



INSIGHTSIAS

SIMPLIFYING IAS EXAM PREPARATION

- I A S S E L F S T U D Y G U I D E -

STATIC QUIZ

Indian Economy

Ecology & Environment

General Science



Series II

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1. Indian Economy

1. Consider the following statements:

1. Monetary Policy Committee (MPC) is entrusted with the task of fixing the repo rate to contain inflation within the specified target level
2. Monetary Policy Committee (MPC) has complete control over monetary policy decisions.

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: c)

The Monetary Policy Committee (MPC) is a committee of the Central Bank in India (Reserve Bank of India), headed by its Governor, which is entrusted with the task of fixing the benchmark policy interest rate (repo rate) to contain inflation within the specified target level.

Monetary Policy Committee is defined in Section 2(iii)(cci) of the Reserve Bank of India Act, 1934 and is constituted under Sub-section (1) of Section 45ZB of the same Act.

The MPC replaces the current system where the RBI governor, with the aid and advice of his internal team and a technical advisory committee, has complete control over monetary policy decisions.

A Committee-based approach will add lot of value and transparency to monetary policy decisions.

For more: [http://www.arthapedia.in/index.php?title=Monetary_Policy_Committee_\(MPC\)](http://www.arthapedia.in/index.php?title=Monetary_Policy_Committee_(MPC))

2. Which of the following committee was appointed in 2005 by the union government to work on a blueprint for a international financial centre (IFC) in Mumbai which could compete with London, Tokyo and Singapore ?

- (a) B N Krishna Committee
- (b) Raghuram Rajan Committee
- (c) U K Sharma Committee
- (d) None of the above

Solution: d)

Mistry, based in the UK, was appointed by former finance minister P Chidambaram in 2005 to work on a blueprint for a global financial centre in Mumbai which could compete with London, Tokyo and Singapore. The reason why Frankfurt, Paris and Tokyo are not as successful IFCs as London is, he said, because they are not as global.

<http://indianexpress.com/article/india/india-news-india/international-financial-centre-forget-it-says-percy-mistry/>

3. With reference to the Financial Stability and Development Council (FSDC), consider the following statements:

1. It is headed by the Governor of RBI
2. It monitors the issues of financial literacy and financial inclusion

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

The Financial Stability and Development Council (FSDC) has been constituted vide GoI notification dated 30th December, 2010. The Council is chaired by the Union Finance Minister and its members are **Governor, Reserve Bank of India**; Finance Secretary and/or Secretary, Department of Economic Affairs; Secretary, Department of Financial Services; Chief Economic Adviser, Ministry of Finance; Chairman, Securities and Exchange Board of India; Chairman, Insurance Regulatory and Development Authority and Chairman, Pension Fund Regulatory and Development Authority.

The Council deals, inter-alia, with issues relating to financial stability, financial sector development, inter-regulatory coordination, financial literacy, financial inclusion and macro prudential supervision of the economy including the functioning of large financial conglomerates. No funds are separately allocated to the Council for undertaking its activities.

4. With reference to the Atal Pension Yojana (APY), consider the following statements:

1. APY will be focussed on all citizens in the unorganised sector, who join the National Pension System (NPS)
2. The minimum age of joining APY is 18 years and maximum age is 40 years

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: c)

The APY will be focussed on all citizens in the unorganised sector, who join the National Pension System (NPS) administered by the Pension Fund Regulatory and Development Authority (PFRDA) and who are not members of any statutory social security scheme. Under the APY, the subscribers would receive the fixed pension of Rs. 1000 per month, Rs. 2000 per month, Rs. 3000 per month, Rs. 4000 per month, Rs. 5000 per month, at the age of 60 years, depending on their contributions, which itself would vary on the age of joining the APY. The minimum age of joining APY is 18 years and maximum age is 40 years.

5. Base erosion and profit shifting (BEPS) refers to tax planning strategies used by multinational companies that exploit gaps and mismatches in tax rules to artificially shift profits to low or no-tax locations where there is little or no economic activity. This project is headed by
- (a) World Bank
 - (b) IMF
 - (c) OECD
 - (d) None of the above

Solution: c)

Base erosion and profit shifting (BEPS) refers to tax planning strategies used by multinational companies that exploit gaps and mismatches in tax rules to artificially shift profits to low or no-tax locations where there is little or no economic activity. The project headed by the OECD was initiated by the G20 in 2012. BEPS concerns strategies which aim to move profits to where they are taxed at lower rates and expenses to where they are relieved at higher rates. The result is a tendency to associate more profit with legal constructs and intangible rights and obligations, and reduce the share of profits associated with substantive operations involving the interaction of people with one another. "While these corporate tax planning strategies may be technically legal and rely on carefully planned interactions of a variety of tax rules and principles, the overall effect of this type of tax planning is to erode the corporate tax base of many countries in a manner that is not intended by domestic policy.

6. Government can counter budget deficits by
- 1. Increasing direct taxes
 - 2. Reducing government spending
 - 3. Printing additional currency
 - 4. Reducing regulation to boost investments
 - 5. Lowering corporate taxes

Which of the above is/are correct ?

- (a) 1 and 2 Only
- (b) 1,2 and 3 Only
- (c) 1,2,3 and 4 Only
- (d) 1,2,3,4 and 5

Solution: d)

<https://www.investopedia.com/terms/b/budget-deficit.asp>

Countries can counter budget deficits by promoting economic growth through fiscal policies such as reducing government spending and increasing taxes. For example, one strategy is to reduce regulations and lower corporate taxes to improve business confidence and increase treasury inflows from taxes. A nation can print additional currency to cover payments on debts owed by issuing securities including Treasury bills and bonds. While this provides a mechanism to make payments, it does carry the risk of devaluing the nation's currency.

7. With reference to the capital budget of the Government of India, consider the following statements:

1. It incorporates transactions in the Public Account
2. It includes borrowings by the government from the Reserve Bank of India

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: c)

Definition: Capital Budget consists of capital receipts and payments. It also incorporates transactions in the Public Account.

Description: Capital receipts are loans raised by the government from the public (which are called market loans), borrowings by the government from the Reserve Bank and other parties through sale of treasury bills, loans received from foreign bodies and governments, and recoveries of loans granted by the Central government to state and Union Territory governments and other parties.

Capital payments consist of capital expenditure on acquisition of assets like land, buildings, machinery, and equipment, as also investments in shares, loans and advances granted by the Central government to state and Union Territory governments, government companies, corporations and other parties.

- 8.** A country can reduce its current account deficit by
1. Decreasing the value of its exports relative to the value of imports
 2. Placing restrictions on imports, such as tariffs or quotas
 3. Improving domestic companies' global competitiveness

Which of the above statements is/are correct ?

- (a) 1 and 3 Only
(b) 2 and 3 Only
(c) 2 Only
(d) 1,2 and 3

Solution: b)

A country can reduce its current account deficit by increasing the value of its exports relative to the value of imports. It can place restrictions on imports, such as tariffs or quotas, or it can emphasize policies that promote exports, such as import substitution, industrialization or policies that improve domestic companies' global competitiveness. The country can also use monetary policy to improve the domestic currency's valuation relative to other currencies through devaluation, which reduces the cost of a country's exports.

While a current account deficit can imply that a country is spending "beyond its means," having a current account deficit is not inherently disadvantageous. If a country uses external debt to finance investments that have a higher return than the interest rate on the debt, it can remain solvent while running a current account deficit. If a country is unlikely to cover current debt levels with future revenue streams, however, it may become insolvent.

Read more: Current Account Deficit

<https://www.investopedia.com/terms/c/currentaccountdeficit.asp#ixzz59bl9x0EX>

- 9.** In 2017, the Union Budget was presented without the distinction between plan and non-plan expenditure. With reference to this move, consider the following statements:
1. Distinction between plan and non-plan expenditure was removed due to the extinction of Planning Commission
 2. At present budgets are presented under the heads of revenue and capital expenditure

Which of the above statements is/are correct ?

- (a) 1 Only
(b) 2 Only
(c) Both 1 and 2
(d) Neither 1 nor 2

Solution: c)

<http://www.financialexpress.com/budget/how-union-budget-2018-will-be-different-from-2017/1014468/>

http://www.business-standard.com/article/economy-policy/govt-to-scrap-distinction-between-plan-and-non-plan-expenditures-in-annual-budget-116092100741_1.html

<https://www.moneycontrol.com/news/business/economy/ending-plannon-plan-expenditure-what-does-it-mean-963248.html>

10. The Article 112 of the Constitution of India deals with

- (a) The Annual Financial Statement
- (b) The Appropriation bill
- (c) Money bill
- (d) Votes on account

Solution: a)

The Union Budget of India, also referred to as the Annual Financial Statement in the Article 112 of the Constitution of India, is the annual budget of the Republic of India.

- 112. Annual financial statement.
- 113. Procedure in Parliament with respect to estimates.
- 114. Appropriation Bills.
- 115. Supplementary, additional or excess grants.
- 116. Votes on account, votes of credit and exceptional grants.
- 117. Special provisions as to financial Bills.

11. With reference to the National Payments Corporation of India (NPCI), consider the following statements:

1. It is a “Not for Profit” Company under the provisions of Section 8 of Companies Act 2013
2. It is set up to provide infrastructure to the entire Banking system in India for physical as well as electronic payment and settlement systems

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: c)

NCPI was in news due to Unified Payments Interface (UPI).

National Payments Corporation of India (NPCI), an umbrella organisation for operating retail payments and settlement systems in India, is an initiative of Reserve Bank of India (RBI) and Indian Banks' Association (IBA) under the provisions of the Payment and Settlement Systems Act, 2007, for creating a robust Payment & Settlement Infrastructure in India.

Considering the utility nature of the objects of NPCI, it has been incorporated as a "Not for Profit" Company under the provisions of Section 25 of Companies Act 1956 (now Section 8 of Companies Act 2013), with an intention to provide infrastructure to the entire Banking system in India for physical as well as electronic payment and settlement systems. The Company is focused on bringing innovations in the retail payment systems through the use of technology for achieving greater efficiency in operations and widening the reach of payment systems.

The ten core promoter banks are State Bank of India, Punjab National Bank, Canara Bank, Bank of Baroda, Union Bank of India, Bank of India, ICICI Bank, HDFC Bank, Citibank N. A. and HSBC. In 2016 the shareholding was broad-based to 56 member banks to include more banks representing all sectors.

12. With reference to the GST council, consider the following statements:

1. The GST Council will be the body that decides which taxes levied by the Centre, States and local bodies will go into the GST
2. Union Finance Minister is the chairperson of the GST council
3. GST council has been established through the constitutional amendment

Which of the above statements is/are correct ?

- (a) 2 Only
(b) 1 and 2 Only
(c) 2 and 3 Only
(d) 1, 2 and 3

Solution: d)

In order to implement GST, Constitutional (122nd Amendment) Bill (CAB for short) was introduced in the Parliament and passed by Rajya Sabha on 03rd August, 2016 and Lok Sabha on 08th August, 2016. The CAB was passed by more than 15 states and thereafter Hon'ble President gave assent to "The Constitution (One Hundred And First Amendment) Act, 2016" on 8th of September, 2016. Since then the GST council and been notified bringing into existence the Constitutional body to decide issues relating to GST.

On September 16, 2016, Government of India issued notifications bringing into effect all the sections of CAB setting firmly into motion the rolling out of GST. This notification sets out an outer limit of time of one year, that is till 15-9-2017 for bringing into effect GST.

GST COUNCIL

As per Article 279A (1) of the amended Constitution, the GST Council has to be constituted by the President within 60 days of the commencement of Article 279A. The notification for bringing into force Article 279A with effect from 12th September, 2016 was issued on 10th September, 2016.

As per Article 279A of the amended Constitution, the GST Council which will be a joint forum of the Centre and the States, shall consist of the following members: –

- a) Union Finance Minister – Chairperson
- b) The Union Minister of State, in-charge of Revenue of finance – Member
- c) The Minister In-charge of finance or taxation or any other Minister nominated by each State Government – Members

As per Article 279A (4), the Council will make recommendations to the Union and the States on important issues related to GST, like the goods and services that may be subjected or exempted from GST, model GST Laws, principles that govern Place of Supply, threshold limits, GST rates including the floor rates with bands, special rates for raising additional resources during natural calamities/disasters, special provisions for certain States, etc.

The GST Council will be the body that decides which taxes levied by the Centre, States and local bodies will go into the GST; which goods and services will be subjected to GST; and the basis and the rates at which GST will be applied

<http://www.gstcouncil.gov.in/gst-council>

13. With reference to the Central Board of Indirect taxes and Customs (CBIC), consider the following statements:

1. It is the nodal national agency responsible for administering Customs, GST, Central Excise, Service Tax & Narcotics in India
2. Currently, CBIC comes under the Department of Economic Affairs, Ministry of Finance

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: a)

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The Central Board of Excise and Custom renamed as Central Board of Indirect taxes and Customs (CBIC) is the nodal national agency responsible for administering Customs, GST, Central Excise, Service Tax & Narcotics in India. The Customs & Central Excise department was established in the year 1855 by the then British Governor General of India, to administer customs laws in India and collection of import duties / land revenue. It is one of the oldest government departments of India.

Currently the Customs and Excise department comes under the Department of Revenue, Ministry of Finance. The agency is staffed by IRS officers who start their careers as Assistant Commissioners in the field and within 20–25 years rise to the post of Chief Commissioners, with a few senior most officers who become Members of CBEC / CESTAT / Settlement Commission.

14. Consider the following statements:

1. India's tax-GDP ratio is very low compared to other developing countries or emerging markets
2. Lower tax-GDP ratio can be addressed by mobilising greater tax revenues

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

India's tax-GDP ratio is comparable to other developing countries. It's not very low

<http://www.livemint.com/Industry/7UAyR2aM3Yh8rBeTD28WHL/Is-India-an-outlier-when-it-comes-to-taxGDP-ratio.html>

Second statement is right (self evident).

15. Consider the following statements:

1. It is estimated that percentage of agricultural workers of total workforce was more than 50% in 2001
2. The high cost of production of many crops in India can be attributed to intensive involvement of labour in different farm operations

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: c)

The Economic Survey says that the sale of tractors to a great extent reflects the level of mechanization. Indian tractor industries have emerged as the largest in the world and account for about one-third of total global tractor production, the Survey adds. While the trend is encouraging, the Economic Survey notes that more needs to be done. It is estimated that percentage of agricultural workers of total workforce would drop to 25.7 per cent by 2050 from 58.2 per cent in 2001. "Thus, there is a need to enhance the level of farm mechanization in the country. Due to intensive involvement of labour in different farm operations, the cost of production of many crops is quite high," Chief Economic Advisor Arvind Subramanian said.

<http://www.financialexpress.com/budget/india-economic-survey-2018-for-farmers-agriculture-gdp-msp/1034266/>

- 16.** With reference to Marginal Standing Facility (MSF), consider the following statements:
1. It is always fixed above the repo rate
 2. The MSF is the first resort for banks to borrow money from the RBI
 3. It was introduced by the RBI with the main aim of reducing volatility in the overnight lending rates in the inter-bank market

Which of the above statements is/are correct?

- (a) 3 Only
- (b) 1 and 2 Only
- (c) 1 and 3 Only
- (d) 1, 2 and 3

Solution: c)

Marginal Standing Facility (MSF) is a new scheme announced by the Reserve Bank of India (RBI) in its Monetary Policy (2011-12) and refers to the penal rate at which banks can borrow money from the central bank over and above what is available to them through the LAF window.

MSF, being a penal rate, is always fixed above the repo rate. The MSF would be the last resort for banks once they exhaust all borrowing options including the liquidity adjustment facility by pledging government securities, where the rates are lower in comparison with the MSF. The MSF would be a penal rate for banks and the banks can borrow funds by pledging government securities within the limits of the statutory liquidity ratio. The scheme has been introduced by RBI with the main aim of reducing volatility in the overnight lending rates in the inter-bank market and to enable smooth monetary transmission in the financial system.

MSF represents the upper band of the interest corridor with repo rate at the middle and reverse repo as the lower band.

To balance the liquidity, RBI uses the sole independent “policy rate” which is the repo rate (in the LAF window) and the MSF rate automatically gets adjusted to a fixed per cent above the repo rate (MSF was originally intended to be 1% above the repo rate). MSF is at present aligned with the Bank rate. Under Section 49 of the Reserve Bank of India Act, 1934, the Bank Rate has been defined as “the standard rate at which the Reserve Bank is prepared to buy or re-discount bills of exchange or other commercial paper eligible for purchase under the Act. On introduction of Liquidity Adjustment Facility (LAF), discounting/rediscounting of bills of exchange by the Reserve Bank has been discontinued. As a result, the Bank Rate became dormant as an instrument of monetary management. It is now aligned to MSF rate and is used only for calculating penalty on default in the maintenance of cash reserve ratio (CRR) and the statutory liquidity ratio (SLR).

17. With reference to Statutory liquidity ratio (SLR), consider the following statements:

1. SLR is determined by Reserve Bank of India
2. The SLR is determined by a percentage of total demand and time liabilities
3. If any Indian bank fails to maintain the required level of the statutory liquidity ratio, then it becomes liable to pay penalty to Reserve Bank of India

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 1 and 3 Only
- (c) 2 and 3 Only
- (d) 1,2 and 3

Solution: d)

‘Statutory liquidity ratio (SLR) is the Indian government term for the reserve requirement that the commercial banks in India are required to maintain in the form of cash, gold reserves, government approved securities before providing credit to the customers. Statutory liquidity ratio is determined by Reserve Bank of India maintained by banks in order to control the expansion of bank credit. The SLR is determined by a percentage of total demand and time liabilities.

Time liabilities refer to the liabilities which the commercial banks are liable to pay to the customers after a certain period mutually agreed upon, and demand liabilities are such deposits of the customers which are payable on demand. An example of time liability is a six month fixed deposit which is not payable on demand but only after six months. An example of demand liability is a deposit maintained in a saving account or current account that is payable on demand through a withdrawal form such as a cheque.

If any Indian bank fails to maintain the required level of the statutory liquidity ratio, then it becomes liable to pay penalty to Reserve Bank of India. The defaulter bank pays penal interest at the rate of 3% per annum above the bank rate, on the shortfall amount for that particular day. However, according to the Circular released by the Department of Banking Operations and Development, Reserve Bank of India, if the defaulter bank continues to default on the next working day, then the

rate of penal interest can be increased to 5% per annum above the bank rate. This restriction is imposed by RBI on banks to make funds available to customers on demand as soon as possible. Gold and government securities (or gilts) are included along with cash because they are highly liquid and safe assets.

- 18.** If the interest rate is decreased in an economy, the investment expenditure in the economy
- (a) Increases
 - (b) Decreases
 - (c) It has no relation with interest rate
 - (d) None of the above

Solution: a)

CSP-2014

Investment expenditure refers to the expenditure incurred either by an individual or a firm or the government for the creation of new capital assets like machinery, building etc.

The relationship between interest rate and investment Expenditure is illustrated by the investment curve of the economy. The curve has downward slope, indicating that a drop in interest rate, causes the investment-spending to rise.

- 19.** For a start-up that's looking for initial investment to start its business, approaching which of the following investors makes more sense?
- (a) Venture capital investors
 - (b) Angel investors
 - (c) A bank loan
 - (d) Initial public offering

Solution: b)

Angel investors provide more favorable terms compared to other lenders, since they usually invest in the entrepreneur starting the business rather than the viability of the business. Angel investors are focused on helping startups take their first steps, rather than the possible profit they may get from the business. Essentially, angel investors are the opposite of venture capitalists.

Angel investors are also called informal investors, angel funders, private investors, seed investors or business angels. These are affluent individuals who inject capital for startups in exchange for ownership equity or convertible debt. Some angel investors invest through crowdfunding platforms online or build angel investor networks to pool in capital.

<https://www.investopedia.com/terms/a/angelinvestor.asp>

<https://www.upcounsel.com/types-of-investors>

20. In business, 'love money' refers to

- (a) Money spent on philanthropy by businesses
- (b) Seed money or capital given by family or friends to an entrepreneur to start a business
- (c) Money spent by businesses to compliment government's social spending
- (d) None of the above

Solution: b)

Love money is usually given to entrepreneurs who have proved their responsibility to close family and friends over the years, but who fail to meet the capital requirements that financial institutions look for in borrowers. An angel investor's love money is sometimes the only way a business can get off the ground; this type of financing can allow for growth that would be impossible through traditional financing channels.

21. With reference to the Pradhan Mantri Fasal Bima Yojana, consider the following statements:

1. The scheme covers post-harvest losses up to a period of 14 days
2. Presently, private insurance companies are not part of the scheme
3. Crops grazed and/or destroyed by domestic and/or wild animals is also covered under the scheme

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 1 and 3 Only
- (c) 1 and 2 Only
- (d) 1, 2 and 3

Solution: a)

The Scheme shall be implemented through a multi-agency framework by selected insurance companies under the overall guidance & control of the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), Ministry of Agriculture & Farmers Welfare (MoA&FW), Government of India (GOI) and the concerned State in co-ordination with various other agencies; viz Financial Institutions like Commercial Banks, Co-operative Banks, Regional Rural Banks and their regulatory bodies, Government Departments viz. Agriculture, Co-operation, Horticulture, Statistics, Revenue, Information/Science & Technology, Panchayati Raj etc.

DAC&FW has designated/empanelled Agriculture Insurance Company of India (AIC) and some private insurance companies presently to participate in the Government sponsored agriculture /crop insurance schemes based on their financial strength, infrastructure, manpower and expertise etc.

The Scheme shall be implemented on an 'Area Approach basis' i.e., Defined Areas for each notified crop for widespread calamities with the assumption that all the insured farmers, in a Unit of Insurance, to be defined as 'Notified Area' for a crop, face similar risk exposures, incur to a large extent, identical cost of production per hectare, earn comparable farm income per hectare, and experience similar extent of crop loss due to the operation of an insured peril, in the notified area.

EXCLUSIONS: Risks and Losses arising out of following perils shall be excluded:-

War & kindred perils, nuclear risks, riots, malicious damage, theft, act of enmity, grazed and/or destroyed by domestic and/or wild animals, In case of Post-Harvest losses the harvested crop bundled and heaped at a place before threshing, other preventable risks.

For more: <http://agri-insurance.gov.in/pmfbby.aspx>

<https://www.thehindubusinessline.com/opinion/columns/slate/all-you-wanted-to-know-about-pradhan-mantri-fasal-bima-yojana/article22317536.ece1>

22. Which of the following is/are benefits of neem-coated urea ?

1. Neem-coating increases nitrogen use efficiency
2. Neem-coating prevents diversion of urea for non-farm uses
3. Neem-coating helps plants stay greener for a longer time

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 1 and 3 Only
- (c) 2 and 3 Only
- (d) 1,2 and 3 Only

Solution: d)

When urea is applied to the soil, it is first hydrolysed or broken by water into ammonium ions (NH_4^+), followed by oxidation to nitrite (NO_2^-) and, then, nitrate (NO_3^-) forms. This nitrification process is what makes the nitrogen, which is 46 per cent in urea, available to the crops. In normal urea, however, the conversion to nitrate happens very rapidly. As a result, up to two-thirds of the nitrogen is lost either through underground percolation ('leaching') of nitrates or 'volatilisation' (escaping into atmosphere).

Neem oil basically acts as a 'nitrification inhibitor' when coated on urea. By slowing down urea hydrolysis and nitrification, it allows a more gradual release of nitrogen, which can be used by the plant. "Neem-coating increases nitrogen use efficiency. Also, since the urea action is prolonged, the plants stay greener for a longer time. Farmers apply urea when they notice the leaves turning

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yellowish. But if the crop here is retaining greenness for an extended period, they would reduce the frequency of application.

<http://indianexpress.com/article/india/india-fertiliser-sales-foodgrain-output-narendra-modi-neem-urea-4581174/>

23. Which of the following is/are the advantage /advantages of practising drip irrigation?

1. No runoff of fertilizers into groundwater
2. Reduction in weed
3. No soil erosion
4. Efficient moisture distribution
5. Prevents salinity

Select the correct answer using codes below:

- (a) 1,2 and 4 Only
- (b) 1,2 and 3 Only
- (c) 3,4 and 5 Only
- (d) 1,2,3,4 and 5

Solution: b)

Advantages and Disadvantages of Drip Irrigation

Advantages of Drip Irrigation:

1. Maximum use of available water.
2. No water being available to weeds.
3. Maximum crop yield.
4. High efficiency in the use of fertilizers.
5. Less weed growth and restricts population of potential hosts.
6. Low labour and relatively low operation cost.
7. No soil erosion.
8. Improved infiltration in soil of low intake.
9. Ready adjustment to sophisticated automatic control.
10. No runoff of fertilizers into ground water.
11. Less evaporation losses of water as compared to surface irrigation.
12. Improves seed germination.
13. Decreased tillage operations.

Disadvantages of Drip Irrigation:

In spite of the fact that drip irrigation has so many potential benefits , they're a certain limitation also, there are as follow:

1. Sensitivity to clogging
2. Moisture distribution problem

3. Salinity hazards
4. High cost compared to furrow.
5. High skill is required for design, install and operation

<http://www.agriinfo.in/default.aspx?page=topic&superid=8&topicid=2243>

24. With reference to millets and its production in India, consider the following statements:

1. India has witnessed a 60 per cent decline in the area under millets since 1960s
2. Millets are grown mostly in the arid, semi-arid and hilly regions
3. Bajra, Jowar and Ragi are some of the examples of millets that are commonly grown in India

Which of the above statements is/are correct ?

- (a) 1 and 2 Only
- (b) 1 and 3 Only
- (c) 2 Only
- (d) 1, 2 and 3

Solution: d)

Although among the food crops, millets occupy relatively a lower position in Indian agriculture, they are quite important from the point of food security at regional/household level. Millets can not only grow in poor soil/climatic conditions, due to their short growing season, these can very well fit into multiple cropping systems under irrigated as well as dry land farming; and provide nutritious grain as well as fodder in a short span. Their prolonged and easy storability under ordinary conditions has accorded them the status of "**famine reserves**"; and this feature is of great relevance for India, as our agriculture suffers from the vagaries of monsoon.

The millets commonly grown in India include: bajra (pearl millet), jowar (sorghum), ragi (finger millet), barri (proso/common millet), jhangora (barnyard millet), kangni (foxtail/ Italian millet), kodra (kodo millet) etc.

Very good articles (must read)

<http://pib.nic.in/newsite/feacontent.aspx?relid=106818>

<http://www.downtoearth.org.in/blog/promoting-millets-the-wheel-need-not-be-reinvented-39088>

(there is a possibility of Mains question on millets appearing in 2018)

25. The Globally Important Agricultural Heritage System (GIAHS) programme is an initiative of

- (a) WHO
- (b) UNESCO
- (c) International Fund for Agricultural Development (IFAD)
- (d) FAO

Solution: d)

The Globally Important Agricultural Heritage Systems (GIAHS) Partnership Initiative was conceptualized and presented by Dr. Parviz Koohafkan the Task Manager of Chapter 10 of **Agenda 21 in Food and Agricultural Organization of United Nations, FAO in 2002** during **World Summit on Sustainable Development** in Johannesburg, South Africa. This UN Partnership Initiative aims to identify, support and safeguard Globally Important Agricultural Heritage Systems and their livelihoods, agricultural and associated biodiversity, landscapes, knowledge systems and cultures around the world. The GIAHS Partnership recognizes the crucial importance of the well-being of family farming communities in an integrated approach while directing activities towards sustainable agriculture and rural development.

The International Fund for Agricultural Development (IFAD) is an international financial institution and a specialised agency of the United Nations dedicated to eradicating poverty and hunger in rural areas of developing countries. It was established as an international financial institution in 1977 as one of the major outcomes of the 1974 World Food Conference. Seventy-five percent of the world's poor live in rural areas in developing countries, yet only 4% of official development assistance goes to agriculture.

26. Which of the following is/are the objectives of Ujwal DISCOM Assurance Yojana (UDAY) ?

1. Development of Renewable Energy
2. Reduction of cost of generation of power
3. Energy efficiency & conservation

Choose the right answer from codes given below:

- (a) 1 and 2 Only
(b) 2 and 3 Only
(c) 3 Only
(d) 1,2 and 3

Solution: d)

Ministry of Power, GoI launched Ujwal DISCOM Assurance Yojana (UDAY) which was approved by Union Cabinet on 5th November, 2015.

The scheme envisages:

- Financial Turnaround
- Operational improvement
- Reduction of cost of generation of power
- Development of Renewable Energy
- Energy efficiency & conservation

<https://www.uday.gov.in/about.php>

27. With reference to District Mineral Foundation (DMF), consider the following statements:

1. It's a no-profit body set-up in all the districts affected by the mining works
2. Funds to DMF are provided by both the union and state governments
3. The Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY) uses the funds from DMF for implementing welfare schemes in mining affected regions

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 1 and 3 Only
- (c) 2 and 3 Only
- (d) 1,2 and 3

Solution: b)

District Mineral Foundation (DMF) is a trust set up as a non-profit body, in those districts affected by the mining works, to work for the interest and benefit of persons and areas affected by mining related operations. It is funded through the contributions from miners.

Its manner of operation comes under the jurisdiction of the relevant State Government.

Setting up of District Mineral Foundations (DMFs) in all districts in the country affected by mining related operations was mandated through the [Mines and Minerals \(Development & Regulation\) Amendment Act, \(MMDRA\) 2015](#). On [16 September 2015](#), Central Government issued a notification directing states to set up DMF.

In addition, the Central Government notified on [17 September 2015](#), the rates of contribution payable by miners to the DMFs. In case of all mining leases executed before 12th January, 2015 (the date on which MMDR Amendment Act came into force) **miners will have to contribute an amount equal to 30% of the royalty payable** by them to the DMFs. Where mining leases are granted after 12.01.2015, the rate of contribution would be 10% of the royalty payable (Subsequent to the enactment of MMDR Amendment Act, mining leases are given out after auctions; hence, a lower levy).

Thus, every holder of a mining lease or a prospecting licence-cum-mining lease shall, in addition to the royalty, pay to the District Mineral Foundation of the district in which their mining operations are carried on. If the mining area is spread across several districts, the fund is shared on a pro-rata basis by these districts. DMF contribution would not be exceeding one-third of royalty and the Central Government retains the power to prescribe the rates of contribution, though DMF's operation is under state governments. The contributions made to DMFs are collected by the State Governments and the details in this regard are not maintained centrally at the moment.

Under the above mentioned [MMRD Amendment Act of 2015](#), a provision was made also to create a [National Mineral Exploration Trust](#) under the jurisdiction of central government, with 2% of royalty as levy, for boosting detailed exploration of minerals.

The contribution to DMFs has been made effective from 12 January, 2015 though DMF was notified only on 16 September 2015. At the above mentioned prescribed rates of contribution, it's expected that, nearly Rs.6000 crore could be utilized for the development of mining areas of different States, at the current level of royalty collection.

DMF funds are treated as [extra-budgetary resources](#) for the State Plan. Efforts are made to achieve convergence with the State and the District Plans so that the activities taken up by the DMF can supplement the development and welfare activities already being carried out.

Further, using the funds generated by this contribution, the DMFs are expected to implement the [Pradhan Mantri Khanij Kshetra Kalyan Yojana \(PMKKKY\)](#), launched on 17 September 2015 for the welfare of mining areas and affected population. The Central Government has issued a directive to the State Governments, under Section 20A of the MMDR Act, 1957, laying down the guidelines for implementation of PMKKKY and directing the States to incorporate the same in the Rules framed by them for the DMFs.

Source: Arthpedia

<http://pib.nic.in/newsite/PrintRelease.aspx?relid=126983>

28. With reference to MUDRA Yojana, consider the following statements:

1. MUDRA Yojana's major focus is on Non-Corporate Small Business Sector (NCSBS)
2. In the long-term, MUDRA will facilitate formalisation of small businesses
3. MUDRA is a wholly owned subsidiary of Small Industries Development bank of India (SIDBI)

Which of the above statements is/are correct ?

- (a) 2 Only
- (b) 1 and 2 Only
- (c) 1 Only
- (d) 1, 2 and 3

Solution: d)

The Micro Units Development & Refinance Agency Ltd (MUDRA) was set up by the Government of India (GoI). MUDRA has been initially formed as a wholly owned subsidiary of Small Industries Development bank of India (SIDBI) with 100% capital being contributed by it. Presently, the authorized capital of MUDRA is 1000 crores and paid up capital is 750 crore, fully subscribed by SIDBI. More capital is expected to enhance the functioning of MUDRA.

Second statement is extrapolation – formal credit helps in formalisation

Non-corporate Small Business: Definition

It is the millions of proprietorship/partnership firms running as small manufacturing units, shopkeepers, fruits/vegetable sellers, truck operators, food-service units, repair shops, machine operators, small industries, artisans, food processors and others, in rural and urban areas.

Loosely referred to as the “unorganised” or “informal” sector, they are mostly self-organised.

Large portion of this sector runs as Own Account Enterprises (OAEs), with no employees ... essentially self-employment.

<https://www.mudra.org.in/AboutUs/Genesis>

29. With reference to ‘Stand up India scheme’, which of the following statement is/are correct ?

1. This scheme benefits only to women belonging to SC and ST communities
2. Loans under this scheme is available for both green field and brown field projects

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: d)

Objective

The objective of the Stand-Up India scheme is to facilitate bank loans between ₹ 10 lakh and ₹ 1 Crore to at least one Scheduled Caste (SC) or Scheduled Tribe (ST) borrower and at least one woman borrower per bank branch for setting up a greenfield enterprise. This enterprise may be in manufacturing, services or the trading sector. In case of non-individual enterprises at least 51% of the shareholding and controlling stake should be held by either an SC/ST or Woman entrepreneur.

Eligibility

1. SC/ST and/or woman entrepreneurs, above 18 years of age.
2. Loans under the scheme is available for only green field project. Green field signifies, in this context, the first time venture of the beneficiary in the manufacturing or services or trading sector.
3. In case of non-individual enterprises, 51% of the shareholding and controlling stake should be held by either SC/ST and/or Women Entrepreneur.
4. Borrower should not be in default to any bank/financial institution.

Nature of Loan

Composite loan (inclusive of term loan and working capital) between ₹ 10 lakh and upto ₹ 100 lakh.

Purpose of Loan

For setting up a new enterprise in manufacturing, trading or services sector by SC/ST/Women entrepreneur.

Size of Loan

Composite loan of 75% of the project cost inclusive of term loan and working capital. The stipulation of the loan being expected to cover 75% of the project cost would not apply if the borrower's contribution along with convergence support from any other schemes exceeds 25% of the project cost.

30. With reference to Paris Club, consider the following statements:

1. It's a group of countries that are at the forefront of providing credit to climate change solutions
2. It's an informal group of 22 permanent members of which India is not a member

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

In 2016 UPSC asked similar question on – International Monetary and Financial Committee (IMFC)

Paris Club:

The Paris Club is an informal group of official creditors, industrial countries in most cases, that seeks coordinated and sustainable solutions for debtor nations facing payment difficulties. Paris Club creditors provide debt treatments to debtor countries in the form of rescheduling or reduction in debt service during a defined period or as of a set date. Although the Paris Club has no legal basis, its members agree to a set of rules and principles designed to reach a coordinated agreement on debt rescheduling quickly and efficiently. This voluntary gathering dates back to 1956, when Argentina

agreed to meet its public creditors in Paris. Since then, the Paris Club and related ad hoc groups have reached 433 agreements covering 90 debtor countries. The Paris Club and the IMF have extensive contact because the Paris Club normally requires countries to have an active Fund-supported program to qualify for a rescheduling agreement.

For more such clubs: <http://www.imf.org/en/About/Factsheets/A-Guide-to-Committees-Groups-and-Clubs#CC>

<http://www.clubdeparis.org/en/communications/page/permanent-members>

2. Ecology & Environment

31. Consider the following statements regarding 'Earth Day'

1. It is an initiative of the World Wide Fund for Nature (WWF)
2. It is a movement in which the participants switch off the lights for one hour on a certain day every year.
3. It is a movement to raise the awareness about protection of the environment

Which of the above statements is/are correct ?

- (a) 1 and 3 Only
- (b) 1 and 2 Only
- (c) 3 Only
- (d) 1, 2 and 3

Solution: c)

Earth Day:

Earth Day is an annual event celebrated on **April 22**. Worldwide, various events are held to demonstrate support for environmental protection. First celebrated in **1970**, Earth Day events in more than 193 countries are now coordinated globally by the Earth Day Network.

On Earth Day 2016, the landmark Paris Agreement was signed by the United States, China, and some 120 other countries. This signing satisfied a key requirement for the entry into force of the historic draft climate protection treaty adopted by consensus of the 195 nations present at the 2015 United Nations Climate Change Conference in Paris.

Earth Hour:

Earth Hour is a worldwide movement organized by the World Wide Fund for Nature (WWF). The event is held annually encouraging individuals, communities, and businesses to turn off non-essential electric lights for one hour, from **8:30 to 9:30 pm** on a specific day towards the end of March, as a symbol of commitment to the planet. It was started as a lights-off event in Sydney, Australia, in 2007. Since then, it has grown to engage more than 7,000 cities and towns across 187 countries and territories.

Occasionally, in years when Holy Saturday falls on the last Saturday of March, Earth Hour is moving a week early rather than its traditional date.

Earth Hour 2018 will be on March 24, from 8:30 pm to 9:30 pm.

32. With reference to the World Wide Fund for Nature (WWF), consider the following statements:

1. It is an international non-governmental organization
2. The Living Planet Report which talks about the impact of human activity, is released by WWF

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: c)

The **World Wide Fund for Nature (WWF)** is an international **non-governmental** organization founded in 1961, working in the field of the wilderness preservation, and the reduction of human impact on the environment. It was formerly named the World Wildlife Fund, which remains its official name in Canada and the United States. The **Living Planet Report** is published **every two years** by WWF since 1998; it is based on a Living Planet Index and ecological footprint calculation.

33. With reference to the Global Footprint Network, consider the following statements:

1. It is a network of nations formed recently after the Paris Climate Agreement
2. Global Footprint Network's goal is to create a future where all humans can live well, within the means of one planet Earth

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

Global Footprint Network, founded in 2003, is an **independent think tank** originally based in the United States, Belgium and Switzerland. It was established as a charitable not-for-profit organization in each of those three countries. Global Footprint Network develops and promotes tools for advancing sustainability, including the ecological footprint and biocapacity, which measure the amount of resources we use and how much we have. These tools aim at bringing ecological limits to the center of decision-making.

Global Footprint Network's goal is to create a future where all humans can live well, within the means of one planet Earth. The organization is headquartered in Oakland, California. The Network brings

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together over 70 partner organizations, including WWF International, ICLEI, Bank Sarasin, The Pictet Group, the New Economics Foundation, Pronatura México, and the Environment Agency Abu Dhabi.

34. With reference to the Earth Overshoot Day (EOD), consider the following statements:

1. It is a day observed to create awareness about increasing numbers of invasive species and their adverse impact on ecology
2. Earth Overshoot Day is an initiative by WWF

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: d)

Earth Overshoot Day (EOD), previously known as **Ecological Debt Day (EDD)**, is the calculated illustrative calendar date on which humanity's resource consumption for the year exceeds Earth's capacity to regenerate those resources that year. Earth Overshoot Day is calculated by dividing the world biocapacity (the amount of natural resources generated by Earth that year), by the world ecological footprint (humanity's consumption of Earth's natural resources for that year), and multiplying by 365, the number of days in one Gregorian common calendar year:

When viewed through an economic perspective, EOD represents the day in which humanity enters an ecological deficit spending. In ecology the term Earth Overshoot Day illustrates the level by which human population overshoots its environment.

Earth Overshoot Day is calculated by Global Footprint Network and is a campaign supported by dozens of other nonprofit organizations. [not in citation given] Information about Global Footprint Network's calculations and national Ecological Footprints are available online

https://en.wikipedia.org/wiki/Earth_Overshoot_Day

35. The biocapacity or biological capacity of an ecosystem is a/an

- (a) Estimate of its production of certain biological materials such as natural resources, and its absorption and filtering of other materials such as carbon dioxide from the atmosphere
- (b) Ability of living beings to make optimum use of natural resources available in their surroundings
- (c) Ability to create in their natural environment space to accommodate diverse migrant species
- (d) None of the above

Solution: a)

The **biocapacity** or **biological** capacity of an ecosystem is an estimate of its production of certain biological materials such as natural resources, and its absorption and filtering of other materials such as carbon dioxide from the atmosphere. “Useful biological materials” are defined as those demanded by the human economy.

Biocapacity is expressed in terms of **global hectares per person**, thus is dependent on human population. A global hectare is an adjusted unit that represents the average biological productivity of all productive hectares on Earth in a given year (because not all hectares produce the same amount of ecosystem services). Biocapacity is calculated from United Nations population and land use data, and may be reported at various regional levels, such as a city, a country, or the world as a whole.

For example, there were 12 billion hectares of biologically productive land and water on this planet in 2008. Dividing by the number of people alive in that year, 6.7 billion, gives a biocapacity of 1.8 global hectares per person . This assumes that no land is set aside for other species that consume the same biological material as humans.

Biocapacity is used together with Ecological Footprint as a method of measuring Human impact on the environment. Biocapacity and Ecological Footprint are tools created by the Global Footprint Network, used in sustainability studies around the world.

36. Which of the following is/are **not** keystone species ?

1. Sea Otter
2. Starfish (*Pisaster ochraceus*)
3. Jaguar

Select the correct answer using codes below:

- (a) 1 Only
- (b) 2 only
- (c) 3 only
- (d) All are keystone species

Solution: d)

A **keystone species** is a species that has a disproportionately large effect on its environment relative to its abundance. Such species are described as playing a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community. A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether.

For examples: https://en.wikipedia.org/wiki/Keystone_species

INSIGHTS QUIZ ON STATIC SYLLABUS

37. Which of the following is/are characteristics of urban ecosystem ?

1. They are often warmer than other ecosystems that surround them
2. They have less infiltration of rainwater into the local soil
3. They show higher rates and amounts of surface runoff after rain and storms
4. These ecosystems tend to contain specialist species and animals that vary across a broader range of sizes

Which of the above statements is/are correct ?

- (a) 1 and 3 Only
- (b) 1, 2 and 3 Only
- (c) 1, 3 and 4 Only
- (d) 1, 2, 3 and 4

Solution: b)

Urban ecosystems are often warmer than other ecosystems that surround them, have less infiltration of rainwater into the local soil, and show higher rates and amounts of surface runoff after rain and storms. Heavy metals, calcium dust, particulates, and human-made organic compounds (e.g., fertilizers, pesticides, and contaminants from pharmaceutical and personal care products) are also concentrated in cities.

Urban animal communities tend to be dominated by medium-size generalists, such as raccoons, coyotes, opossums, skunks, foxes, and other animals capable of surviving across a wide range of environmental conditions. In contrast, nonurban ecosystems tend to contain specialist species and animals that vary across a broader range of sizes. Urban habitats tend to be dominated by introduced plant and animal species that have a long history of association with humans and that show adaptations to urban conditions.

38. With reference to trophic pyramids, consider the following statements:

1. The apex of the pyramid is composed of the primary producers of the ecosystem
2. Primary producers of the ecosystem obtain energy and nutrients by eating other organisms.
3. The higher the organism is on the trophic pyramid, the less energy is available to it

Which of the above statements is/are **incorrect** ?

- (a) 1 only
- (b) 1 and 2 Only
- (c) 3 Only
- (d) All

Solution: b)

All are INCORRECT (Question is asking which statements are incorrect)

All biological communities have a basic structure of interaction that forms a **trophic pyramid**. The trophic pyramid is made up of trophic levels, and **food energy** is passed from one level to the next along the food chain (see below Food chains and food webs). The base of the pyramid is composed of species called autotrophs, the primary producers of the ecosystem. They do not obtain energy and nutrients by eating other organisms. Instead, they harness solar energy by photosynthesis (photoautotrophs) or, more rarely, chemical energy by oxidation (chemoautotrophs) to make organic substances from inorganic ones. All other organisms in the ecosystem are consumers called heterotrophs, which either directly or indirectly depend on the producers for food energy.

Within all biological communities, **energy at each trophic level is lost** in the form of **heat** (as much as 80 to 90 percent), as organisms expend energy for metabolic processes such as staying warm and digesting food (see biosphere: The flow of energy). The higher the organism is on the trophic pyramid, the less energy is available to it; herbivores and detritivores (primary consumers) have less available energy than plants, and the carnivores that feed on herbivores and detritivores (secondary consumers) and those that eat other carnivores (tertiary consumers) have the least amount of available energy.

39. The cells of all organisms are made up primarily of six major elements that occur in similar proportions in all life-forms. Which of the following is/are **not** one of these elements ?
1. Sulfur
 2. Phosphorous
 3. Hydrogen

Select the correct answer using codes below:

- (a) 1 only
- (b) 2 only
- (c) 1 and 2 Only
- (d) All the above are one of the six elements

Solution: d)

The cells of all organisms are made up primarily of six major elements that occur in similar proportions in all life-forms. These elements—hydrogen, oxygen, carbon, nitrogen, phosphorus, and sulfur—form the core protoplasm of organisms, and the first four of these elements make up about 99 percent of the mass of most cells.

Comes under Nutrient Cycling, under ecology

INSIGHTS QUIZ ON STATIC SYLLABUS

40. The trophic structure of the ocean is built on the plankton known as
- (a) Krill
 - (b) Phytoplankton
 - (c) Zooplankton
 - (d) None of the above

Solution: a)

Krill are considered an important trophic level connection – near the bottom of the food chain – because they **feed on phytoplankton** and (to a lesser extent) **zooplankton**, converting these into a form suitable for many larger animals for which krill make up the largest part of their diets. In the Southern Ocean, one species, the **Antarctic krill**, *Euphausia superba*, makes up an estimated biomass of around 379,000,000 tonnes, making it among the species with the largest total biomass. Of this, over half is eaten by whales, seals, penguins, squid, and fish each year, and is replaced by growth and reproduction. Most krill species display large daily vertical migrations, thus providing food for predators near the surface at night and in deeper waters during the day.

41. With reference to permafrost, consider the following statements
1. Permafrost forms and exists in a climate where the mean annual air temperature is 0° C or colder
 2. Permafrost is widespread in the Arctic region, but absent in Antarctica
 3. It is estimated methane release from cooling permafrost may outpace carbon dioxide as a major contributor to global warming over the next century

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 1 and 2 Only
- (c) 2 and 3 Only
- (d) 1, 2 and 3

Solution: a)

Permafrost forms and exists in a climate where the mean annual air temperature is 0 °C or colder. Such a climate is generally characterized by long, cold winters with little snow and short, relatively dry, cool summers. Permafrost, therefore, is widespread in the Arctic, sub-Arctic, and Antarctica. It is estimated to underlie 20 percent of the world's land surface.

Permafrost soils store vast quantities of organic matter that are vulnerable to decomposition under a warming climate. Recent research finds that methane release from thawing permafrost may outpace carbon dioxide as a major contributor to global warming over the next century.

Statement 3 is wrong as it says 'COOLING' instead of THAWING.

42. With reference to ecological successions, consider the following statements:
1. Secondary ecological succession occurs in areas such as lava flows, newly formed sand dunes, or rocks left from a retreating glacier
 2. Primary ecological succession occurs in an area affected by forest fires

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: d)

Two different types of succession, primary and secondary, have been distinguished. Primary succession occurs in essentially lifeless areas—regions in which the soil is incapable of sustaining life as a result of such factors as lava flows, newly formed sand dunes, or rocks left from a retreating glacier. Secondary succession occurs in areas where a community that previously existed has been removed; it is typified by smaller-scale disturbances that do not eliminate all life and nutrients from the environment. Events such as a fire that sweeps across a grassland or a storm that uproots trees within a forest create patches of habitat that are colonized by early successional species. Depending on the extent of the disturbance, some species may survive, other species may be recolonized from nearby habitats, and others may actually be released from a dormant condition by the disturbance. For example, many plant species in fire-prone environments have seeds that remain dormant within the soil until the heat of a fire stimulates them to germinate.

43. With reference to Climate sensitivity, consider the following statements:
1. It is ability of living organisms to tolerate a certain threshold of increase in temperature due to climate change
 2. Climate sensitivity understanding helps nations to adopt suitable climate change mitigation policies

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: d)

Question is asked to introduce you to Climate sensitivity concept. Both statements are wrong.

Climate sensitivity can be defined as the amount of surface warming resulting from each additional watt per square metre of radiative forcing. Alternatively, it is sometimes defined as the warming that would result from a doubling of CO₂ concentrations and the associated addition of 4 watts per square metre of radiative forcing. In the absence of any additional feedbacks, climate sensitivity would be approximately 0.25 °C (0.45 °F) for each additional watt per square metre of radiative forcing. Stated alternatively, if the CO₂ concentration of the atmosphere present at the start of the industrial age (280 ppm) were doubled (to 560 ppm), the resulting additional 4 watts per square metre of radiative forcing would translate into a 1 °C (1.8 °F) increase in air temperature.

https://en.wikipedia.org/wiki/Climate_sensitivity

44. With reference to ocean currents and their impact on marine organisms, consider the following statements

1. Ocean currents do not affect species range of oceans
2. Ocean currents help coral reef get nutrients

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

Marine organisms of all sizes are influenced by ocean currents, which can determine the range of a species. For example, **krill** (*Euphausia superba*) are restricted to the Antarctic Circumpolar Current. Distribution patterns of both large and small pelagic organisms are affected as well. Mainstream currents such as the Gulf Stream and East Australian Current transport larvae great distances. As a result cold temperate coral reefs receive a tropical infusion when fish and invertebrate larvae from the tropics are relocated to high latitudes by these currents. The successful recruitment of eels to Europe depends on the strength of the Gulf Stream to transport them from spawning sites in the Caribbean. Areas where the ocean is affected by nearshore features, such as estuaries, or areas in which there is a vertical salinity gradient (halocline) often exhibit intense biological activity. In these environments, small organisms can become concentrated, providing a rich supply of food for other animals.

45. Which of the following species is/are extinct ?

1. West African Black Rhino
2. Northern White Rhino
3. Tasmanian Tiger
4. Javan Tiger

Select the correct answer using codes below:

- (a) 3 and 4 Only
- (b) 1, 3 and 4 Only
- (c) 1 and 4 Only
- (d) 1, 2, 3 and 4

Solution: b)

Recent Sudan, the last male northern white male died. However, his daughter and granddaughter still live (only two individuals of its species)

<https://www.nytimes.com/2018/03/20/science/rhino-sudan-extinct.html>

Whereas, other species are all extinct.

See slide show here: https://www.huffingtonpost.in/entry/11-extinct-animals_n_4078988#gallery/317674/9

46. Gases that contribute to the greenhouse effect does **not** include which of the following gases?

1. Nitrous dioxide
2. Sulfur hexafluoride
3. Carbon monoxide
4. Hydrogen chloride gas

Select the correct answer using codes below:

- (a) 1, 3 and 4 Only
- (b) 1, 2 and 4 Only
- (c) 3 and 4 Only
- (d) 1, 2 and 3 Only

Solution: a)

Greenhouse gases are those that absorb and emit infrared radiation in the wavelength range emitted by Earth. In order, the most abundant greenhouse gases in Earth's atmosphere are:

Water vapor (H₂O)

Carbon dioxide (CO₂)

Methane (CH₄)

Nitrous oxide (N₂O)

Ozone (O₃)

Chlorofluorocarbons (CFCs)

Hydrofluorocarbons (incl. HCFCs and HFCs)

Nitrogen dioxide is the chemical compound with the formula NO₂. It is one of several nitrogen oxides. NO₂ is an intermediate in the industrial synthesis of nitric acid, millions of tons of which are produced each year. At higher temperatures it is a reddish-brown gas that has a characteristic sharp, biting odor and is a prominent air pollutant. (not proven as GHG)

47. Why both oxygen and nitrogen gases are *not* greenhouse gases ?

- (a) They are located in the lower parts of the atmosphere
- (b) They are vital for the life on earth
- (c) Both gases can not be broken into single molecules
- (d) None of the above

Solution: d)

The major atmospheric constituents, nitrogen (N₂), oxygen (O₂), and argon (Ar), are not greenhouse gases because molecules containing two atoms of the same element such as N₂ and O₂ and monatomic molecules such as argon (Ar) have no net change in the distribution of their electrical charges when they vibrate. Hence they are almost totally unaffected by infrared radiation. Although molecules containing two atoms of different elements such as carbon monoxide (CO) or hydrogen chloride (HCl) absorb infrared radiation, these molecules are short-lived in the atmosphere owing to their reactivity and solubility. Therefore, they do not contribute significantly to the greenhouse effect and often are omitted when discussing greenhouse gases.

Although option (c) seems right, it doesn't fully explain the question. These confusing type of questions are asked by UPSC.

48. Solar irradiance is

- (a) A measure of the amount of energy the sun gives off
- (b) A measure of brightness sun gives off
- (c) A measure of nuclear radiation given out by the sun
- (d) None of the above

Solution: a)

The **solar irradiance** is the output of light energy from the entire disk of the Sun, measured at the Earth. It is looking at the Sun as we would a star rather than as a image.

The **solar spectral irradiance** is a measure of the brightness of the entire Sun at a wavelength of light. Important spectral irradiance variations are seen in many wavelengths, from the visible and IR, through the UV, to EUV and X-ray. As we look at the solar irradiance we should remember that space weather is related to ionization, while climate is related to absorption of heat.

https://www.nasa.gov/mission_pages/sdo/science/solar-irradiance.html

49. Which of the following animal species live in desert ecosystems ?

1. Kangaroo
2. Kangaroo mouse
3. Jerboa

Select the correct answer using codes below:

- (a) 1 only
- (b) 1 and 2 Only
- (c) 2 and 3 Only
- (d) 1, 2 and 3

Solution: c)

UPSC asks similar questions (about unheard species sometimes)

The jerboa forms the bulk of the membership of the family Dipodidae. Jerboas are hopping desert rodents found throughout Northern Africa and Asia east to northern China and Manchuria. They tend to live in hot deserts (<https://en.wikipedia.org/wiki/Jerboa>)

A **kangaroo mouse** is either one of the two species of jumping mouse (genus Microdipodops) native to the deserts of the southwestern United States, predominantly found in the state of Nevada. The name "kangaroo mouse" refers to the species' extraordinary jumping ability, as well as its habit of bipedal locomotion. (<https://climate.nasa.gov/news/2486/10-interesting-things-about-ecosystems/>)

Kangaroos live in Eastern Australia, not in deserts. They live in varied habitats, from forests and woodland areas to grassy plains and savannas.

INSIGHTS QUIZ ON STATIC SYLLABUS

50. In which of the following regions you will **not** find Alpine Tundra biomes?

- (a) Himalayas
- (b) American Cordillera
- (c) Antarctica
- (d) Rift Mountains of Africa

Solution: c)

Alpine tundra occurs at high enough altitude at any latitude. Portions of montane grasslands and shrublands ecoregions worldwide include alpine tundra. Large regions of alpine tundra occur in the Himalayas in Asia, American Cordillera in North and South America, the Alps, the Scandinavian mountains, Pyrenees and Carpathian Mountains of Europe, the Caucasus Mountains, the Rift Mountains of Africa, and a large portion of the Tibetan Plateau.

3. General Science

51. Why do clouds float when they have tons of water in them?

Consider the following arguments:

1. Ice particles in clouds have smaller fall velocity due to their irregular shapes
2. Updrafts in the atmosphere contribute to floating of clouds
3. Clouds consists of small water droplets and crystals on which effect of gravity is negligible

Which of the above statements is/are correct ?

- (a) 1 and 2 Only
- (b) 1 Only
- (c) 2 and 3 Only
- (d) 1, 2 and 3 Only

Solution: d)

Clouds are composed primarily of small water droplets and, if it's cold enough, ice crystals. The vast majority of clouds you see contain droplets and/or crystals that are too small to have any appreciable fall velocity. So the particles continue to float with the surrounding air. For an analogy closer to the ground, think of tiny dust particles that, when viewed against a shaft of sunlight, appear to float in the air.

Indeed, the distance from the center of a typical water droplet to its edge—its radius—ranges from a few microns (thousandths of a millimeter) to a few tens of microns (ice crystals are often a bit larger). And the speed with which any object falls is related to its mass and surface area—which is why a feather falls more slowly than a pebble of the same weight. For particles that are roughly spherical, mass is proportional to the radius cubed (r^3); the downward-facing surface area of such a particle is proportional to the radius squared (r^2). Thus, as a tiny water droplet grows, its mass becomes more important than its shape and the droplet falls faster. Even a large droplet having a radius of 100 microns has a fall velocity of only about 27 centimeters per second (cm/s). And because ice crystals have more irregular shapes, their fall velocities are relatively smaller.

Upward vertical motions, or updrafts, in the atmosphere also contribute to the floating appearance of clouds by offsetting the small fall velocities of their constituent particles. Clouds generally form, survive and grow in air that is moving upward. Rising air expands as the pressure on it decreases, and that expansion into thinner, high-altitude air causes cooling. Enough cooling eventually makes water vapor condense, which contributes to the survival and growth of the clouds. Stratiform clouds (those producing steady rain) typically form in an environment with widespread but weak upward motion (say, a few cm/s); convective clouds (those causing showers and thunderstorms) are associated with

INSIGHTS QUIZ ON STATIC SYLLABUS

updrafts that exceed a few meters per second. In both cases, though, the atmospheric ascent is sufficient to negate the small fall velocities of cloud particles.

Another way to illustrate the relative lightness of clouds is to compare the total mass of a cloud to the mass of the air in which it resides. Consider a hypothetical but typical small cloud at an altitude of 10,000 feet, comprising one cubic kilometer and having a liquid water content of 1.0 gram per cubic meter. The total mass of the cloud particles is about 1 million kilograms, which is roughly equivalent to the weight of 500 automobiles. But the total mass of the air in that same cubic kilometer is about 1 billion kilograms—1,000 times heavier than the liquid!

So, even though typical clouds do contain a lot of water, this water is spread out for miles in the form of tiny water droplets or crystals, which are so small that the effect of gravity on them is negligible. Thus, from our vantage on the ground, clouds seem to float in the sky.

<https://www.scientificamerican.com/article/why-do-clouds-float-when/>

52. With reference to enzymes, consider the following statements:

1. Enzymes accelerate chemical reactions by increasing the reaction rate by lowering its activation energy
2. Unlike other chemical catalysts, enzymes in biological reactions are consumed in the end
3. All enzymes are proteins

Which of the above statements is/are correct ?

- (a) 1 and 3 Only
- (b) 1 Only
- (c) 2 and 3 Only
- (d) 1 and 2 Only

Solution: b)

Enzymes are macromolecular biological catalysts. Enzymes accelerate chemical reactions. The molecules upon which enzymes may act are called substrates and the enzyme converts the substrates into different molecules known as products. Almost all metabolic processes in the cell need enzyme catalysis in order to occur at rates fast enough to sustain life. Metabolic pathways depend upon enzymes to catalyze individual steps. The study of enzymes is called enzymology and a new field of pseudoenzyme analysis has recently grown up, recognising that during evolution, some enzymes have lost the ability to carry out biological catalysis, which is often reflected in their amino acid sequences and unusual 'pseudocatalytic' properties.

Enzymes are known to catalyze more than 5,000 biochemical reaction types. Most enzymes are proteins, although a few are catalytic RNA molecules. The latter are called ribozymes. Enzymes' specificity comes from their unique three-dimensional structures. Like all catalysts, enzymes increase the reaction rate by lowering its activation energy. Some enzymes can make their conversion of

substrate to product occur many millions of times faster. An extreme example is orotidine 5'-phosphate decarboxylase, which allows a reaction that would otherwise take millions of years to occur in milliseconds.

Chemically, enzymes are like any catalyst and are not consumed in chemical reactions, nor do they alter the equilibrium of a reaction. Enzymes differ from most other catalysts by being much more specific. Enzyme activity can be affected by other molecules: inhibitors are molecules that decrease enzyme activity, and activators are molecules that increase activity. Many therapeutic drugs and poisons are enzyme inhibitors.

An enzyme's activity decreases markedly outside its optimal temperature and pH. Some enzymes are used commercially, for example, in the synthesis of antibiotics. Some household products use enzymes to speed up chemical reactions: enzymes in biological washing powders break down protein, starch or fat stains on clothes, and enzymes in meat tenderizer break down proteins into smaller molecules, making the meat easier to chew.

There are some enzymes which are made up of RNA (ribozymes)

53. With reference to antibiotics, consider the following statements:

1. Antibiotics are highly effective against viruses such as the common cold or influenza
2. Antibiotics are ineffective against superbugs
3. Antibacterials are used in soaps and disinfectants

Which of the above statements is/are correct ?

- (a) 1 and 2 Only
- (b) 2 Only
- (c) 1 and 3 Only
- (d) 2 and 3 Only

Solution: d)

Antibiotics also called **antibacterials**, are a type of antimicrobial drug used in the treatment and prevention of bacterial infections. They may either kill or inhibit the growth of bacteria. A limited number of antibiotics also possess antiprotozoal activity. Antibiotics are not effective against viruses such as the common cold or influenza; drugs which inhibit viruses are termed antiviral drugs or antivirals rather than antibiotics. Sometimes the term antibiotic (which means "opposing life") is used to refer to any substance used against microbes, synonymous with antimicrobial.

Some sources distinguish between antibacterial and antibiotic; antibacterials are used in soaps and disinfectants, while antibiotics are used as medicine. Antibiotics revolutionized medicine in the 20th century. However, their effectiveness and easy access have also led to their overuse, prompting bacteria to develop resistance.

This has led to widespread problems, so much as to prompt the World Health Organization to classify antimicrobial resistance as a "serious threat [that] is no longer a prediction for the future, it is

INSIGHTS QUIZ ON STATIC SYLLABUS

happening right now in every region of the world and has the potential to affect anyone, of any age, in any country”

<http://www.who.int/mediacentre/factsheets/fs194/en/>

54. Consider the following animals:

1. Sea cow
2. Seahorse
3. Sea lion
4. Dolphin
5. Sea otter

Which of the above is/are living mammal/mammals ?

- (a) 1,2, 4 and 5 Only
- (b) 1,3,4 and 5 Only
- (c) 3, 4 and 5 Only
- (d) 3 and 4 Only

Solution: c)

There are five groups of marine mammals: pinnipeds (seals, sea lions, fur seals, and walruses), cetaceans (whales, dolphins, and porpoises), sea otters, sirenians (dugongs and manatees), and polar bears.

Steller’s sea cow (*Hydrodamalis gigas*) is an extinct sirenian discovered by Europeans in 1741. At that time, it was found only around the Commander Islands in the Bering Sea between Alaska and Russia; its range was more extensive during the Pleistocene epoch, and it is possible that the animal and humans previously interacted.

As question asks only “living mammals’ – sea cow is wrong as it’s extinct.

<http://www.bbc.com/earth/story/20150613-the-giant-cow-that-swam-the-ocean>

55. Formation of rainbow involves

1. Refraction
2. Interference
3. Reflection
4. Dispersion
5. Diffraction

Select the correct answer using codes below:

- (a) 1, 3 and 4 Only
- (b) 1,2,3 and 4 Only
- (c) 3, 4 and 5 Only
- (d) 1,2,3,4 and 5

Solution: d)

Similar question was asked by UPSC in 2012

Fogbows, similar to rainbows form in the same way as rainbows, but they are formed by much smaller cloud and fog droplets that diffract light extensively.

Supernumerary rainbows cannot be explained using classical geometric optics. The alternating faint bands are caused by interference between rays of light following slightly different paths with slightly varying lengths within the raindrops. Some rays are in phase, reinforcing each other through constructive interference, creating a bright band; others are out of phase by up to half a wavelength, cancelling each other out through destructive interference, and creating a gap. Given the different angles of refraction for rays of different colours, the patterns of interference are slightly different for rays of different colours, so each bright band is differentiated in colour, creating a miniature rainbow. Supernumerary rainbows are clearest when raindrops are small and of uniform size

A rainbow is a meteorological phenomenon that is caused by reflection, refraction and dispersion of light in water droplets resulting in a spectrum of light appearing in the sky.

<https://en.wikipedia.org/wiki/Rainbow#Explanation>

You may debate Interference and diffraction, but as rainbows include variety of types, it's safe to assume even interference and diffraction play certain role in formation of rainbows.

56. With reference to diffused light, consider the following statements

1. Light is diffused due to its dual nature of wave and particle
2. Light diffuses when it gets scattered
3. In atmosphere light gets diffused by gas molecules

Which of the above statements is/are correct ?

- (a) 1 and 2 Only
- (b) 1 Only
- (c) 2 and 3 Only
- (d) 1, 2 and 3

Solution: d)

INSIGHTS QUIZ ON STATIC SYLLABUS

It is a modified previous year UPSC question.

First statement is right as it is its particle nature of light that scatters it.

(<https://sciencing.com/diffused-light-5470956.html>)

Second statement is correct. Light is diffused after being scattered by particles in atmosphere (or in any medium)

Rayleigh scattering of sunlight in the atmosphere causes diffuse sky radiation, which is the reason for the blue color of the sky and the yellow tone of the sun itself. This involves gas molecules.

57. With reference to sodium sulfate, consider the following statements:

1. It is used as surfactants in a range of cleaning products from detergents to toothpastes
2. It is used in washing powders to keep them dry

Which of the above statements is/are correct ?

- (a) 1 only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: d)

It is a modified previous year UPSC question.

Most of us will have used a product containing sodium sulfate, though oddly it is present in a role that has no practical function. Powdered detergents for washing clothes usually contain sodium sulfate simply to bulk up the product, making detergent manufacturers the biggest users of the compound. It does nothing for the wash, but as a very cheap, pH neutral substance that readily dissolves in warm water, it simply passes through the system, making the product less costly to produce per unit weight. There isn't as much of it around as there used to be, though, as powder has declined in popularity and there is no need for filler in liquids and gels. Our compound is sometimes confused with sodium lauryl sulfate (also known as sodium dodecyl sulfate) and sodium laureth sulfate which are surfactants used in a range of cleaning products from detergents to toothpastes, but both these compounds are quite complex organic structures which aren't produced from basic sodium sulfate.

Our sulfate also turns up as a fining agent – not in the more familiar environment of wine or beer fining, but in making glass. In the alcoholic drinks, the fining agent's role is to extract organic substances that make the liquid cloudy, where in glass it picks up scum and prevents small bubbles from forming. But perhaps the most interesting application of sodium sulfate is in the rapidly advancing world of solar energy heat storage.

As solar thermal power plants, which concentrate incoming light with mirrors to store energy in the form of heat, become more common, there is a need to hold onto that heat before using it. Sodium

sulfate takes a high amount of energy to change from solid to liquid and goes through a second phase change at around 32 degrees Celsius when it changes to the anhydrous form, which means that it can store considerably more heat energy than would be expected for any particular mass. Although it isn't appropriate for the high temperature systems that store heat directly from solar collectors, it has the potential to be valuable in secondary solar facilities, for instance where the heated material gradually releases the heat to warm a building.

Second statement is wrong as it's Sodium silicate that is used to keep washing powder dry. (<https://www.marketizer.com/articles/uses-and-applications-of-liquid-and-solid-sodium-silicate-2735414.htm>)

58. Longitudinal waves are waves in which the displacement of the medium is in the same direction as, or the opposite direction to, the direction of propagation of the wave. Which of the following is/are examples of longitudinal waves ?

1. Sound waves
2. A ripple in a pond
3. Pressure waves
4. Light

Select the correct answer using codes below:

- (a) 1 and 4 Only
- (b) 1 and 2 Only
- (c) 2 and 3 Only
- (d) 1 and 3 Only

Solution: d)

A **transverse wave** is a moving wave that consists of oscillations occurring perpendicular (right angled) to the direction of energy transfer (or the propagation of the wave).

If a transverse wave is moving in the positive x-direction, its oscillations are in up and down directions that lie in the y-z plane.

Light is an example of a transverse wave, while sound is a longitudinal wave. A ripple in a pond and a wave on a string are easily visualized as transverse waves.

Longitudinal waves are waves in which the displacement of the medium is in the same direction as, or the opposite direction to, the direction of propagation of the wave. Mechanical longitudinal waves are also called compressional or compression waves, because they produce compression and rarefaction when traveling through a medium, and pressure waves, because they produce increases and decreases in pressure.

INSIGHTS QUIZ ON STATIC SYLLABUS

59. With reference to photochemical smog, consider the following statements

1. A chemical reaction between ultraviolet radiation and sulphur oxides causes photochemical smog
2. It usually occurs in the night
3. Ozone is produced during the formation of photochemical smog

Which of the above statements is/are correct ?

- (a) 1 and 3 Only
- (b) 3 Only
- (c) 1 and 2 Only
- (d) 1, 2 and 3 Only

Solution: b)

It is also based on previous UPSC question.

Option A is wrong as it is oxides of nitrogen

Option B is wrong, as photochemical smog requires sunlight and occurs in the morning or in afternoon

Option C is right (see explanation below – second paragraph)

Photochemical smog forms from a complex process, however the source of it is quite apparent. The largest contributor is automobiles, while coal-fired power plants and some other power plants also produce the necessary pollutants to facilitate its production. Due to its abundance in areas of warmer temperatures, photochemical smog is most common in the summer.

It forms in the morning when a tremendous number of people are driving their vehicles to work. Nitrogen oxides produced in the car engine are introduced into the atmosphere, which may combine with water to form nitric acid or react with sunlight to produce singular oxygen atoms, which then combine with molecular oxygen to produce ozone. The nitric acid may precipitate to the Earth resulting in acid rain, or remain in the smog. Due to the direct production of it by vehicles, the smog forms over cities where many people may encounter its adverse health effects.

Hotter days mean more photochemical smog, especially in the densely populated cities such as those mentioned above. As more and more urban populations arise around the globe, this problem is only expected to increase

http://energyeducation.ca/encyclopedia/Photochemical_smog

60. With reference to the speed of sound, consider the following statements:

1. It depends on the type and temperature of the medium
2. The speed of sound depends on the state of the gas
3. The Space Shuttle re-enters the atmosphere at approximate Mach number of 25

Which of the above statements is/are correct ?

- (a) 1 and 2 Only
- (b) 1 Only
- (c) 2 and 3 Only
- (d) 1, 2 and 3

Solution: d)

Based on previous year UPSC question on sound waves

Air is a gas, and a very important property of any gas is the speed of sound through the gas. Why are we interested in the speed of sound? The speed of “sound” is actually the speed of transmission of a small disturbance through a medium. Sound itself is a sensation created in the human brain in response to sensory inputs from the inner ear. (We won’t comment on the old “tree falling in a forest” discussion!)

Disturbances are transmitted through a gas as a result of collisions between the randomly moving molecules in the gas. The transmission of a small disturbance through a gas is an isentropic process. The conditions in the gas are the same before and after the disturbance passes through. Because the speed of transmission depends on molecular collisions, the speed of sound depends on the state of the gas. The speed of sound is a constant within a given gas and the value of the constant depends on the type of gas (air, pure oxygen, carbon dioxide, etc.) and the temperature of the gas.

The speed of sound in the atmosphere is a constant that depends on the altitude, but an aircraft can move through the air at any desired speed. The ratio of the aircraft’s speed to the speed of sound affects the forces on the aircraft. Aeronautical engineers call the ratio of the aircraft’s speed to the speed of sound the Mach number, M . If the aircraft moves much slower than the speed of sound, conditions are said to be subsonic, $0 < M \ll 1$, and compressibility effects are small and can be neglected. If the aircraft moves near the speed of sound, conditions are said to be transonic, $M \sim 1$, and compressibility effects like flow choking become very important. For aircraft speeds greater than the speed of sound, conditions are said to be supersonic, $1 < M < 3$, and compressibility effects are important. Depending on the specific shape and speed of the aircraft, shock waves may be produced in the supersonic flow of a gas. For high supersonic speeds, $3 < M < 5$, aerodynamic heating becomes very important. If the aircraft moves more than five times the speed of sound, conditions are said to be hypersonic, $M > 5$, and the high energy involved under these conditions has significant effects on the air itself. The Space Shuttle re-enters the atmosphere at high hypersonic speeds, $M \sim 25$. Under these conditions, the heated air becomes an ionized plasma of gas and the spacecraft must be insulated from the high temperatures.

<https://www.grc.nasa.gov/www/k-12/airplane/sound.html>

INSIGHTS QUIZ ON STATIC SYLLABUS

61. With reference to small intestine, consider the following statements:

1. The primary function of the small intestine is the digestion of fats and proteins
2. Chemical digestion takes place in small intestine
3. The villi, and the microvilli of small intestine limit the loss of nutrients to intestinal fauna

Which of the above statements is/are correct ?

- (a) 2 and 3 Only
- (b) 1 and 3 Only
- (c) 3 Only
- (d) 1 and 2 Only

Solution: a)

The **primary function** of the small intestine is the absorption of nutrients and minerals from food, using small finger-like protrusions called villi. (Hence statement 1 is wrong)

In the small intestine, structurally, the mucosa is covered in wrinkles or folds called plicae circulares, which are considered permanent features in the wall of the organ. They are distinct from rugae which are considered non-permanent or temporary allowing for distention and contraction. From the plicae circulares project microscopic finger-like pieces of tissue called villi (Latin for “shaggy hair”). The individual epithelial cells also have finger-like projections known as microvilli. The functions of the plicae circulares, the villi, and the microvilli are to increase the amount of surface area available for the absorption of nutrients, and to limit the loss of said nutrients to intestinal fauna.

62. Which of the following is **not** a function of spleen

- (a) Recycling of red blood cells
- (b) Storage of lymphocytes
- (c) Active immune response
- (d) Protein metabolism

Solution: d)

First 3 are the functions of spleen (check here: <https://en.wikipedia.org/wiki/Spleen#Function>)

Last one is the function of liver.

Previously UPSC has asked question on functions of pancreas.

63. Novichok, which was recently in news, is a/an
- (a) Insecticide
 - (b) Nerve agent
 - (c) Choking agent
 - (d) None of the above

Solution: b)

Novichok is a series of nerve agents the Soviet Union and Russia developed between 1971 and 1993. Russian scientists who developed the agents claim they are the deadliest nerve agents ever made, with some variants possibly five to eight times more potent than VX, and others up to ten times more potent than soman.

Novichok agents have never been used on the battlefield. Theresa May, Prime Minister of the United Kingdom, said that one such agent was used in the poisoning of Sergei and Yulia Skripal in England in March 2018. Russia officially denies producing or researching Novichok agents.

A pulmonary agent, or choking agent, is a chemical weapon agent designed to impede a victim's ability to breathe. They operate by causing a build-up of fluids in the lungs, which then leads to suffocation. Exposure to the eyes and skin tends to be corrosive, causing blurred vision and severe deep burns. Inhalation of these agents cause burning of the throat, coughing, vomiting, headache, pain in chest, tightness in chest, and respiratory and circulatory failure. Example – chlorine gas.

Nerve agents, sometimes also called nerve gases, are a class of organic chemicals that disrupt the mechanisms by which nerves transfer messages to organs. The disruption is caused by the blocking of acetylcholinesterase, an enzyme that catalyzes the breakdown of acetylcholine, a neurotransmitter.

64. Which of the following is/are freshwater mammals ?
- 1. Giant otter
 - 2. Hippopotamus
 - 3. Platypus
 - 4. Polar Bear
 - 5. Muskrat
 - 6. Capybara

Select the correct answer using codes below:

- (a) 2, 3 and 6 Only
- (b) 2, 3, 4 and 6 Only
- (c) 1, 2, 3, 4 and 6 Only
- (d) 1, 2, 3, 5 and 6 Only

Solution: d)

Polar bear is considered as ocean mammal.

(<http://www.marinemammalcenter.org/education/marine-mammal-information/>)

Check here photos of freshwater mammals:

<https://www.nationalgeographic.com/environment/photos/freshwater-mammals/>

65. Serum albumin is the most abundant blood plasma protein and forms a large proportion of all plasma protein. It is produced in the
- (a) Pancreas
 - (b) Spleen
 - (c) Liver
 - (d) Bone marrow

Solution: c)

Serum albumin is the most abundant blood plasma protein and is produced in the liver and forms a large proportion of all plasma protein. The human version is human serum albumin, and it normally constitutes about 50% of human plasma protein. Serum albumins are important in regulating blood volume by maintaining the oncotic pressure (also known as colloid osmotic pressure) of the blood compartment.

They also serve as carriers for molecules of low water solubility this way isolating their hydrophobic nature, including lipid-soluble hormones, bile salts, unconjugated bilirubin, free fatty acids (apoprotein), calcium, ions (transferrin), and some drugs like warfarin, phenobutazone, clofibrate & phenytoin. For this reason, it is sometimes referred as a molecular “taxi”. Competition between drugs for albumin binding sites may cause drug interaction by increasing the free fraction of one of the drugs, thereby affecting potency.

66. With reference to vulcanisation, consider the following statements:
1. This process makes natural rubber or related polymers more durable materials
 2. Vulcanised rubber acts a better electrical conductor due to cross linkages created by the process
 3. Sulfur is used to heat natural rubber in vulcanisation

Which of the above statements is/are correct ?

- (a) 1 and 2 Only
- (b) 2 and 3 Only
- (c) 1 and 3 Only
- (d) 1, 2 and 3

Solution: c)

Vulcanization or vulcanisation is a chemical process for converting natural rubber or related polymers into more durable materials by heating them with sulfur or other equivalent curatives or accelerators. These additives modify the polymer by forming cross-links (bridges) between individual polymer chains.

Advantages of Vulcanized rubber:

- It has good tensile strength and extensibility.
- Excellent resilience i.e.it returns to the original shape, when the deforming load is removed.
- Low water absorption tendency.
- Higher resistance to oxidation, wear and tear abrasion.
- Better electrical insulator.
- It is resistant to organic solvents (petro, benzene), fats and oils.
- It has higher useful temperature range unlike uncured rubber which becomes soft at high temperature ($>335\text{K}$) and brittle at low temperatures ($<283\text{K}$)

67. With reference to breeder reactors, consider the following statements:

1. It consumes more fissile material than it generates
2. These have better fuel economy compared to light water reactors

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

A **breeder reactor** is a nuclear reactor that generates more fissile material than it consumes. These devices achieve this because their neutron economy is high enough to breed more fissile fuel than they use from fertile material, such as uranium-238 or thorium-232. Breeders were at first found attractive because their fuel economy was better than light water reactors, but interest declined after the 1960s as more uranium reserves were found, and new methods of uranium enrichment reduced fuel costs.

INSIGHTS QUIZ ON STATIC SYLLABUS

68. Why does information travel 'faster' down fibre optic cable than copper wire ?
- (a) Fiber optic cable is thinner than copper wire
 - (b) Fiber optic cable experiences no electromagnetic interference
 - (c) Fiber optic cable is made up of silica
 - (d) In the fiber optic cable pulses of light is used

Solution: b)

Though all statements are correct, Option – B explains better why optic fiber is better than copper.

So what gives it the technical edge over copper wires?

Traditional copper wires transmit electrical currents, while fibre optic technology sends pulses of light generated by a light emitting diode or laser along optical fibres.

“In both cases you’re detecting changes in energy, and that’s how you encode data.

“With copper wires you’re looking at changes in the electromagnetic field, the intensity of that field and perhaps the phase of the wave being sent down a wire.

“With fibre optics, a transmitter converts electronic information into pulses of light — a pulse equates to a one, while no pulse is zero. When the signal reaches the other end, an optical receiver converts the light signal back into electronic information,” explains Malaney.

The throughput of the data is determined by the frequency range that a cable will carry — the higher the frequency range, the greater the bandwidth and the more data that can be put through per unit time.

And this is the key difference — fibre optic cables have much higher bandwidths than copper cables.

“Optical fibre can carry much higher frequency ranges — note that light is a very high frequency signal — while copper wire attenuates or loses signal strength at higher frequencies,” says Malaney.

Also, fibre optic technology is far less susceptible to noise and electromagnetic interference than electricity along a copper wire.

“You can send the signal for over 200 kilometres without any real loss of quality while a copper cable signal suffers a lot of degradation over that distance,” says Malaney.

69. Unenriched natural uranium is appropriate fuel for
- (a) Light water reactors
 - (b) Nuclear weapons
 - (c) Heavy-water reactor
 - (d) None of the above

Solution: c)

Natural uranium can be used to fuel both low- and high-power nuclear reactors. Historically, graphite-moderated reactors and heavy water-moderated reactors have been fueled with natural uranium in the pure metal (U) or uranium dioxide (UO_2) ceramic forms. However, experimental fuelings with uranium trioxide (UO_3) and triuranium octaoxide, (U_3O_8) have shown promise. The 0.72% uranium-235 is not sufficient to produce a self-sustaining critical chain reaction in light water reactors or nuclear weapons; these applications must use enriched uranium.

Nuclear weapons take a concentration of 90% uranium-235, and light water reactors require a concentration of roughly 3% uranium-235. Unenriched natural uranium is appropriate fuel for a heavy-water reactor, like a CANDU reactor.

https://en.wikipedia.org/wiki/Natural_uranium

70. The bulk (96%) of the byproduct from enrichment is depleted uranium (DU). It is stored in the form of
- Uranyl nitrate
 - Uranium hexafluoride (UF_6)
 - Yellowcake (U_3O_8)
 - None of the above

Solution: b)

The bulk (96%) of the byproduct from enrichment is depleted uranium (DU), which can be used for armor, kinetic energy penetrators, radiation shielding and ballast. As of 2008 there are vast quantities of depleted uranium in storage. The United States Department of Energy alone has 470,000 tonnes. About 95% of depleted uranium is stored as uranium hexafluoride (UF_6).

(nuclear related questions are favourite with UPSC, hence these questions)

71. Consider the following statements:
- Only sulfur is used in vulcanisation of rubber
 - During vulcanisation, anti-oxidants are also commonly included to retard deterioration caused by oxygen and ozone

Which of the above statements is/are correct ?

- 1 Only
- 2 Only
- Both 1 and 2
- Neither 1 nor 2

Solution: b)

Apart from sulfur, Phenolic resin is also used.

Vulcanization, chemical process by which the physical properties of natural or synthetic rubber are improved; finished rubber has higher tensile strength and resistance to swelling and abrasion, and is elastic over a greater range of temperatures. In its simplest form, vulcanization is brought about by heating rubber with sulfur.

The reactions between rubber and sulfur are not fully understood, but in the product, the sulfur is not simply dissolved or dispersed in the rubber; it is chemically combined, mostly in the form of cross-links, or bridges, between the long-chain molecules.

In modern practice, temperatures of about 140°–180° C are employed, and in addition to sulfur and accelerators, carbon black or zinc oxide is usually added, not merely as an extender, but to improve further the qualities of the rubber. Anti-oxidants are also commonly included to retard deterioration caused by oxygen and ozone. Certain synthetic rubbers are not vulcanized by sulfur but give satisfactory products upon similar treatment with metal oxides or organic peroxides.

72. Oil paint is a type of slow-drying paint that consists of particles of pigment suspended in a drying oil. The commonly used oil in these oil paintings is
- (a) Kerosene
 - (b) Linseed oil
 - (c) Sunflower oil
 - (d) Mustard oil

Solution: b)

Linseed Oil – made from flax, linseed is the most popular due to its flexibility and resistance to cracking. It does have a strong tendency to yellow with age, however.

Walnut Oil, Poppy Oil and Safflower Oil – much less likely to yellow, these thin, clear watery oils are much more prone to cracking.

<https://blogs.scientificamerican.com/symbiartic/httpblogsscientificamericancomsymbiartic20110802the-chemistry-of-oil-painting/>

Oil paint is a type of slow-drying paint that consists of particles of pigment suspended in a drying oil, commonly linseed oil. The viscosity of the paint may be modified by the addition of a solvent such as turpentine or white spirit, and varnish may be added to increase the glossiness of the dried oil paint film.

73. After hatching on beaches around the world, loggerhead sea turtles undertake multiyear, epic migrations at sea. Then, the turtles return to the exact spot where they were born to mate and lay their own eggs. Which of the following options explains how these turtles find exact spot of their birth ?
- They are guided by ocean currents
 - They remember smell of beach and its ecology
 - They rely on Earth's magnetic field to find their way home
 - They follow the stars

Solution: c)

It's explained in the following article:

<https://news.nationalgeographic.com/news/2015/01/150115-loggerheads-sea-turtles-navigation-magnetic-field-science/>

74. With reference to lekking, a sort of animal behaviour, consider the following statements:

- It is observed only in mammals such as blackbucks
- Lekking erodes genetic diversity

Which of the above statements is/are correct ?

- 1 Only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

Solution: d)

(Questions like this are asked keeping in mind Prelims is both for civils and forest service – which UPSC remembers well while framing paper)

A **lek**, from the Swedish word for “play”, is an aggregation of male animals gathered to engage in competitive displays, lekking, to entice visiting females which are surveying prospective partners for copulation. Leks are commonly formed before or during the breeding season. A lekking species is characterised by male displays, strong female mate choice, and the conferring of male indirect benefits. Although most prevalent among birds such as black grouse, lekking is also found in insects including paper wasps, crustaceans, fishes, amphibians, reptiles and mammals. (hence, statement 1 is wrong)

Second statement:

Lekking creates a paradox: strong sexual selection by females for specific male traits ought to erode genetic diversity by Fisherian runaway, but diversity is maintained and runaway does not occur. Many attempts have been made to explain it away, but the paradox remains

Fisherian runaway: (someone please explain in comment section!)

https://en.wikipedia.org/wiki/Fisherian_runaway

75. With reference to Genetic diversity, consider the following statements:

1. It is either the presence of, or the generation of, genetic differences in a species
2. Genetic diversity helps in species diversity

Which of the above statements is/are correct ?

- (a) 1 Only
- (b) 2 Only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Solution: b)

First statement refers to Genetic Variability (https://en.wikipedia.org/wiki/Genetic_variability)

Second statement is correct:

A 2007 study conducted by the National Science Foundation found that genetic diversity and biodiversity (in terms of species diversity) are dependent upon each other—that diversity within a species is necessary to maintain diversity among species, and vice versa. According to the lead researcher in the study, Dr. Richard Lankau, “If any one type is removed from the system, the cycle can break down, and the community becomes dominated by a single species.”

Genotypic and **phenotypic diversity** have been found in all species at the protein, DNA, and organismal levels; in nature, this diversity is nonrandom, heavily structured, and correlated with environmental variation and stress.

The interdependence between genetic and species diversity is delicate. Changes in species diversity lead to changes in the environment, leading to adaptation of the remaining species. Changes in genetic diversity, such as in loss of species, leads to a loss of biological diversity. Loss of genetic diversity in domestic animal populations has also been studied and attributed to the extension of markets and economic globalization.

