

# Biology

Class-XI



## OPEN TEXT- BASED ASSESSMENT 2015-16



**CENTRAL BOARD OF  
SECONDARY EDUCATION**

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# OPEN TEXT BASED ASSESSMENT

## BIOLOGY CLASS-XI

### Theme-1: Take Care!

#### Abstract

*Living beings are blessed with the body systems which work in perfect and automated coordination in such a manner that one system cannot work in complete isolation with the other organ systems. They all are integrated, due to which if some changes are taking place in one system, other systems get affected equally. There is a biological phenomenon behind every human feeling and emotion, and action and reaction out of that. After being aware of relation between changes in the outside environment and inside the body, to keep the body balanced and to stay fit; you need to take good care of yourself.*

We all talk of "gut feelings," and we will really appreciate the amazing connections between our brain and digestive system. Stomach and intestines actually carry more nerve cells than the spinal cord, which leads some of the experts to consider the digestive system as "mini brain." A highway of nerves runs directly from our brain to digestive system, and maintains a continuous flow in two directions. It means 95 % of the body's serotonin, a hormone that helps in controlling moods, is found in the digestive system, and not in the brain.

You need not to do a PhD in Physiology to acknowledge that stress can be hard on the stomach. We all have done our own experiments on the subject, intentionally or not. Try to remember how you felt last time when you spoke in public? Those butterflies weren't in your head.

The impact of stress on the stomach reaches far beyond indigestion. However, in recent years, doctors have revealed a remarkably complex connection between brain and digestive system. The whole system is extremely sensitive to our moods. In fact, experts now see stress as a major participant in a wide range of digestive problems, including irritable bowel syndrome, heartburn and indigestion.

People with digestive inconveniences often scoff at the idea that stress can be at the root of their problems. To them, it sounds like "blaming the victim."

But experts who do research about the link between stress and digestion are not searching for people to blame them. Instead, they are looking for scientific explanations for some of life's most frequent maladies. By understanding how stress affects our bodies, they are opening new avenues for treatment and prevention of many conditions.





*Observe! Appreciate! .....Unity in Diversity*

### Listen to your gut....



Sensing something, without the information and drawing conclusions, is a part of human nature. A gut feeling about the weather, someone's state of mind or even a decision to buy a car, our 'intuition' is a constant factor in our decision making.

There are many ways to describe 'Tacit Knowledge' (Schon described it as "usable but difficult to express"). In healthcare the term gut feeling is used extensively; almost every day we listen to someone

saying, "I wasn't sure why I did this – it was just a 'gut feeling'". Given that, the cognitive theory behind intuition and decision making has been well researched, it is interesting that the term 'gut feeling' itself has been relatively poorly explored in medicine.

Gut feeling has inherent anecdotal appeal because of its face validity. We have all experienced a gut feeling about something so it makes sense that it is real 'thing' in the clinical world.

When we are able to communicate from the inside out, we are in conversation directly to that part of the brain that controls behaviour, and then we let people to rationalize it with the tangible things we do and say. This is where our gut decisions come from.

**–Simen Sinek**

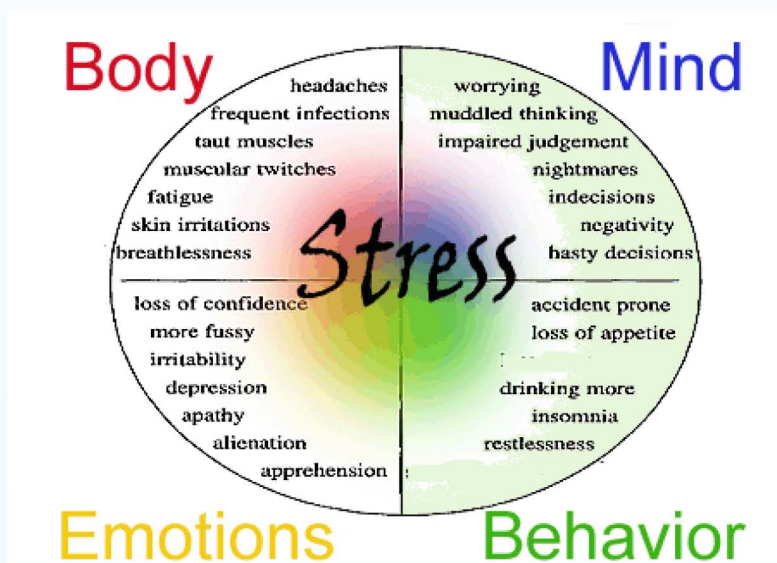
There are strong reasons why should pay such a close attention to our brains and digestive system. During stroke of stress, our bodies are designed to keep those things on focus that can help us stay alive. When the brain feels intensely stressed, it unleashes a cascade of hormones that can put the entire digestive system into an uproar. The hormones have different and sometimes contradictory duties. For example, the hormone CRH (Corticotropin-releasing hormone) is one of the body's main



alarm bells. In stressful situations, the brain pumps out CRH to tell the adrenal gland to start making steroids and adrenaline chemicals that can give strength and energy to run or fight the way out of trouble.

CRH also turns off appetite, which explains why some people cannot eat anything when they are stressed. At the same time, the steroids triggered by CRH can make a person hungry, which is why some people fight stress with ice cream, chocolate, or potato chips.

Different people have different responses to stress, and there is no way to surely say how specific situations will affect digestion. But there are some general thumb rules. Over the short term, stress can cause stomach aches, nausea, and diarrhoea. In the long term, prolonged stress can aggravate chronic diseases such as irritable bowel syndrome and heartburn.



The classic example of a functional GI disorder is Irritable Bowel Syndrome (IBS), a very common and perplexing malady often characterized by painful cramps, bloating, and constipation alternating with diarrhoea.

Nobody knows how IBS gets its start, but there is no doubt that stress can worsen the symptoms. Stress can make the colon contract, leading to stomach pain. It is not completely clear why people with IBS sometimes become constipated. One possibility is that stress can occasionally make the contractions uncoordinated and non-productive. Stress can also make the mind more aware of sensations in the colon, and since people with IBS may feel more discomfort due to extra-sensitive pain receptors in the gastrointestinal tract, even normal contractions can feel really unpleasant.

IBS can flare up over everyday annoyances, especially those that make a person feel tensed, angry, or overwhelmed. But as reported in a 2004 issue of Psychosomatic Medicine, IBS, like other chronic conditions, is even more sensitive to the stress that comes from major life changes, such as diagnosis with a dangerous disease or a loss of job.

Ulcerative colitis and Crohn's disease are the conditions known together as Inflammatory Bowel Diseases (IBD). These are definitely not caused by stress, but once these diseases take hold, a bout of stress can worsen their symptoms.





### How are you????



If your digestive system is not running smoothly, do not suffer in silence. According to a report from the University of North Carolina, as many as 80 percent of people with IBS or any other functional gastro-intestinal problems never discuss their symptoms with a doctor. That's unfortunate, because doctors can often prescribe medications to get the digestive system back on track. A doctor can also check for underlying diseases that might explain the symptoms.

If your doctor cannot find a physical explanation for your digestive troubles, you may need to calm your mind before you calm your stomach. Ask your doctor if you would be a good candidate for cognitive behavioural therapy, interpersonal therapy, relaxation therapy, or another form of counselling. You can do your part to battle adverse situation outside by eating well, exercising regularly, and getting plenty of sleep.

Digestive problems might be a message. That message is "Live well and learn to relax." This is the time when you definitely would like to listen to your gut.

The emerging and surprising view of how the enteric nervous system in our bellies goes far beyond just processing the food we eat.

In Olympics, even the steeliest players are likely to experience that familiar feeling of "butterflies" in the stomach. This sensation, which is because of an often-overlooked network of neurons lining gut, is so extensive that some scientists have nick-named it as our "second brain". Although its influence is far-reaching, the second brain is not the seat of any conscious thoughts or decision-making.

"The second brain does not help with the great thought processes...religion, philosophy and poetry is left to the brain in the head," says Michael Gershon, Chairman of the Department of Anatomy and Cell Biology at New York-Presbyterian Hospital/Columbia University Medical Center, an expert in the nascent field of neurogastroenterology.

Technically known as the enteric nervous system, our second brain consists of sheaths of neurons embedded in the walls of the long tube of our gut, or alimentary canal, which measures about nine meters end to end from the oesophagus to the anus. The second brain contains some 100 million neurons, more than in either the spinal cord or the peripheral nervous system, Gershon says.

This multitude of neurons in the enteric nervous system enables us to "feel" the inner world of our gut and its contents. Much of this neural firepower comes to bear in the elaborate daily grind of digestion. Breaking down food, absorbing nutrients, and expelling of waste require chemical processing, mechanical mixing and rhythmic muscle contractions that move everything on down the line.



Thus, equipped with its own reflexes and senses, the second brain can control gut behaviour independent of the brain. We evolved this intricate web of nerves to perform digestion and excretion "on site," rather than remotely from our brains through the middleman - spinal cord. "The brain in the head does not need to get its hands dirty with the messy business of digestion, which is delegated to the brain in the gut," Gershon says. He and other researchers explain, however, that the complexity of second brain cannot be interpreted through this process alone.

The second brain informs our state of mind in other more obscure ways as well. A big part of our emotions are probably influenced by the nerves in our gut.

Butterflies in the stomach — signaling in the gut as part of our physiological stress response is one such example.

Gastrointestinal (GI) turmoil can sour moods..... emotional well-being may rely on messages from the brain below to the brain above.....

Given that the commonalities of the two brains, other depression treatments that target the mind can unintentionally impact the gut. The enteric nervous system uses more than 30 neurotransmitters, just like the brain, and in fact 95 percent of the body's serotonin is found in the bowels. Because antidepressant medications called selective serotonin reuptake inhibitors (SSRIs) increase serotonin levels, it is little wonder that medications meant to cause chemical changes in the mind often provoke GI issues as a side effect.

Serotonin seeping from the second brain might even play some part in autism, the developmental disorder often first noticed in early childhood. It has been discovered that the same genes involved in synapse formation between neurons in the brain are involved in the alimentary synapse formation. If these genes are affected in autism, it could explain why so many kids with autism have GI motor abnormalities in addition to elevated levels of serotonin in their blood.

So for those who are physically skilled and mentally strong enough to compete in the Olympic Games as well as those watching at home, it is necessary for us all to pay more heed to our so-called "gut feelings" in the future.

## May I help you !!!!

### Yoga and Cognitive behavioural Therapy (CBT)

Imagine yourself walking through a relaxing rain forest, exotic wildlife all around you, with nothing but the sweet sound of a waterfall besides. This sort of imagery is







actually a treatment for a problem that plagues 1 in every 5 people. Disorders of the digestive system have long been an uncomfortable problem for many people. Until now, there have been few treatments that did not involve the use of medications, side effects of which were often worse than the symptoms. This is where visual therapies such as Meditation and Cognitive Behavioural Therapy (CBT) come in. New research shows that Meditation therapy and CBT are becoming more and more effective in treating many different disorders of the digestive system.



*Stressed???.....Relax ! .....its a healthy choice.*

The digestive system includes everything within the digestive tract. It is associated with all organs that are involved with the breaking down and digestion of food. Organs within the system include the stomach, liver, large and small intestines, mouth, oesophagus, etc. Digestive system disorders are diseases that obstruct the normal functions of these organs. Such disorders often include Crohn's disease, Irritable Bowel Syndrome (IBS), acid reflux disease, etc.

It is estimated that 80% of our well-being is dependent upon how our stomach feels. Many times, when people get stressed or nervous, conditions that are purely mental, they complain of stomach pain or abdominal discomfort.

Turning to Meditation and CBT should not always be a last resort, but often times, it seems so. CBT, like Meditation, teaches relaxation techniques, and also includes certain characteristics of helping people better cope with their emotional conditions. 60% of IBS sufferers have reported a history of stress. By learning to control stress and by being more relaxed with the help of Meditation and CBT, digestive system disorders can not only become less severe but can be treated in much better manner.

On recommendations and supportive justifications of Government of India, world observed 21<sup>st</sup> June, 2015 as 'International Day of Yoga' to bring awareness about it and to bring it into practice of a common individual, and also to help the people to get be better prepared to deal with the stressful situations today.



## Internal Ecology

Science is finding that teeny tiny creatures living in your gut, known as your micro-biome, are there for a definite purpose. About 100 trillion of these cells populate the body, particularly intestines and other parts of digestive system. In fact, 90 percent of the genetic material in your body is not of its own, but rather that of bacteria, fungi and other microorganisms that compose inner microflora.

Some of these bacteria can make living beings sick; for example, the National Institute of Allergy and Infectious Diseases (NIAID) at Bethesda recently found that Crohn's Disease may be caused by immune responses to certain gut microbiota. But the majority are good, and they work together as helpmates to aid to digestive system and keep humans well. Beneficial bacteria, better known as probiotics, are so crucial to the health that researchers have compared them to "a newly recognized organ."

One of the major results of eating a healthy diet is that by doing so, humans cause beneficial gut bacteria to flourish, and they secondarily perform the real "magic" of restoring the health.

Remember, an estimated 80 percent of immune system is located in gut, which is just one more reason why "tending to" gut microflora is an essential element of good health. A robust immune system, supported by flourishing inner ecosystem, is the first defense against all diseases, from the common cold to cancer.

Being physically active may encourage beneficial germs to thrive in your gut, while inactivity could do the reverse.

[ According to an innovative study done by University College Cork]

In recent years, there has been an explosion of interest in the role that gut microbes play in whole-body health. A multitude of studies have shown that people with large and diverse germ populations in their digestive tracts tend to be less prone to obesity, immune problems and other health disorders than people with low microbial diversity, and that certain germs, in particular, may contribute to improved metabolic and immune health.

A featured article in *Time Magazine* says:

"Our surprisingly complex internal ecology has been a hot topic in medicine lately. Initiatives such as the Human Micro-biome Project, an extension of the Human Genome Project, have been working tirelessly to probe potential links between the human microbiota and human health, and to construct strategies for manipulating bacteria so that they work with us rather than against us."

Draw attention to the possibility that exercise may have a beneficial effect on the microbiota of the gut!!!





## Immunity Versus Breast Milk

This is precisely what Dr. Natasha Campbell-McBride's work centers around, and Gut and Psychology Syndrome (GAPS) nutritional plan is designed to reestablish proper gut flora in order to heal and seal your gut – thereby reversing and eliminating ailments running the gamut from autism, learning disorders, and Obsessive-Compulsive Disorder (OCD), just to name a few possibilities. It is exciting to see that science is starting to take this more seriously, as autism has reached epidemic proportions.

'Until a little while ago it was outlandish to suggest that microbiomes in the gut could be behind this disease,' University of Guelph Assistant Professor of Biology Emma Allen-Vercoe said. 'But I think it is an intersection between the genetics of the patient and the micro-biome and their environment.'

According to the National Institute of Allergy and Infectious Diseases; presence of T cells in the gut mount is an immune response to commensal bacteria [normal microflora] during an infection. They also are the first to show that commensal-specific T cells remain in circulation after the infection is cleared.

Based on their observations, the investigators speculate that, when uncontrolled, commensal-specific T- cells may contribute to development of Crohn's disease, but more research is needed.

Adding more weight to Dr. Natasha Campbell-McBride's insistence that breastfeeding is crucial to help normalize an infant's microflora (hence protecting against disease and developmental problems), a first-of-its-kind study on human breast milk and its impact on infants' gut flora gives new insight on why breast milk is better than formula at protecting newborns from infectious illness.

The study's author, William Parker, Ph.D, Associate Professor of Surgery at Duke explained that breast milk appears to promote a healthy colonization of beneficial bio-films. Previous research has already established that breast milk reduces diarrhoea, flu, and respiratory infections in infants, as well as lowers their risk of developing allergies, Type 1 diabetes, multiple sclerosis and other diseases.

The researchers grew bacteria in samples of three popular brands each of milk- and soy-based infant formulae, cow's milk, and breast milk. All samples were incubated with two strains of beneficial *E.coli* bacteria (while some *E.coli* cause violent disease, other 'friendly cousins' actually serve helpful roles). While the bacteria rapidly multiplied in all the specimens, there was one major difference; in the breast milk specimens, the bacteria formed bio-films, whereas the bacteria in the whole milk and the different infant formulae grew as individual organisms and failed to form into a bio-film.



This is indeed important. Biofilms are essentially thin, sticky bacterial "sheaths" that adhere to intestinal wall, where they serve as a shield, effectively blocking out pathogens and infectious agents. This is an essential part of the "healing and sealing" of your gut that Dr. Campbell-McBride's GAPS protocol accomplishes.

It is easy to get a much wider variety of beneficial bacteria in natural food than could ever be obtained from a supplement.

## Genes

Two concurrent avenues of high-powered research are supported by the Crohn's and Colitis Foundation of America (C.C.F.A.). One is the C.C.F.A. Genetics Initiative, in which scientists are exploring more than 100 genetic factors now known to influence the risk of developing an inflammatory bowel disease, or I.B.D.

The other research effort, the C.C.F.A. Microbiome Initiative, has so far identified 14 different bacterial metabolic factors associated with the diseases.

By combining findings from the two initiatives, experts now know that certain genes affect the types of bacteria living in the gut; in turn, these bacteria influence the risk of getting an inflammatory bowel disease.

Genes, identified, thus appear to account for about 30 percent of the risk of developing an I.B.D., according to Dr. Sartor, who is chief medical adviser of the foundation. Studies of twins underscore the role of genetics. When one identical twin has Crohn's disease, the other also has a 50 percent chance of developing it.

## Antibiotics

Another major contributor to the rise in Crohn's disease in particular is the widespread, often inappropriate use of antibiotics, Dr. Sartor said.

"Early exposure to antibiotics, especially during the first 15 months of life, increases the risk of developing Crohn's disease, though not ulcerative colitis," he said. "If there is a family history of I.B.D., particularly Crohn's disease, antibiotics should be used only for a documented bacterial infection like strep throat or bacterial meningitis. "When antibiotics are needed, probiotics can be used during and afterward to minimize their effect and restore the normal bacterial population of the gut." Dr. Sartor also noted that early exposure to common viruses and bacteria can strengthen the immune system and keep it checked from attacking normal tissues.

Dr. Sartor has lived with Crohn's disease for 43 years and for most of the part of his life he has managed to keep flare-ups at bay with a proper diet, medications and daily probiotics.

You never get something for nothing, especially not in health care. Every test, every incision, every little pill brings benefits and risks. Antibiotics have cowed many of our old bacterial enemies into





submission. We aimed to blast them off the planet, and we dosed accordingly. Now we are beginning to reap the consequences. It turns out that not all germs are bad — and even some bad germs are not all bad. In “Missing Microbes,” Dr. Blaser, a Professor at the New York University School of Medicine, presents the daunting array of reasons we have to rethink the enthusiastic destruction of years past.

Researchers tested 336 healthy children ages 6 months to 3 years who were attending day-care centers in Mexico City. Half received a daily dose of *Lactobacillus reuteri*, a beneficial gut bacterium naturally present in many foods and in most people; the other half got an identical placebo.

The intervention lasted three months, and the children were followed for another three months without supplements. The study was published in Pediatrics and was supported by a grant from a manufacturer of probiotic supplements.

During the study, there were 69 episodes of diarrhoea in the placebo group and 42 in the supplement group. The placebo group had 204 respiratory tract infections, compared with 93 in those taking *L. reuteri*. The placebo takers spent an average of 4.1 days on antibiotics, while the supplement users averaged 2.7 days. The differences persisted during the 12-week follow-up.

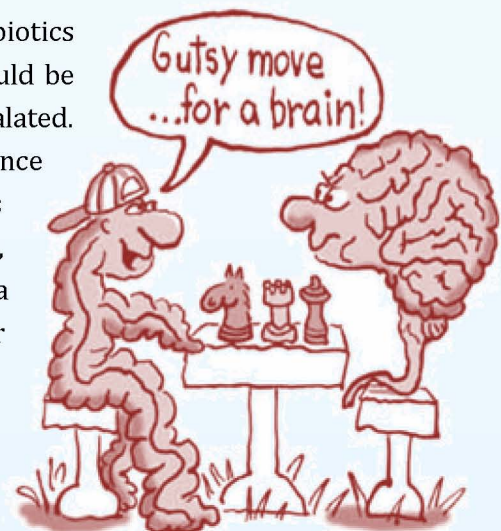
“What’s notable here is that they used a specific probiotic in a good design and they also did follow-up,” said Stephen S. Morse, an infectious disease specialist at Columbia University who was not involved in the study.

This strengthens the evidence for the value of probiotics, but we still have a lot to learn.

Genes make you ... you, but where do they come from? Antibiotics save lives, but their overuse is evolving supergerms and could be changing our bodies. First and foremost, the war has escalated. Imprudent antibiotic use has resulted in widespread resistance among microbes. Second, as always, it is the hapless bystanders who have suffered the most –not human beings, but the gazillions of benevolent, hard working bacteria colonizing our skin and the inner linings of our gastrointestinal tracts. We need these good little creatures to survive, but even a short course of antibiotics can destroy their universe, with incalculable casualties and a devastated landscape. Sometimes neither the citizenry nor

the habitat ever recovers. A randomized trial of a common probiotic has shown that a daily dose substantially reduced

episodes of diarrhoea and respiratory tract infections among children at day care centers. Diet is one obvious factor that affects both the composition of the gut biota and also its function. Bacteria



Source: [blackhealth.co.uk](http://blackhealth.co.uk)



eat what we eat, and every bacterium has certain food preferences. Diet influences the types and balance of microbes in the gut, and different microbes produce substances that are either protective or harmful.

We, humans, are privileged to have such a systematic body and its systems. The need is to take good care of it by adopting healthy habits. If we, together, can catalyze a movement to motivate more people to apply dietary wisdom to their normal eating patterns, then we will start seeing a radical change in mental, physical and social health of humans and hence society.

### BIBLIOGRAPHY

- ☆ [www.nih.gov.in](http://www.nih.gov.in)
- ☆ [www.blackhealth.co.uk](http://www.blackhealth.co.uk)

### SAMPLE QUESTIONS

1. Represent the integrity in various systems of the body by taking examples of at least three body systems and any two examples from your daily life and their processes. [5 Marks]
2. Reflect, how the above text material prepares you for life, by giving suitable examples from real life situations. [5 Marks]

### MARKING SCHEME

1.
  - Connection between digestive system and nervous system during encounter with a stimulus
  - Connection between digestive and excretory systems in response to a stimulus
  - Connection between excretory and nervous system while responding towards a stimulus

All the above reactions should be explained in context of any two real life situations– stressful/ joyful
2. Real life situations:  

Encounter with stress, sudden encounter with dangerous animals, and any other adverse situation in life, managing and understanding secretions from endocrine glands in such cases. Learning how to strike a balance between physiology and physiological responses in such advance adverse situation.





## OPEN TEXT BASED ASSESSMENT

### BIOLOGY CLASS-XI

#### Theme-2: The Ambient Air

##### Abstract

*A great number of microbial species thrive in our bodies- in various systems, namely, digestive, respiratory and reproductive. Amongst these, the respiratory system may have species like, Mycobacterium tuberculosis, Streptococcus pneumoniae as well as certain viruses. Not only these biotic agents, but certain inert, abiotic substances can also cause extremely severe lung problems. These are caused due to pollutants, dust, soot, fibres and so on. In the following text, diseases caused by abiotic agents are discussed, namely, occupational disorders and hazards of smoking and air pollution.*

##### Let's see the following two cases:

*Situation 1- Gaurav's house is being renovated; it's being 15 days and he is irritated by the continuous noise of marble tiles being cut and the dust generated from it. He was hoping that his parents would think of shifting to another house but it did not happen.*

*Situation 2- Rita's parents had planned to get the house whitewashed during her holidays. Now, the varnishing of doors and windows is going on, using the small spraying machines. Rita can neither stand the fumes nor the smell. She dislikes staying at home, nowadays.*

The two children are not at ease and are looking for immediate, but temporary relief. What would you have done in such a situation? What are the alternatives? Do the people in the profession have an alternative?

People who face such situations in their profession have no other alternative but to suffer with these diseases called Occupational disorders. Intensity of these diseases may differ for different individuals.

##### Occupational Disorders

National Institute of Occupational Safety & Health (NIOSH) has developed a list of ten leading profession-related disorders and diseases. Three criteria were used for illness, namely, frequency of occurrence, its severity, and its potential for prevention. Occupational lung diseases are the first on the list. The three major occupational diseases prevalent in several parts of the world are silicosis, asbestosis and byssinosis. Occupational asthma is also very common among all the workers in some of the high-risk occupations. NIOSH considers cancer to be the second leading work-related disease, followed by heart diseases, psychological disorders and those related to reproduction, hearing loss and dermatological problems. Body Mass Index (BMI) of the workers is also significantly low.



There are around 11 million cases of occupational diseases in the world out of which 1.9 million cases (17%) are contributed by India. Also, out of 0.7 million deaths in the world, 0.12 (17%) are contributed by India. (Source: [www.who.int](http://www.who.int))

Though, the National Health Policy-2002 includes occupational health, very little attention has been paid to reduce the effect of occupational diseases through a proper programme.

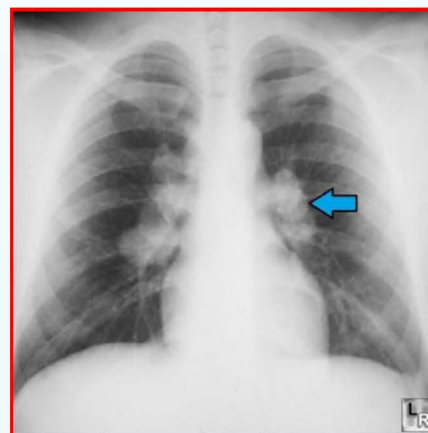
### **Pneumoconiosis**

The most common types of pneumoconiosis include silicosis, asbestosis and coal worker's **Pneumoconiosis**. It is seen in specific occupations such as coal mining and construction industries where the emissions as well as concentration of dust particles is very high.

**Silicosis** is marked by the formation of lumps (nodules) and fibrous scar tissue in the lungs. It is the oldest known occupational lung disease, and is caused by inhalation of particles of silica, mostly from quartz in rocks, sand, and from other similar substances. Silicosis mostly occurs in adults over the age of 40.

The precise mechanism that triggers the development of silicosis is still not clear. What is known is that particles of silica dust get trapped in the alveoli of the lungs. Macrophages in the alveoli ingest the silica and die. The resulting inflammation attracts other macrophages to the region. The nodules form when the fibrous tissue seals off the reactive area. The progress of the disease may stop at this point, or speed up and destroy large areas of lungs.

Early symptoms of silicosis include shortness of breath and a harsh, dry cough. Patients with advanced silicosis may experience chest pain, hoarseness, and loss of appetite and may cough up blood too. Silicosis patients are also at a high risk for TB, and should be checked for the disease. Thus they should be advised to quit smoking, prevent infections like cold and receive vaccinations against influenza and pneumonia.



*Modules in Lungs*

### **Prevalence of Silicosis in India**

Surveys have shown that the problem of silicosis is much more severe in the slate pencil cutting (54.6% prevalence), stone cutting (20-35% prevalence) and agate industries (38% prevalence). These industries in the unorganized sector do not even fall under the purview of the Factories Act, which aims at protecting the health and safety of the workers.

### **Prevention and Control of Silicosis and Silico-tuberculosis**

**Dust control measures:** There is a direct relationship of silicosis with dust exposure at the workplace. Thus these measures include replacement of hazardous substances with innocuous



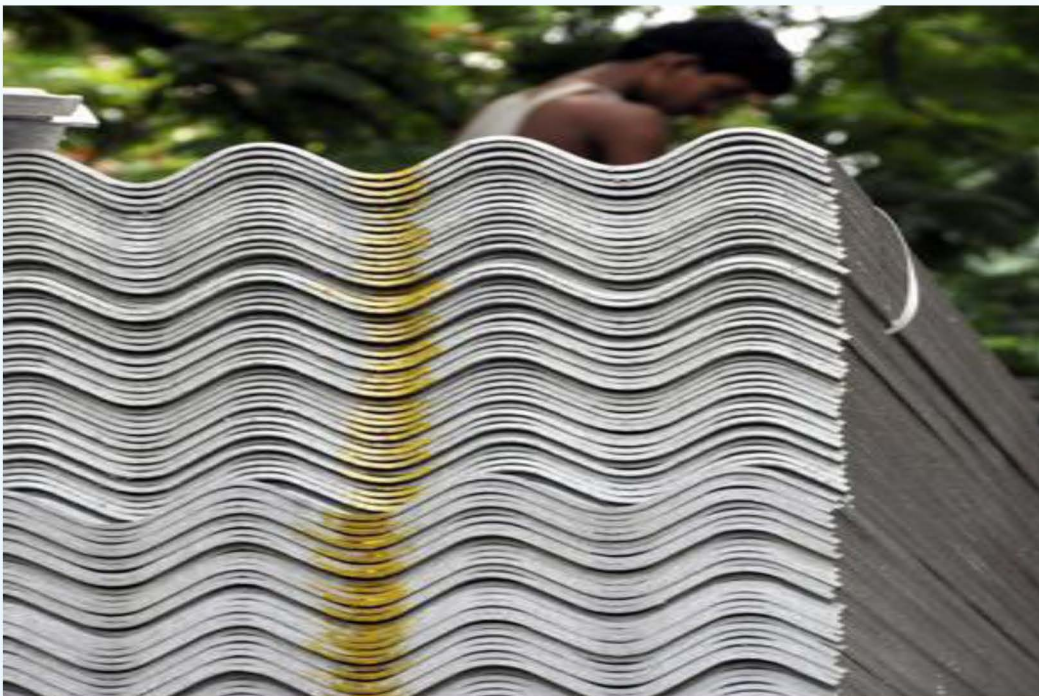


substances, enclosing the source of dust, use of wet methods, exhaust facilities etc. Use of dust masks is suggested, only in the absence of the above control measures, but these are not suited for hot, humid climate.

**Medical surveillance:** The medical measures include pre-employment and periodical examinations, that include chest X- ray, sputum examination for TB bacteria and spirometry. The pre-employment medical examination provides the base-line data for each individual and the periodical medical examination helps in early detection of silicosis and silico-tuberculosis.

### Health problems attributed to asbestos include:

- **Asbestosis** – It is caused in response to injury caused by inhaled asbestos fibers. Growth factors are produced that stimulate fibroblasts to proliferate and synthesize the scar tissue in the lungs. The scarring may eventually become so severe that lungs stop functioning. The latency period is often 10–20 years.
- **Mesothelioma** – A cancer of the mesothelial lining of the lungs (chest cavity), peritoneum (abdominal cavity) or pericardium (protective layer around the heart). Unlike lung cancer, mesothelioma has no association with smoking. The only established causal factor is exposure to asbestos or similar fibers. The latency period may be about 20–50 years.
- **Cancer of the lung, gastrointestinal tract, kidney and larynx** – The latency period in these cases, is often 15–30 years.



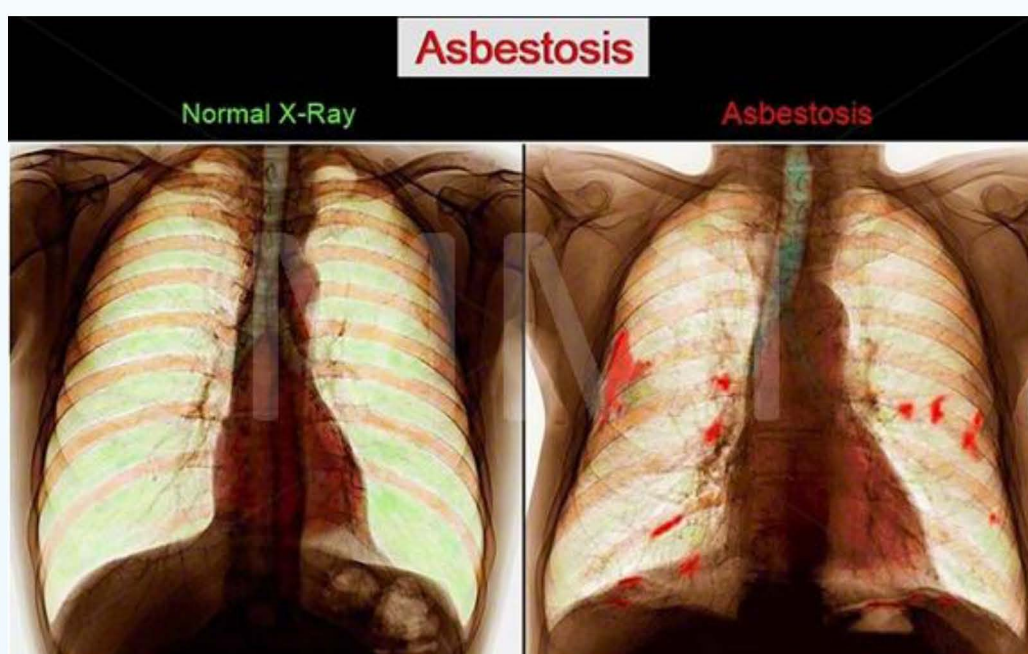
*Asbestos sheets*



Chrysotile, the most common form of asbestos, is a fibrous substance often mixed with cement to create a fire-resistant mixture applied to corrugated steel sheets and pipes. Called 'the poor man's material', it is often used for roofing, because of its high resistivity and low-cost.

Affordability can never match with the cost of contracting lethal lung diseases, caused by inhalation of chrysotile dust – prevalent in asbestos plants, where safety regulations are minimal and often not enforced.

The World Health Organisation (WHO) classifies asbestos as a carcinogen, estimating that over 1,07,000 people die each year from asbestos-related lung cancer, mesothelioma and asbestosis. It is now banned in over 50 countries.



The only way to prevent these diseases is to prevent mining, trade, manufacturing and use of all forms of asbestos and asbestos-based products.

### **Non-occupational Pneumoconiosis in high altitude villages of Ladakh**

Till recently, it was believed that the problem of Silicosis and Pneumoconiosis was limited to industries and mines only. NIOH (National Institute of Occupational Health) investigated a few cases of non occupational pneumoconiosis reported from some villages of Ladakh. Epidemiological studies showed the prevalence of pneumoconiosis to be 2.0%, 20.1% and 45.3% respectively, in three of the villages. The chest radiographs of villagers could not be distinguished from those of miners and industrial workers suffering from the disease. The pneumoconiosis observed amongst the villagers was attributed to dust storms and exposure to soot from domestic fuels as there are no industries and mines in the district.





## Byssinosis

Byssinosis is an occupational lung disease caused by exposure to cotton, flax and hemp dust. Most workers with byssinosis are reported from the cotton textile industry, one of the largest industries in the world. In India, there are about 1.07 million workers engaged in the manufacture of cotton textiles. Workers in mills that manufacture yarn, thread or fabric have a significant risk of dying of this disease.

Byssinosis is a chronic, asthma-like narrowing of the airways. It is also called brown lung disease.

Although inhaling cotton dust was identified as a source of respiratory disease more than 300 years ago, Byssinosis has been recognized as an occupational hazard for textile workers for less than 50 years.

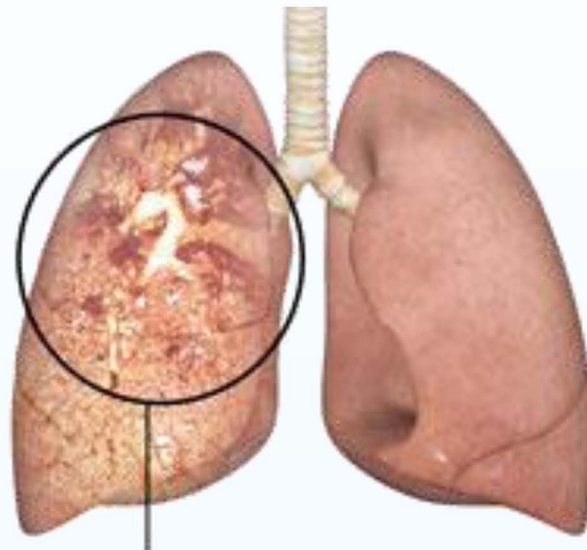
Therapy for early-stage Byssinosis focuses on reversing airway narrowing. Anti-histamines may be prescribed to reduce tightness in chest. Bronchodilators drugs used to relax breathing passages and improve air flow may be used with an inhaler or taken in tablet form. Any worker who has symptoms of Byssinosis or who faces trouble in breathing should be transferred to a less contaminated area.

That 'poverty is a curse' is exemplified through these workers, working in an unfriendly environment. With age, they contract the disease and when unable to work, their wives, or children (aged 13 or so) start working at the same place to make ends meet. Thus, this vicious cycle continues. Strict laws, along with government intervention only, can improve the situation.

Since there is no specific therapy for these progressive and irreversible diseases, all steps should be taken for their prevention. The benefits of prevention include, economic benefits due to increased production, less absenteeism, low expenditure on health care, but most importantly, the alleviation of human suffering!

## Smoking

Smoking is the inhalation of the smoke of burning tobacco encased in cigarettes, pipes, and cigars. A smoking habit is a physical addiction to tobacco products. Many health experts now regard habitual smoking as a psychological addiction too, and the one with serious health consequences.

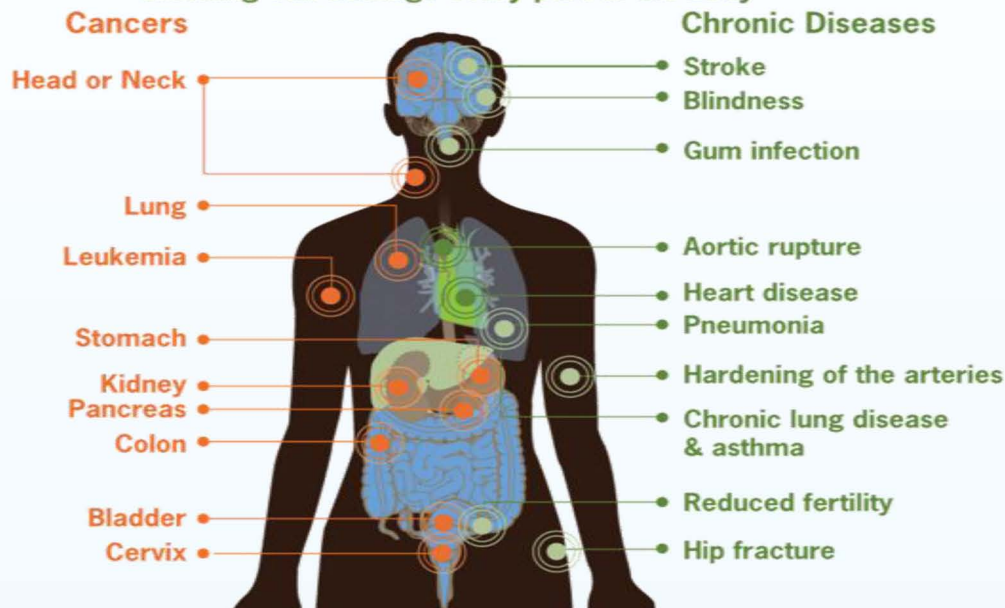


**Brown Lung Disease**

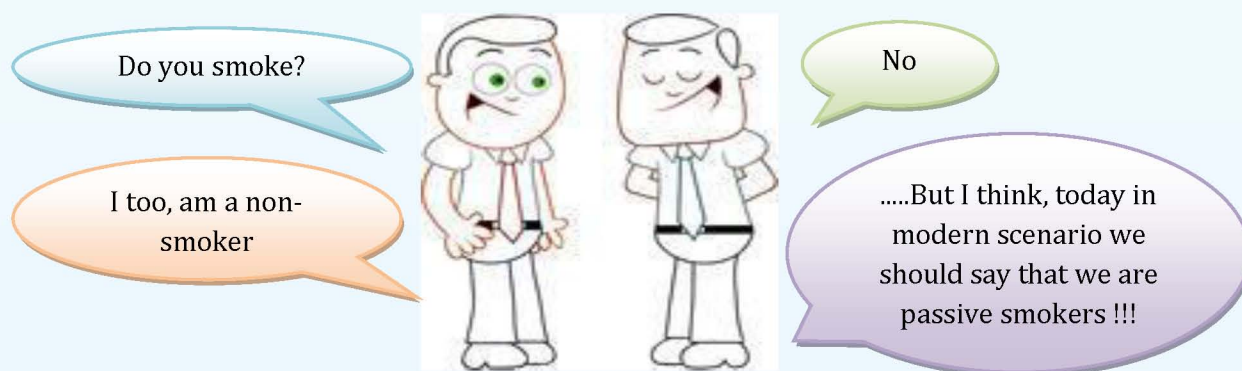


# Risks from Smoking

Smoking can damage every part of the body

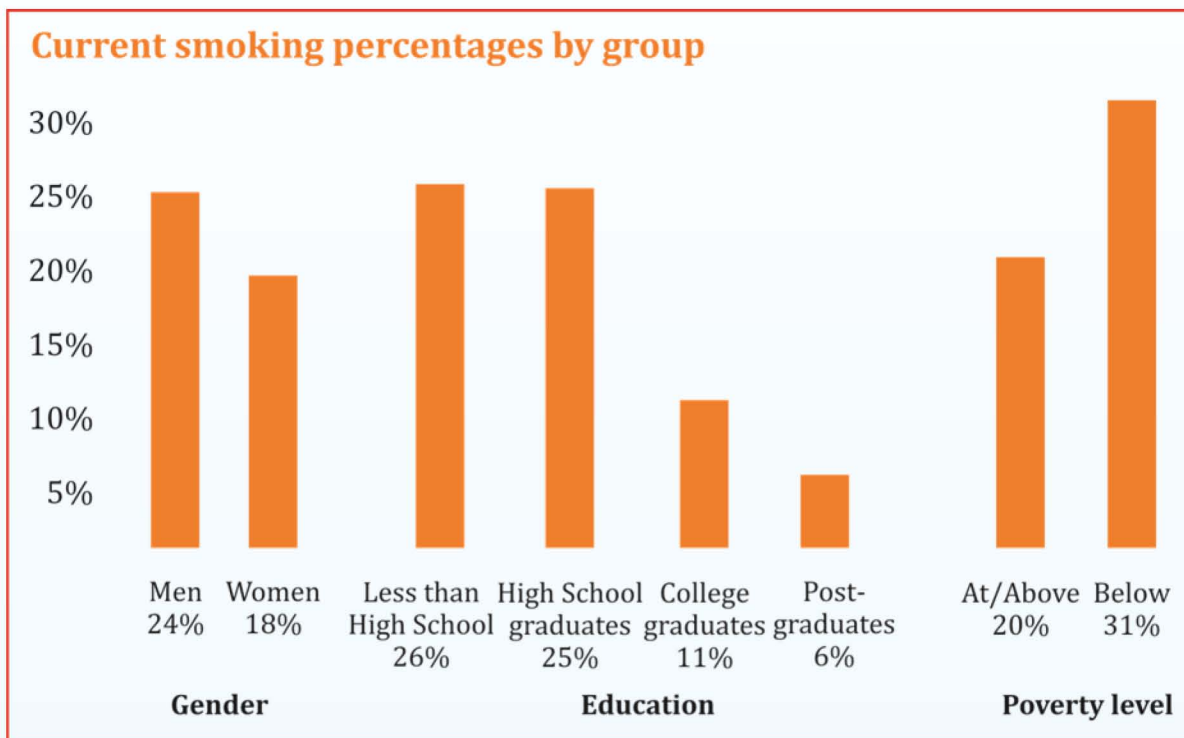


The major health impacts of smoking were long established, but Governments were slow to respond to this growing health epidemic. Despite laudable tobacco control strategies in many countries, deaths from smoking are on the rise globally, and may reach to 10 million a year by the 2030's.



Tobacco kills nearly six million people worldwide each year and passive inhaling of tobacco smoke (SHS) kills 600,000 people every year. Some 4000 chemicals have been identified in tobacco smoke, out of which about 250 are known to be harmful. Toxic chemicals from SHS cling to rugs, clothes, food, furniture and other materials. These toxins remain in spite of windows, fans or air filters, and can cycle back into the ambient air. Passive smoking is linked to an increased risk of cardiovascular diseases, lung cancer, asthma and other respiratory diseases in adults; and ear infection and sudden infant death syndrome in children.





[Statistics obtained by - National Council of Applied Economic Research (NCAER)]

Another recent study by National Council of Applied Economic Research (NCAER) has revealed that the trends continued to remain the same. The statistics show that only 16% of college graduates smoke, in contrast to 46% of illiterate adults in the category. It was also observed that smoking is concentrated among the lowest income group.

### Legislation and Enforcement

*Statutory Warning: Cigarette Smoking is Injurious to Health!*

Since 1975, it is mandatory to display the above statutory health warning on all packets and advertisements of cigarettes because of the Cigarettes (Regulation of Production, Supply and Distribution) Act. The Cigarettes and Other Tobacco Products (Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution) Bill, was passed in April 2003, which became an Act on 18 May 2003 – COTPA (The Cigarettes and other Tobacco Products). The Act is applicable to all products containing tobacco in any form, and extends to whole of the India.

**The key provisions of COTPA are:**

- Prohibition of smoking in public places (Implemented from 2<sup>nd</sup> October 2008 in the whole of India).
- Prohibition on advertising, sponsorship and promotion of tobacco products.



- Prohibition of selling tobacco products to children and within a radius of 100 yards of any educational institution.
- Regulation of health warning in tobacco products' packs, in English and one more Indian language. Pictorial health warnings also to be included.
- Regulation and testing of nicotine contents of tobacco products; declaring these on packages.

Following the provisions of COTPA, schools have displayed boards like-

**Tobacco Free Zone**

### **National Tobacco Control Programme**

The Ministry of Health and Family Welfare, GOI, launched the National Tobacco Control Programme to facilitate the implementation of Tobacco Control Laws and to bring about greater awareness about the harmful effects of tobacco.

A total ban on tobacco advertising and promotion, restriction on smoking in public places and in the workplace, sustained increase in tobacco taxation, bold health warnings and health education campaigns, will help curb the problem. While legislation may be favoured over voluntary controls, the key to the successful implementation of these measures is by winning public support and ensuring proper enforcement.

### **Air Pollution**

It includes-

- i) any change in the composition of air,
- ii) addition of an undesired chemical, that is not part of the normal composition of air.

This may be due to natural or manmade pollutants which cause discomfort, disease or death to humans. Other living organisms may also get affected.







## Pollutants

Primary air pollutants include-

Sulphur oxides, Nitrogen oxides, Ammonia, Carbon monoxide, Volatile Organic Compounds classified as methane and non-methane (NMVOCs), particulate matter (PM), free radicals, radioactive pollutants, chloro-fluorocarbons, toxic metals such as lead and mercury and their compounds.

The secondary air pollutants include-

**Smog** which is a portmanteau of smoke and fog. Photochemical smog results from a chemical reaction of nitrogen oxides and VOCs, in the presence of sunlight. **Ground level ozone** that becomes toxic at high amounts. **Peroxyacetyl nitrate (PAN)** which is produced from nitrous oxides and VOCs.

## Health Effects of Air Pollution

The World Health Organization (WHO) estimates that nearly 2.4 million deaths every year are attributable to air pollution. Nearly 1.5 million people die each year due to indoor pollution.

Exposure to air pollution has been found to-

- increase in the mortality due to heart diseases and strokes
- increase in the Lead to several pulmonary complications
- cause asthma and Chronic Obstructive Pulmonary Disease (COPD)
- increase the risk of lung cancer

Children are at increased risk of developing asthma, pneumonia and other lower respiratory infections. Long term exposure may affect their growth (especially lung development).



*Outdoor and indoor pollutions are equally hazardous to health of children and womenfolk*



## Household (Indoor) Air Pollution

Cooking and heating with biomass fuels (agricultural residues, dung, wood) or coal produces lots of indoor smoke that contains a variety of hazardous pollutants. There is evidence to support that exposure to indoor air pollution can lead to acute lower respiratory infections, particularly pneumonia in children and COPD and lung cancer in adults.

## Air Quality Index

The Air Quality Index (AQI) focuses on health effects experienced within a few hours or days after breathing polluted air. Its value ranges from 0 to 500. A value of 100 is taken as a cut off and corresponds to the national air quality standard for the pollutant. Air quality is regarded as unhealthy when the AQI exceeds 100.

### NATIONAL AIR QUALITY INDEX LAUNCHED

10

Cities where people can get information on actual air quality and its health implications:  
Delhi, Agra, Kanpur, Lucknow, Varanasi, Faridabad, Ahmedabad, Chennai, Bangalore and Hyderabad



- ▶ Most of the **monitoring stations** in these 10 cities **started displaying the index from monday** (April 6)
- ▶ **Index can be accessed from websites** of Union environment ministry or respective state pollution control boards
- ▶ AQI scheme reflects '**one colour one code**' for different types of air quality (good, satisfactory, moderate, poor, very poor and severe)
- ▶ 46 other million-plus cities and 20 state capitals will have **similar air quality index** in next one to two years
- ▶ Each of these **cities** will have **6-7 monitoring station** with **AQI display boards**

AQI SCHEME		
AQI	Colour Code	Likely health implications
1-50	Good	Minimal impact
51-100	Satisfactory	Minor breathing discomfort to sensitive people
101-200	Moderate	Breathing discomfort to people with lungs, asthma & heart disease
201-300	Poor	Breathing discomfort to most people on prolonged exposure
301-400	Very Poor	Respiratory illness of prolonged exposure
401-500	Severe	Effects healthy people & serious impact to those existing diseases

[Released by Meteorological deptt. of India April 6, 2015]





As an endeavour to sensitize the public on air quality, SAFAR (savar.tropnet.res.in) and Central Pollution Control Board (CPCB) gives regular data checked at 4pm on a regular basis. The comparative indices for Delhi are reflected below:

## HYPED BEGINING, BUT POOR SHOW

CPCB Index			
Location	AQI	Category	Dominant pollutant
IGI Airport	259	Poor	PM 2.5 (last updated at 3pm on April 20)
RK Puram	309	V Poor	Ozone (up to date)
IHBAS & ITO	Insufficient data for computing		
NSIT Dwarka	166	Moderate	Ozone (last updated at 1pm on May 4)
Paschim Vihar	154	Moderate	PM10 (last updated at 7pm on April 30)
Shadipur	293	Poor	Ozone (last updated at 3pm on May 4)
Civil Lines	156	Moderate	Ozone (last updated at 4pm on April 17)
Anand Vihar	380	V Poor	PM10 (up to date)
Website checked at 4pm on May 4			

SAFAR-IITM-MoES index			
Location	AQI	Category	Dominant pollutant
Lodhi Road	231	Poor	PM10
PUSA	186	Moderate	PM10
Mathura Road	226	Poor	PM10
Airport	243	Poor	PM10
Ayanagar	233	Poor	PM10
Noida	213	Poor	PM2.5
Delhi University	236	Poor	PM10
Dhirpur	247	Poor	PM10
Website checked at 4.35pm on May 4			

US embassy AQI for PM 2.5 at Chanakyapuri: 117 (unhealthy for sensitive groups)
Website checked at 4pm on May 4, 2015

Delhi has been ranked first among the 1,600 most polluted cities, by WHO due to its alarmingly poor air quality. After which, research and civil society groups have been demanding that India move to Euro VI fuel norms. Environment activist, Sunita Narain has said that stringent on-road inspection can have an impact, as almost every vehicle passes through pollution check. As of now, Delhi and 12 other cities in India adhere to Euro IV fuel norms while the rest of the country is on Euro III. The Auto Fuel Policy Committee for 2025, has recommended that Euro V be implemented by April 2020 and Euro VI by April 2024.

### Efforts to Reduce Air Pollution

Proper land use planning can reduce air pollution. Apart from that, measures can be taken to reduce pollution from sources. These involve:

- use of alternative environment friendly fuel sources, like bio-ethanol, biodiesel, or conversion to electric vehicles



- ensuring better fuel efficiency
- use of pollution control devices in industries such as Electro Static Precipitators (ESPs), mechanical collectors, scrubbers and so on
- Enforcement of legal regulations so as to attain target levels of atmospheric concentrations for specific pollutants

Such concerted efforts by the government, and will-power along with efforts at the individual level will help control most of the 100% preventable but not irreversible and curable diseases. It is a well known fact that life span gets reduced due to continuous exposure to harmful substances. It is not just a personal loss but also a national loss as the amount spent in diagnosis, treatment and compensation could have been diverted towards prevention as well as in improving the ambient air quality. But, most importantly, it is to be able to lead a life of dignity.

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### SAMPLE QUESTIONS

1. The poor man's material is ironically proving to be highly expensive. Explain. (5 Marks)
2. One may not be conscious about the presence of household pollution but the smoke, fumes and dust particles may cling onto the upholstery, furniture and other materials. Suggest any five measures that can be adopted by you to help mitigate indoor air pollution. (5 Marks)





### MARKING SCHEME

1. Chrysotile is referred to as the poor man's material/ it is used by the poor for roofing, as it is highly resistant/inexpensive as compared to other building materials.

It is proving to be expensive as:

- Affects the health of the workers / they may fall ill / suffer from asbestosis/ mesothelioma/ any other cancer
- The disease progresses slowly and there is no cure
- The person has to go on sick leave / workplace absenteeism increases
- Economic loss
- Under 'No work-No pay,' individual or family may now fall below poverty line
- Education of children / health of other family members may take a backseat

(Any other appropriate answer explained )

(5)

- 2.
- Regular cleaning / dusting/ vacuum cleaning
  - Replace 'chulhas' using cow dung cakes with those working on bio-gas/ PNG
  - Proper ventilation/ circulation of air (adopt such house/building design)
  - Use alternatives for varnishing, other than sprays
  - Not allow burning of leaves/ waste in the garden
  - Avoid using spray deodorants
  - No smoking in closed rooms
  - Anti-cracker campaign (Any five points with explanation)

(Any other appropriate points)

(5)



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