry is one of two largest producers of carbon dioxide (CO2), creating up to 5% of worldwide man-made emissions of this gas, of which 50% is from the chemical process and 40% from burning fuel.[[1]](https://en.wikipedia.org/wiki/Environmental_impact_of_concrete#cite_note-wbcsd-1) The carbon dioxide CO2 produced for the manufacture of one tonne of structural concrete (using ~14% cement) is estimated at 410 kg/m3 (~180 kg/tonne @ density of 2.3 g/cm3) (reduced to 290 kg/m3 with 30% fly ash replacement of cement).The CO2 emission from the concrete production is directly proportional to the cement content used in the concrete mix; 900 kg of CO2 are emitted for the fabrication of every ton of cement, accounting for 88% of the emissions associated with the average concrete mix. Cement manufacture contributes greenhouse gases both directly through the production of carbon dioxide when [calcium carbonate](https://en.wikipedia.org/wiki/Calcium_carbonate) is thermally decomposed, producing [lime](https://en.wikipedia.org/wiki/Lime_(material)) and [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide),[6and also through the use of energy, particularly from the combustion of [fossil fuels](https://en.wikipedia.org/wiki/Fossil_fuel).

One area of the concrete life cycle worth noting is the fact that concrete has a very low embodied energy relative to the quantity that is used. This is primarily the result of the fact that the materials used in concrete construction, such as aggregates, [pozzolans](https://en.wikipedia.org/wiki/Pozzolan), and water, are relatively plentiful and can often be drawn from local sources. This means that transportation only accounts for 7% of the embodied energy of concrete, while the cement production accounts for 70%. With a total embodied energy of 1.69 GJ/tonne concrete is lower than any other building material besides wood. It is worth noting that this value is based on mix proportions for concrete of no more than 20% fly ash. It is estimated that one percent replacement of cement with fly ash represents a .7% reduction in [energy consumption](https://en.wikipedia.org/wiki/Energy_consumption). With some proposed mixes containing as much as 80% [fly ash](https://en.wikipedia.org/wiki/Fly_ash), this would represent a considerable energy savings.

## 1.3 Discussions /Suggestions/Views/Recommendations

Students are expected to discuss the solutions obtained in section 1.2 and present their views/suggestions/recommendations (not to exceed 150 words)

## 1.4 Conclusions

Students are expected to draw conclusions based on the discussions and suggestions (not to exceed 100 words)

# **Question No. 2**

**Solution to Question No. 2:**

## 2.1 Effects of Fracking on soil and ground water table:

In order to frack, an enormous amount of water is mixed with various toxic chemical compounds to create frack fluid. This frack fluid is further contaminated by the heavy metals and radioactive elements that exist naturally in the shale. A significant portion of the frack fluid returns to the surface, where it can spill or be dumped into rivers and streams. Underground water supplies can also be contaminated by fracking, through migration of gas and frack fluid underground.

In order to hydraulically fracture shale and extract the hydrocarbons, large quantities of water and chemicals must be injected underground. Thus [fracking](http://greenpeaceblogs.org/2014/05/28/north-carolina-fracking-bills-sponsor-close-ties-oil-gas-industry/) can pose a threat to local water resources, especially in areas where water is already scarce

Because of the tremendous amount of water needed for hydraulic fracturing, fresh water must be acquired, transported, and stored for every well pad.  To manage the massive amounts of water necessary for the hydraulic fracturing process, drillers build large open air pits called impoundments next to the well pads, to store the water before it is used and after it returns to the surface.

There are two types of impoundments, those that hold drilling waste, used while drilling the well bore, and impoundments for the fracking fluid. The frack fluid pits are larger and contain [toxic fracking fluid](http://www.nytimes.com/2011/11/20/magazine/fracking-amwell-township.html?pagewanted=all.).  These open pits have been linked to animal deaths and health effects in humans.

During the hydraulic fracturing of a well, water is mixed with various chemicals to make a toxic brew called frack fluid. Until recently, neither the federal nor state governments required drilling companies to disclose the ingredients used in frack fluids. Some states have begun to require that companies disclose the chemicals they use, but even in such cases, companies can withhold some chemical names under trade secret exemptions. As a result, a comprehensive list of chemicals used in the fracking process does not exist. Some states have begun to require that companies disclose the chemicals they use, but even in such cases, confidential business information claims result in only partial disclosures. Corporations involved in fracking, like ExxonMobil, have inserted [loopholes](http://www.propublica.org/article/alec-and-exxonmobil-push-loopholes-in-fracking-chemical-disclosure-rules) in drilling legislation that allow them to keep various chemicals used in the fracking process secret.

Groundwater becomes contaminated by hydraulic fracturing in a number of ways, including leakage from liquid storage areas, leakage from injection wells, leakage during hydrofracking along faults or up abandoned wells, seepage into the ground when wastewater and residuals are applied to land (i.e. used for irrigation or on roads for dust suppression or de-icing), and other means.

The cement casing which rings the well bore and goes through underground aquifers is meant to act as a barrier between underground water and the shaft through which frack fluid and gas flow.  But the casing can fail or break during the fracturing process, allowing the frack fluid or naturally-occurring contaminants to contaminate groundwater.  When that happens, frack fluid and methane can leak from the well bore directly into the water supply, causing dangerous gas buildups, and making water unfit to drink.

Even if the cement casings hold, gas can travel up from the shale layer to the water table. When gas travels through fractures in the rock layer above the shale and in to water supplies, it is called gas migration. It is common for wells to lose pressure during the fracking stage, which indicates that the [frack fluid is not contained](http://www.pittsburghgeologicalsociety.org/naturalgas.pdf) within the well and is seeping into some place the drillers did not anticipate.  There has not been enough study of this phenomenon, even though drillers indicate it happens on a frequent basis.

One of the main chemicals used in the [fracking process](https://www.investopedia.com/terms/f/fracking.asp) is methane, and it is estimated that 4% escapes into the atmosphere during extraction. Because methane is 25 times stronger than carbon dioxide in terms of trapping heat, the release of this gas is detrimental to the air quality of surrounding fracking sites. Additionally, the ancillary components of fracking directly increase air pollution at well sites. These include the pollutants released from new construction and subsequent operation of fracking locations, the increased emissions from transporting oil and gas from the site, in addition to waste disposal and storage. Pollutants increase the production and long-term lingering of smog, which decreases the availability of clean air for workers and local residents.

## 2.2 Methods to overcome the effects due to Fracking:

**Treating Wastewater:** At hydraulic fracturing sites, the amount of wastewater typically far exceeds the amount of oil produced. The [fluid that returns to the surface](http://www.epa.gov/radiation/tenorm/oilandgas.html) through the well bore is not only the chemically treated frack water, but water from the rock formation that can contains brines, metals, and radionuclides. That wastewater must be captured and stored on site, and then often is shipped long distances to deep well injection underground storage facilities. There have been few treatment options. But Halliburton has developed the [CleanWave](http://www.halliburton.com/en-US/ps/stimulation/water-solutions/cleanwave.page) treatment system, which uses positively charged ions and bubbles to remove particles from the water at the fracking site.GE and its partner [Memsys](http://www.memsys.eu/) also tested a new [on-site treatment system](http://www.genewscenter.com/Press-Releases/GE-and-memsys-Achieve-Technology-Milestone-for-Unconventional-Gas-Water-Treatment-42c5.aspx) that allows the water to be reused without being diluted with freshwater, by employing a desalination process called membrane distillation.

**Plugging Methane Leaks:** Another improvement that can reduce methane emissions: Replacing conventional pressure-monitoring pneumatic controllers, which are driven by gas pressure and vent gas when they operate. A U.S.-wide move to lower-bleed designs could reduce emissions by 35 billion cubic feet annually. And switching out conventional chemical injection pumps used in the fracking process, which are powered by gas pressure from the wells, and replacing them with solar-powered pumps, operators could eliminate an 5.9 billion cubic feet of methane emissions annually, the EDF report concludes.

EPA should review new research on shallow hydraulic fracturing activities, including new work out of [Stanford](http://news.stanford.edu/news/2015/july/fracking_water-jackson-072115.html) and the state mandated [study](http://ccst.us/projects/hydraulic_fracturing_public/SB4.php) by California Council on Science and Technology (CSST).  Shallow hydraulic fracturing must be highlighted as a high-risk activity with increased likelihood of contamination and impacts on drinking water. CSST report [echoed](http://switchboard.nrdc.org/blogs/bmordick/california_scientists_find_num.html) this point: "Shallow hydraulic fracturing presents a higher risk of groundwater contamination, which groundwater monitoring may not detect. This situation warrants additional scrutiny.”

## 2.3 Discussions /Suggestions/Views/Recommendations

Students are expected to discuss the solutions obtained in section 1.2 and present their views/suggestions/recommendations (not to exceed 150 words)

## 2.4 Conclusions

Students are expected to draw conclusions based on the discussions and suggestions (not to exceed 100 words)

# **Question No. 3**

**Solution to Question No. 3:**

## 3.1 Impact of mobile phones on flora and fauna:

Just as humans are adversely affected by seemingly low power, non-thermal levels of RF (Radio Frequency) electromagnetically radiated fields, particularly those in the lower microwave spectrum, birds, bees and even mammals are shown to become disoriented. Magnetite-based nanocrystals capable of sensing the Earth's magnetic field have been found even in microorganisms.  Such nanocrystals are also influenced by EMFs.

Physiological affects on leafy material have also been noted.  As with people, these symptoms can be caused by cellphone, WiFi / WiMAX use or by lower frequency, longer wavelength broadcasts.

“The review of existing literature shows that the EMRs are interfering with the biological systems in more ways than one and there had already been some warning bells sounded in the case on bees and birds, which probably heralds the seriousness of this issue and indicates the vulnerability of other species as well,” the study found.

Of the 919 studies, a staggering 593 showed the negative impact of mobile towers on birds, bees, humans, wildlife and plants. The experts even cited an international study that pinpointed cellphone towers as a potential cause in the decline of animal populations. They went on to say that there was an urgent need to focus more scientific attention on the subject before it was too late.

In addition to calling for a law protecting urban flora and fauna from emerging threats of electromagnetic radiation, the experts are also suggesting bold signs and messages on the dangers of cell phone tower and radiation to be posted near the position of cellphone towers.

Other wildlife such as amphibians and reptiles also appear to

be at high risk with possible interference of EMF with metamorphosis and sex ratios where temperature dependent sex determination is operational.

## 3.2 Effect of Electromagnetic radiation on Sparrows:

The electromagnetic radiation emerging from mobile tower and mobile phones has caused thedecline of sparrows. Increasing number of mobile towers in urban and rural areas is affecting the breeding of sparrows. The eggs of sparrows failed to hatch in presence of electromagneticradiation even after a month, though their normal incubation period ranged from 10 -12 days.Apart from this, changing lifestyles and architectural evolution have wreaked havoc on the bird'shabitat and food sources. Modern buildings devoid of eaves and crannies, disappearing homegardens and crop fields cleaned of insects by the use of chemical pesticides, all play a part indenying sparrows nesting sites and food, especially for the young. It is the same sad story for thesparrow all over the globe. To protect the sparrows to become fully out of the world Sacon haslaunched the Common Bird Conservation Programme. This is in addition to the EndangeredSpecies Conservation Programme, which is investigating factors affecting the populations of endangered birds.

Birds are good ecological indicators for low-intensity electromagnetic radiation, they have thin skulls and their feathers can act as dielectric receptors of microwave radiation. Many species use magnetic navigation and microwaves can interfere with their sensors and misguide them while navigating and preying

# **Question No. 4**

**Solution to Question No. 4:**

## 4.1 Role of Genetic Engineering the development of a country:

**Genetic engineering**, also called **genetic modification**, is the direct manipulation of an organism's [genes](https://en.wikipedia.org/wiki/Gene) using [biotechnology](https://en.wikipedia.org/wiki/Biotechnology). It is a set of technologies used to change the genetic makeup of cells, including the transfer of genes within and across species boundaries to produce improved or novel [organisms](https://en.wikipedia.org/wiki/Organisms).

Genetic engineering is a process that alters the genetic make-up of an organism by either removing or introducing [DNA](https://en.wikipedia.org/wiki/DNA). Unlike traditionally [animal](https://en.wikipedia.org/wiki/Animal_husbandry) and [plant breeding](https://en.wikipedia.org/wiki/Plant_breeding), which involves doing multiple crosses and then selecting for the organism with the desired [phenotype](https://en.wikipedia.org/wiki/Phenotype), genetic engineering takes the [gene](https://en.wikipedia.org/wiki/Gene) directly from one organism and inserts it in the other. This is much faster, can be used to insert any genes from any organism (even ones from different [domains](https://en.wikipedia.org/wiki/Domain_(biology))) and prevents other undesirable genes from also being added.

There are many advantages with this technology. Genetic engineering could potentially fix severe [genetic disorders](https://en.wikipedia.org/wiki/Genetic_disorder) in humans by replacing the defective gene with a functioning one. It is an important tool in research that allows the function of specific genes to be studied. Drugs, vaccines and other products have been harvested from organisms engineered to produce them. [Crops](https://en.wikipedia.org/wiki/List_of_genetically_modified_crops) have been been developed that aid [food security](https://en.wikipedia.org/wiki/Food_security) by increasing yield, nutritional value and tolerance to environmental stresses.

Plants, animals or micro organisms that have been changed through genetic engineering are termed [genetically modified organisms](https://en.wikipedia.org/wiki/Genetically_modified_organism) or GMOs. If genetic material from another species is added to the host, the resulting organism is called [transgenic](https://en.wikipedia.org/wiki/Transgenic). If genetic material from the same species or a species that can naturally breed with the host is used the resulting organism is called [cisgenic](https://en.wikipedia.org/wiki/Cisgenic). If genetic engineering is used to remove genetic material from the target organism the resulting organism is termed a [knockout](https://en.wikipedia.org/wiki/Gene_knockout) organism. In Europe genetic modification is [synonymous](https://en.wikipedia.org/wiki/Synonymous) with genetic engineering while within the United States of America and Canada genetic modification can also be used to refer to more conventional breeding methods.

Genetic engineering has potential applications in conservation and natural area management. Gene transfer through [viral vectors](https://en.wikipedia.org/wiki/Viral_vector) has been proposed as a means of controlling invasive species as well as vaccinating threatened fauna from disease. Transgenic trees have been suggested as a way to confer resistance to pathogens in wild populations. With the increasing risks of [maladaptation](https://en.wikipedia.org/wiki/Maladaptation) in organisms as a result of climate change and other perturbations, facilitated adaptation through gene tweaking could be one solution to reducing extinction risks. Applications of genetic engineering in conservation are thus far mostly theoretical and have yet to be put into practice.

Genetic engineering is also being used to create [BioArt](https://en.wikipedia.org/wiki/BioArt). Some bacteria have been genetically engineered to create black and white photographs. Novelty items such as lavender-colored [carnations](https://en.wikipedia.org/wiki/Dianthus_caryophyllus#Colors), [blue roses](https://en.wikipedia.org/wiki/Blue_rose), and [glowing fish](https://en.wikipedia.org/wiki/GloFish) have also been produced through genetic engineering.

4.2 **Effect of Genetically Modified Crops on human health :**

Genetically modified organisms (GMO’s) are a broad group of plants, animals, and bacteria that are engineered for a wide variety of applications ranging from agricultural production to scientific research. The types of potential hazards posed by GMO’s vary according to the type of organism being modified and its intended application. Most of the concern surrounding GMO’s relates to their potential for negative effects on the environment and human health. Because GMO’s that could directly effect human health are primarily products that can enter the human food supply.

**The following problem’s can be occurred due to genetically modified crops** :

1. **Food allergy -** [According to the Organic Consumers Association](https://www.organicconsumers.org/old_articles/ge/allergies111603.php), "The list of GM food products intersect with the eight most common food allergens: eggs, milk, fish, peanuts, shellfish, soy, tree nuts, and wheat." OCA states that protein in foods is what triggers allergic reactions and "most of the foreign proteins being gene-spliced into foods have never been eaten by humans before or tested for their safety."   
     
   2. **Toxicity** **-** "A review of 19 studies (including industry's own studies submitted to regulators in support of applications to commercialise GM crops) on mammals fed with commercialised GM soy and maize that are already in our food and feed chain found consistent toxic effects on the liver and kidneys,"   
   5. **DNA Transfer -** GMOs are created using horizontal gene transfers as opposed to natural reproduction, which is accomplished via vertical gene transfer. Horizontal gene transfer "involves injecting a gene from one species into a completely different species, which yields unexpected and often unpredictable results." There are concerns that GM DNA can transfer to humans and the environment.   
     
   6. **Birth defects -** Glyphosate is the active ingredient in the herbicide RoundUp. Monsanto Company, considered the giant of GMOs, engineers "RoundUp Ready" crops that are routinely treated with the herbicide.

7. **Cancer -** A study that linked GMOs and RoundUp to cancer was first published in 2012, was retracted in 2013 and republished in 2014. The controversial study reported that rats were more likely to develop tumors and die after eating a diet of Monsanto GM corn

# **Question No. 5**

**Solution to Question No. 5:**

## 5.1 Causes for change in climate:

The earth's climate is dynamic and always changing through a natural cycle. What the world is more worried about is that the changes that are occurring today have been speeded up because of man's activities. These changes are being studied by scientists all over the world who are finding evidence from tree rings, pollen samples, ice cores, and sea sediments. The causes of climate change can be divided into two categories - those that are due to natural causes and those that are created by man.

**Natural causes**   
  
There are a number of natural factors responsible for climate change. Some of the more prominent ones are continental drift, volcanoes, ocean currents, the earth's tilt, and comets and meteorites.

**Volcanoes**   
When a volcano erupts it throws out large volumes of sulphur dioxide (SO2), water vapour, dust, and ash into the atmosphere. Although the volcanic activity may last only a few days, yet the large volumes of gases and ash can influence climatic patterns for years. Millions of tonnes of sulphur dioxide gas can reach the upper levels of the atmosphere (called the stratosphere) from a major eruption. The gases and dust particles partially block the incoming rays of the sun, leading to cooling. Sulphur dioxide combines with water to form tiny droplets of sulphuric acid. These droplets are so small that many of them can stay aloft for several years. They are efficient reflectors of sunlight, and screen the ground from some of the energy that it would ordinarily receive from the sun. Winds in the upper levels of the atmopshere, called the stratosphere, carry the aerosols rapidly around the globe in either an easterly or westerly direction. Movement of aerosols north and south is always much slower. This should give you some idea of the ways by which cooling can be brought about for a few years after a major volcanic eruption.

**Ocean currents**   
The oceans are a major component of the climate system. They cover about 71% of the Earth and absorb about twice as much of the sun's radiation as the atmosphere or the land surface. Ocean currents move vast amounts of heat across the planet - roughly the same amount as the atmosphere does. But the oceans are surrounded by land masses, so heat transport through the water is through channels.   
  
Winds push horizontally against the sea surface and drive ocean current patterns.   
Certain parts of the world are influenced by ocean currents more than others.

**Human causes**

Fossil fuels such as oil, coal and natural gas supply most of the energy needed to run vehicles, generate electricity for industries, households, etc. The energy sector is responsible for about ¾ of the carbon dioxide emissions, 1/5 of the methane emissions and a large quantity of nitrous oxide. It also produces nitrogen oxides (NOx) and carbon monoxide (CO) which are not greenhouse gases but do have an influence on the chemical cycles in the atmosphere that produce or destroy greenhouse gases.

**Greenhouse gases and their sources**  
Carbon dioxide is undoubtedly, the most important greenhouse gas in the atmosphere. Changes in land use pattern, deforestation, land clearing, agriculture, and other activities have all led to a rise in the emission of carbon dioxide.   
  
Methane is another important greenhouse gas in the atmosphere. About ¼ of all methane emissions are said to come from domesticated animals such as dairy cows, goats, pigs, buffaloes, camels, horses, and sheep. These animals produce methane during the cud-chewing process. Methane is also released from rice or paddy fields that are flooded during the sowing and maturing periods

## 5.2 Methods to create awareness among people about climatic change:

1. Purchase a fuel-efficient car (rated at 32 mpg or more) to replace your most frequently used automobile.

2. Insulate your home, clean your air conditioning filters and install energy efficient showerheads

3. Leave your car at home (walk, bike or take mass transit instead).

4. Recycle your home's waste newsprint, cardboard, glass and metal.

5. Install a solar heated system to provide your hot water

6. Replace incandescent light bulbs with compact fluorescent bulbs.

7. Buy food and other products with reusable or recyclable packaging instead of those in non-recyclable packaging.

8. Buy food and other products with reusable or recyclable packaging instead of those in non-recyclable packaging.

9. Use an electric or push mower instead of a gasoline-powered mower to cut your lawn.

10.Plant native, drought-resistant trees and shrubs around your home and outdoor air conditioning unit.

**Bibliography**

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3. J.A.F. Stoner, Freeman R. E and Daniel R Gilbert. (2004) *Management*, 6th Edition, Pearson Education.
4. Fraidoon Mazda. (2000) *Engineering Management*, Addison Wesley.

All referencing, bibliography needs to be done as described in the following article:

<http://www.msruas.ac.in/pdf_files/VCBlogs/Academic%20Good%20Practices.pdf>

***Guidelines for writing the report***

Font and Font size of the text: Calibri, 11

Line Spacing: 1.5, Justified

All mathematical equations be edited using Microsoft Equation Editor

All figures, tables, equations taken from reference material be cited

1. **Inserting a table**

Title of the table should be at the top of the table and be left justified with ref to table

**Table 1.1 Properties of Air at Low Pressure [Ref.]**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **T (K)** | **h (J/kg)** | **p (atm)** | **u (J/kg)** | **φ (J/kg K)** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

[Note: the table should be centered w.r.t the page width. Use suitable SI units]

**Referring to a table in the text:**

The data is tabulated as shown in Table 1.1.

[Note: Please do not write as *“As shown below”* or *“As shown above”*]

1. **Inserting a figure, a photo or screen shot**

The figure should be sufficiently large and legible. It should be centered w.r.t the page width.

Figure

Figure 2.1 Machining Process [Ref.]

Title of the Figure should be at the bottom of the figure and be left justified. The reference must be quoted.

**Referring to a figure in the text:**

The machine is shown in Figure 7.1

[Note: Please do not write as *“As shown below”* or *“As shown above”*]

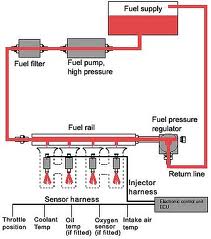


Figure 7.1 The Wonder Machine [2]

**[5]….. reference number; this should be quoted in the References.**

1. **Quoting the references in the text**

According to Kestin[5], “ the science of thermodynamics is a branch of physics. It describes natural processes in which changes in temperature play an important part. Such as the …………………………..”

1. **The Appendix if any should be the last section in the report.**