

GS FOUNDATION PROGRAM 2024*to be filled by the student:***BATCH: D5**

NAME: _____

ForumIAS Roll No: 19100 _____

Date: __/__/_____

Email Id: _____

Mobile No. _____

*For Office Use Only***Feedbacks:**

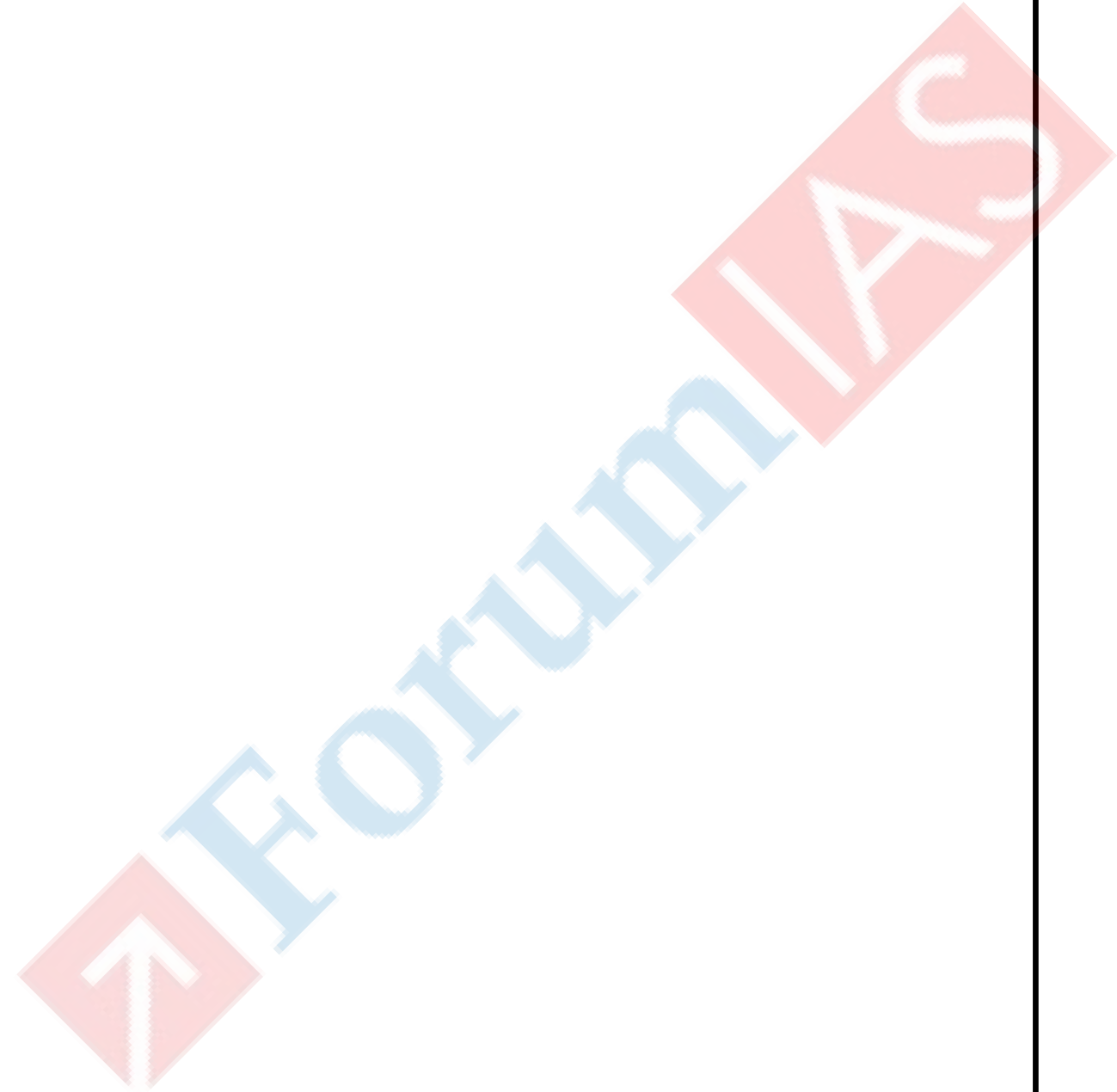
	Excellent	Very Good	Good	Average	Immediate Efforts/Improvement Required
Content					
Presentation					
Structure					
Consistency					
Revision/Recall					

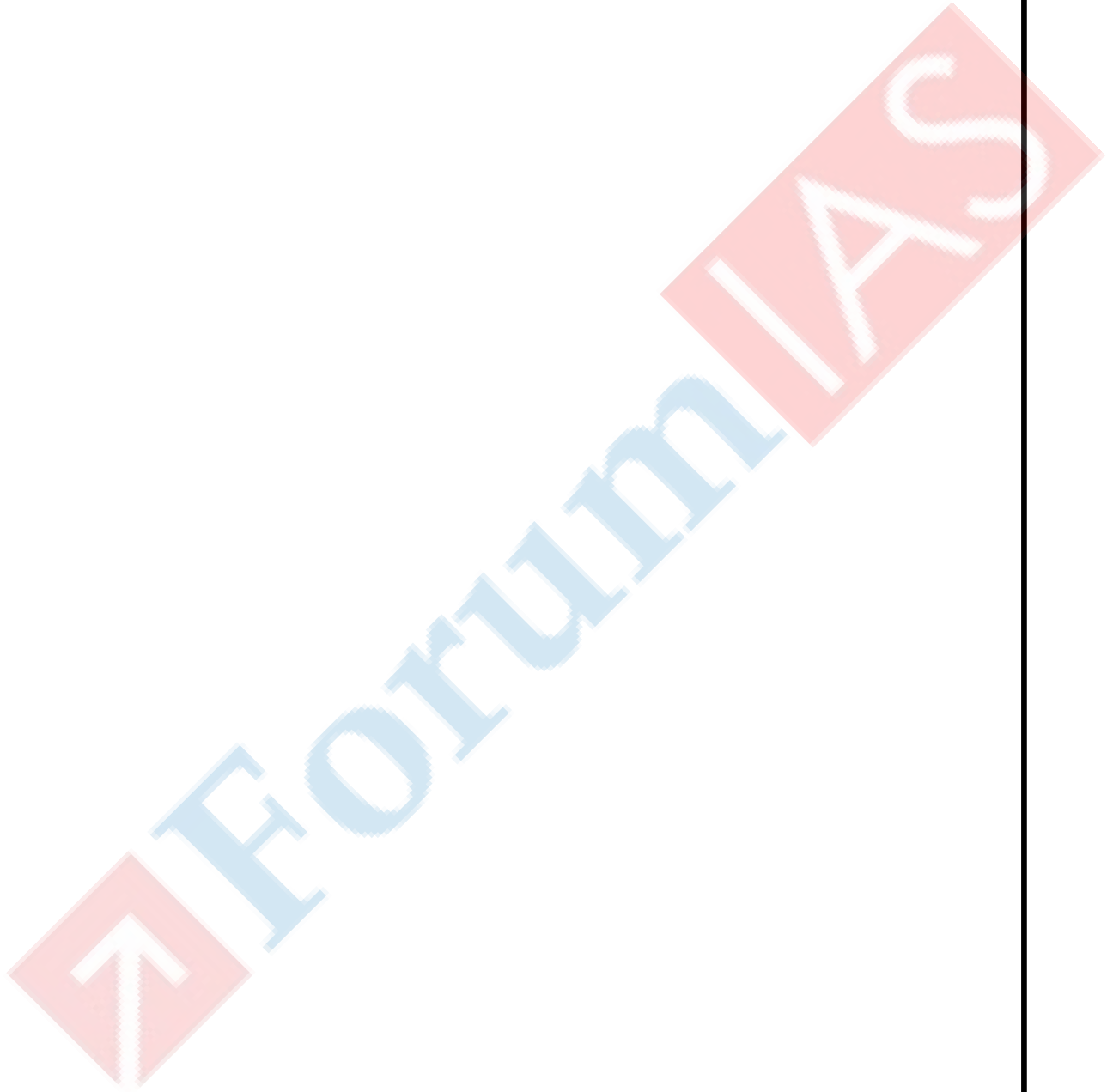
Marks:

Subjective	Objective	Total

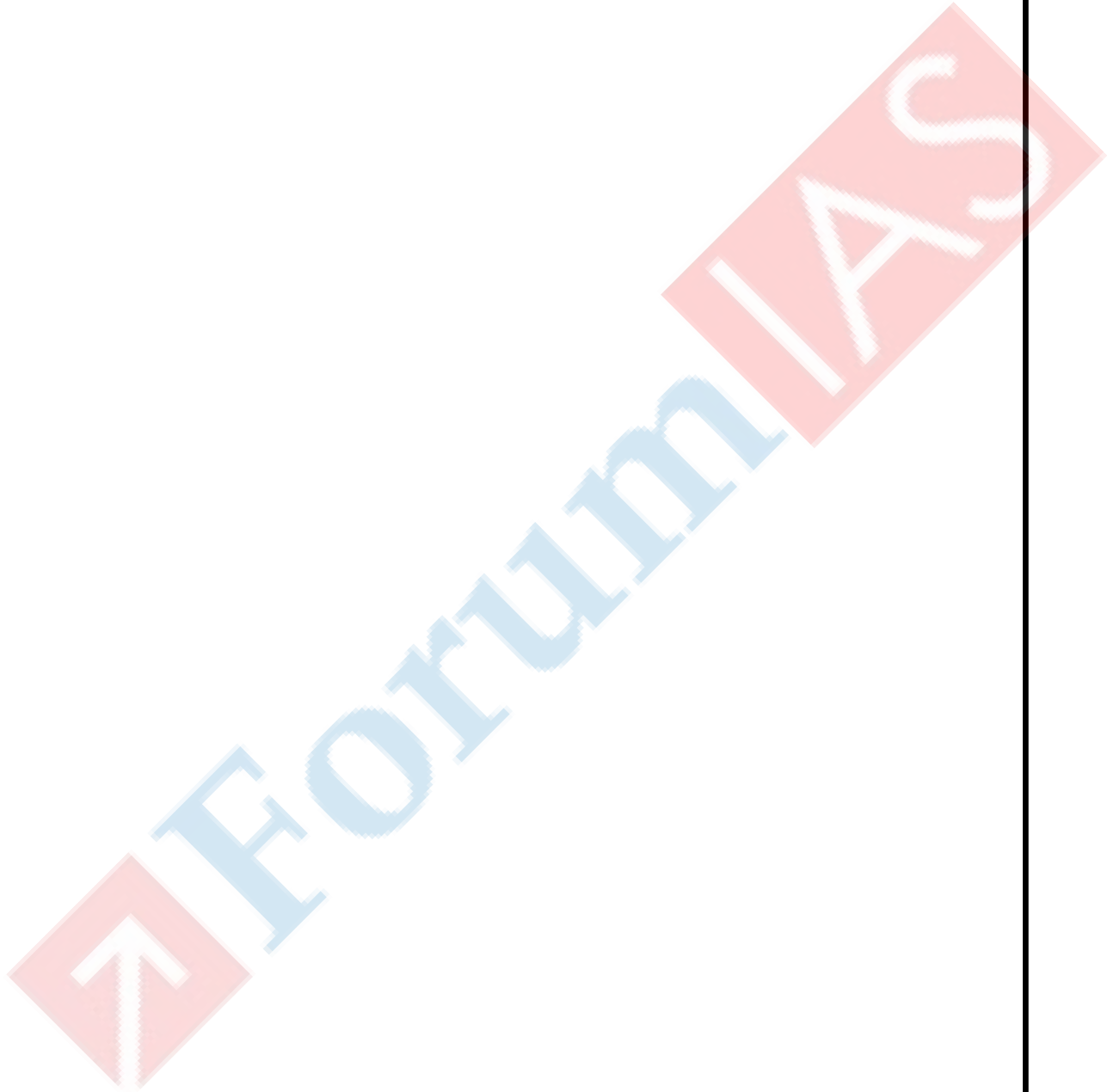
Subjective Questions:

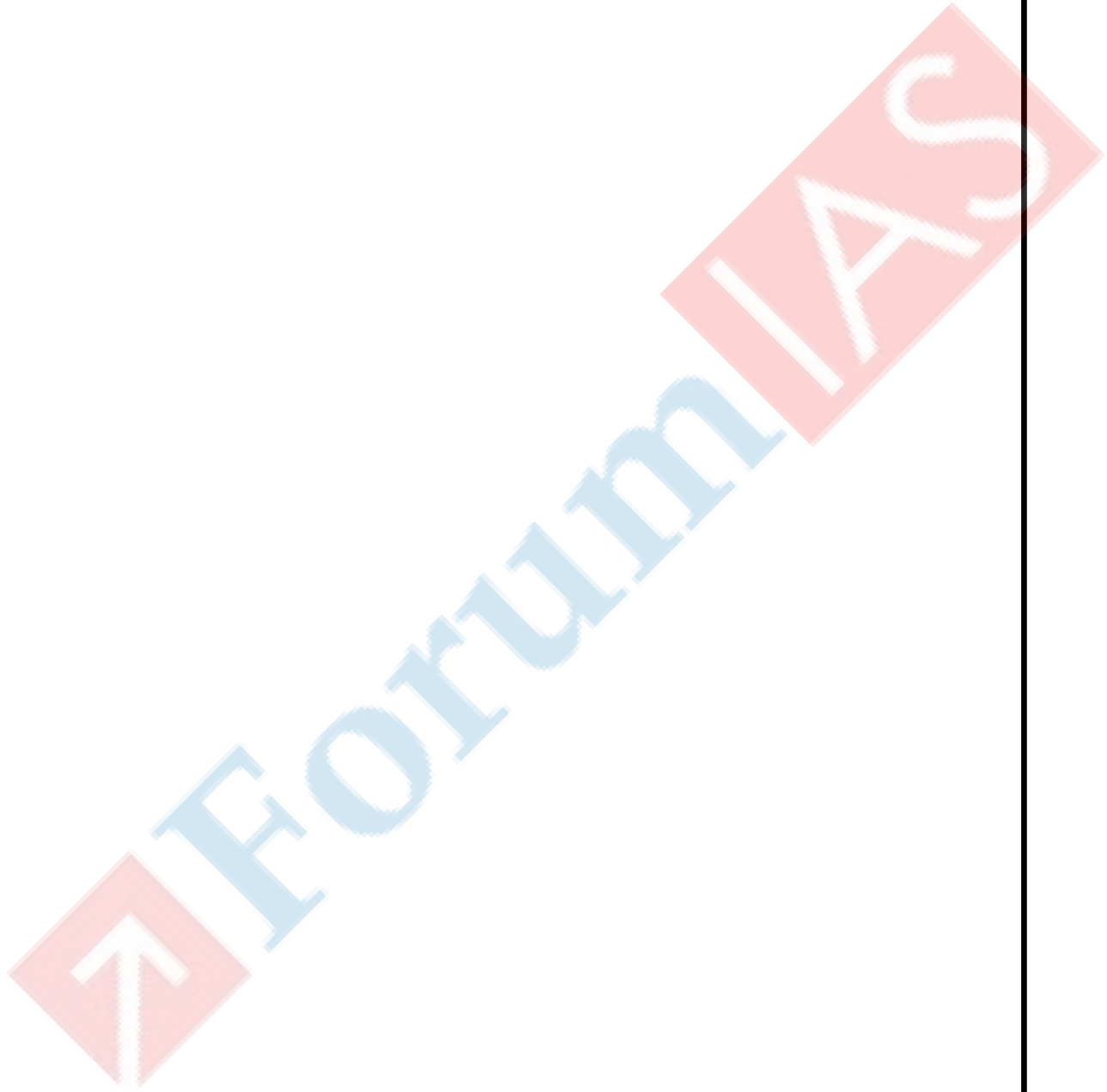
Q.1) What are the potential advantages and disadvantages of Pressurized heavy Water Reactors (PHWRs) as a form of nuclear power generation? (10 marks, 150 words)





Q2.) To what extent, urban planning and culture of the Indus Valley Civilization has provided inputs to the present-day urbanization? Discuss. (10 marks, 150 words)





Objective Questions:

Q.1) In the context of 'Artificial Sun', consider the following statements:

1. It is based on nuclear fission technology.
2. The device can potentially unlock a powerful clean energy source.
3. The power is generated by applying powerful magnetic field to a contained loop of hot plasma.

Which of the statements given above is/are correct?

- a) 1 only
- b) 1 and 2 only
- c) 2 only
- d) 2 and 3 only

Q.2) Consider the following statements with respect to the difference between Pressurised Heavy Water Reactors (PHWRs) and Fast Breeder Reactors (FBRs):

1. While PHWR uses natural uranium as fuel, a fast breeder reactor uses thorium to produce electricity.
2. While PHWRs have a neutron moderator, it is not present in FBR.
3. Unlike FBR, PHWRs produce less radioactive waste as they use heavy water as coolant.

Which of the statements given above is/are correct?

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

Q.3) Regarding the Indus Valley Civilization, consider the following statements:

1. It was predominantly a secular civilization and the religious element, though present, did not dominate the scene
2. During this period, cotton was used for manufacturing textiles in India

Which of the statements given above is/are correct?

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

Q.4) Which of the following characterizes / characterize the people of Indus Civilization?

1. They possessed great palaces and temples.
2. They worshipped both male and female deities.
3. They employed horse-drawn chariots in warfare.

Select the correct statement/statements using the codes given below.

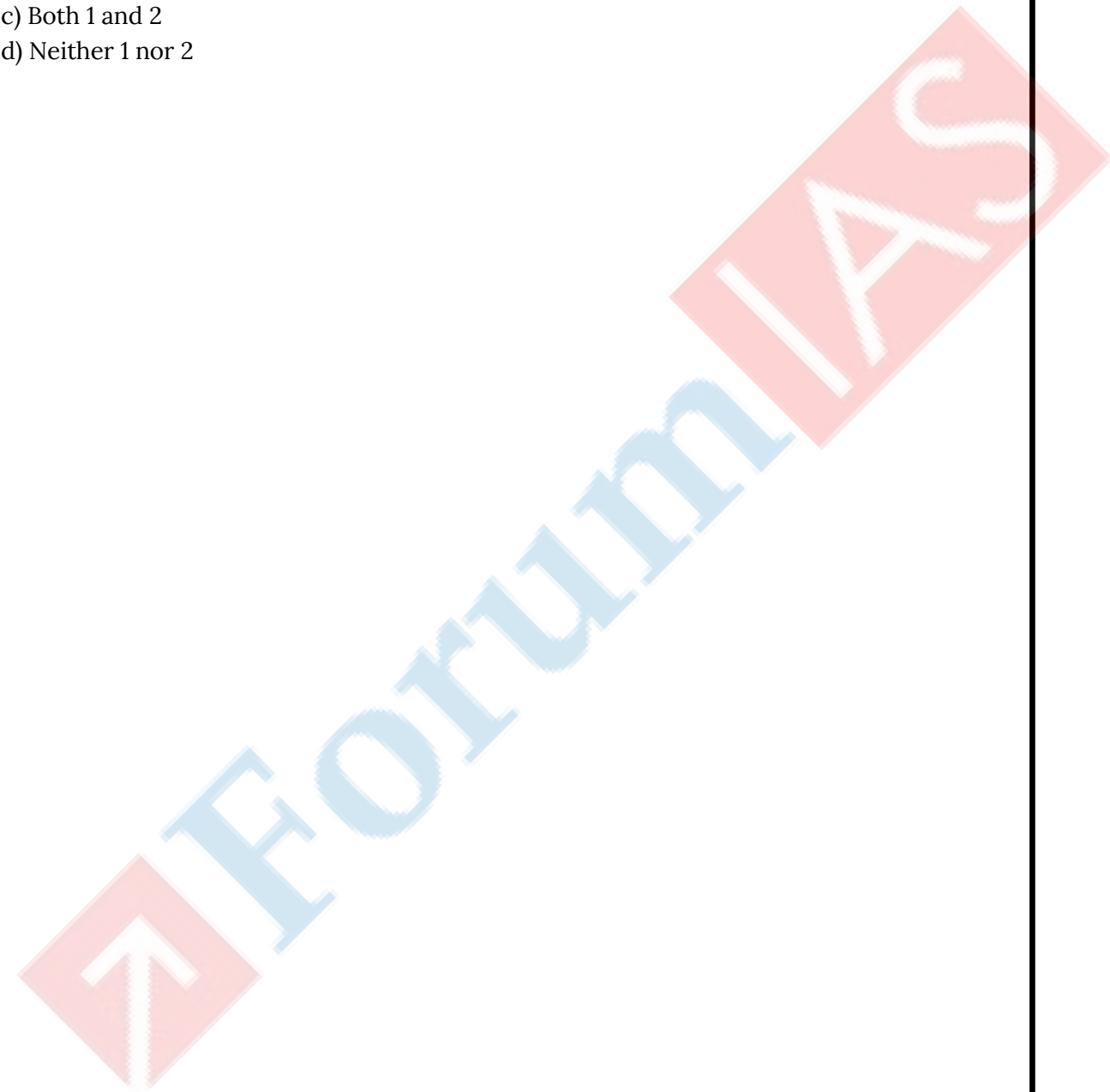
- a) 1 and 2 only
- b) 2 only
- c) 1, 2 and 3
- d) None of the above.

Q.5) Consider the following statements:

1. Lothal was the only port-town of the Indus Valley Civilisation.
2. Bhrigukachchha was a trading port during the ancient India.

Which of the statements given above is/are correct?

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

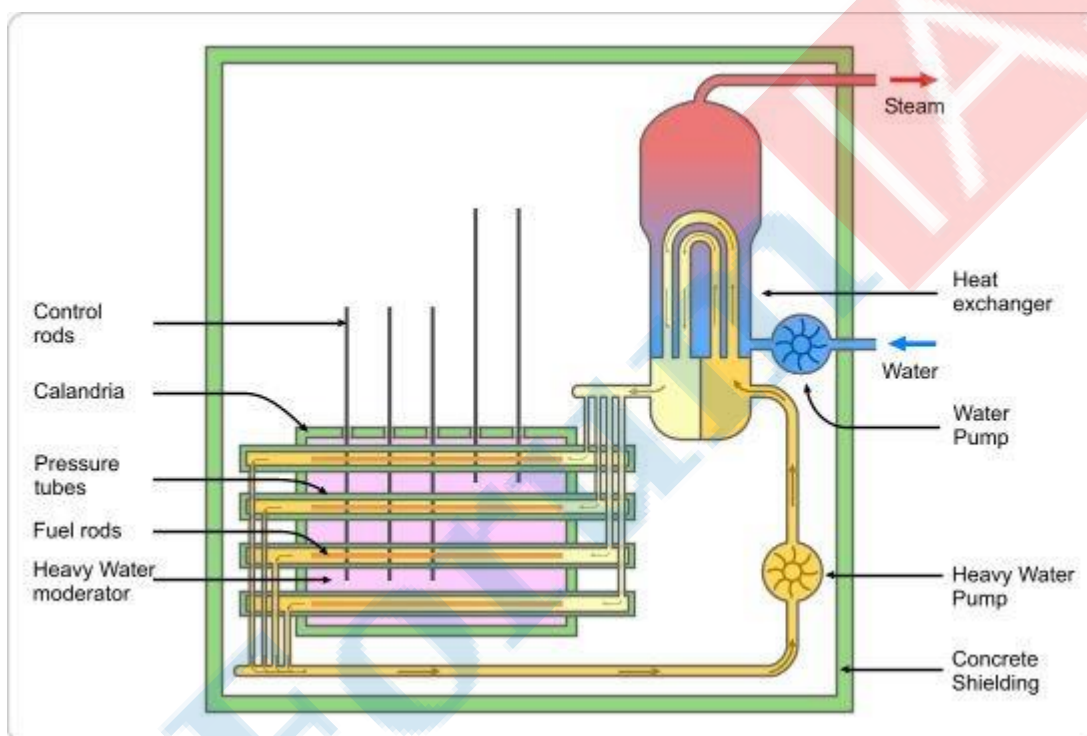


GS Foundation Program 2024 | D5 | Benchmark Assignment #89

Subjective Questions:

Q.1) What are the potential advantages and disadvantages of Pressurized heavy Water Reactors (PHWRs) as a form of nuclear power generation?

Answer: A pressurized **heavy water reactor** (PHWR) is a nuclear power reactor, commonly using unenriched natural uranium as its fuel, that uses heavy water (deuterium oxide D_2O) as its coolant and moderator. The heavy water coolant is kept under pressure, allowing it to be heated to higher temperatures without boiling, much as in a typical pressurized water reactor.



Pressurized Heavy Water Reactors (PHWRs) have both advantages and disadvantages as a form of nuclear power generation. Let's explore them:

Advantages of PHWRs:

- Fuel Availability:** PHWRs can use natural uranium as fuel, which is more abundant than enriched uranium used in other reactor types. This makes PHWRs less dependent on uranium enrichment facilities and provides a long-term fuel supply.
- Enhanced Safety:** PHWRs utilize heavy water (deuterium oxide) as a moderator and coolant. Heavy water has a higher boiling point and excellent neutron moderation properties, which enhances safety and stability in reactor operations.
- Efficient Use of Fuel:** PHWRs can achieve a higher fuel utilization rate compared to other reactor types. They can extract more energy from natural uranium through the use of a slightly enriched uranium fuel bundle combined with heavy water moderation. This results in better fuel efficiency and reduced waste generation.

4. **Flexibility in Fuel Cycles:** PHWRs have the capability to accommodate different fuel cycles. They can operate on a once-through fuel cycle or a closed fuel cycle, allowing for the recycling of spent fuel and extraction of additional energy from the fuel.
5. **Co-generation of Heat and Electricity:** PHWRs can generate both electricity and heat simultaneously. This co-generation capability makes them suitable for district heating, industrial processes, and desalination, thereby increasing their overall energy efficiency.

Disadvantages of PHWRs:

1. **High Capital Cost:** PHWRs tend to have higher capital costs compared to other reactor types. The specialized design requirements for heavy water as a moderator and coolant contribute to the increased construction expenses.
2. **Limited Power Density:** PHWRs typically have lower power density, meaning they require larger reactor sizes to produce the same amount of electricity as other reactor types. This can have implications for land usage and construction.
3. **Radioactive Waste Generation:** Although PHWRs are more fuel-efficient, they still produce radioactive waste that requires careful management and disposal. The spent fuel from PHWRs contains long-lived radioactive isotopes, necessitating the implementation of proper storage and disposal methods.
4. **Tritium Concerns:** PHWRs using heavy water as a moderator produce tritium, a radioactive isotope of hydrogen. Tritium is challenging to contain and manage, requiring additional safety measures to prevent its release into the environment.
5. **Limited Operational Experience:** Compared to other reactor types, the operational experience and deployment of PHWRs on a global scale are relatively limited. This can present challenges in terms of knowledge sharing, training, and standardization across multiple projects.

India has a long history of using Pressurized Heavy Water Reactors (PHWRs) for its nuclear power generation. PHWRs have been a key component of India's nuclear energy program, which aims to meet the country's growing energy needs while reducing its dependence on fossil fuels.

Q.2) To what extent, urban planning and culture of the Indus Valley Civilization has provided inputs to the present-day urbanization? Discuss.

The Indus Valley Civilization (IVC), also known as the Harappan Civilization, was one of the earliest and most advanced urban civilizations of the ancient world. The IVC flourished from around 2600 BCE to 1900 BCE, in the region that is now Pakistan and northwest India. Its urban planning and culture have had a lasting impact on the present-day urbanization in several ways.

1. Urban Planning:

(a) Grid system: In Indus Valley civilization, cities were planned with a grid layout of streets and lanes. This orderly arrangement allowed for efficient movement within the city the same concept is used in modern urban planning where cities are designed with straight roads and buildings arranged in a rectangular grid. The drainage systems used in the IVC were advanced for their time, and their design is still used in modern cities..

(b) Drainage Systems: The IVC had an advanced system of drainage and sewage management. The presence of well-laid drainage systems in these ancient cities inspired later civilizations and even contemporary urban planners to develop effective wastewater management systems.

(c) Public Buildings: The IVC cities were organized around a **central citadel or fort**, with residential and commercial areas radiating outwards. This centralization of power and planning is echoed in modern city centers and administrative layouts.



2. Water Management:

The IVC relied on the Indus River for their water supply. They built advanced water management systems, such as wells, reservoirs, and canals to ensure that their cities had a steady supply of water. This emphasis on water management has influenced modern urbanization, where cities are designed with water supply and management in mind. Modern cities have sophisticated water supply and sewage systems, which are essential for their survival.

3. Culture and Trade:

The IVC had a rich culture, which was based on trade and commerce. They traded with other civilizations, such as Mesopotamia and Egypt, which helped to spread their culture and ideas. This emphasis on trade and commerce is still present in modern urbanization, where cities are centers of trade and commerce.

4. Architecture:

The IVC was known for its unique architecture, which included the use of baked bricks, terracotta, and stone. The buildings were designed to be strong and durable, and many of them have survived to this day. The use of baked bricks and stone is still prevalent in modern urbanization, where buildings are designed to be strong and durable.

5. Religious Practices:

The worship of deities, such as the "Pashupati Seal" indicating reverence for animals, may have contributed to the development of religious and cultural practices that continue to shape urban life today.

In conclusion, the urban planning and culture of the Indus Valley Civilization have had a significant influence on present-day urbanization. The grid pattern, water management, trade and commerce, and architecture used in the IVC are still present in modern cities, which shows the lasting impact of this ancient civilization on the world.

Objective Questions:

Q.1) In the context of 'Artificial Sun', consider the following statements:

1. It is based on nuclear fission technology.
2. The device can potentially unlock a powerful clean energy source.
3. The power is generated by applying powerful magnetic field to a contained loop of hot plasma.

Which of the statements given above is/are correct?

- a) 1 only
- b) 1 and 2 only
- c) 2 only
- d) 2 and 3 only

Ans) d

Exp) Option d is correct.

Statement 1 is incorrect. China successfully powered up its "artificial sun" **nuclear fusion reactor** for the first time, state media reported on Friday, marking a great advance in the country's nuclear power research capabilities.

Statement 2 is correct. The HL-2M Tokamak reactor is China's largest and most advanced nuclear fusion experimental research device, and **scientists hope that the device can potentially unlock a powerful clean energy source.**

Statement 3 is correct. **The power in the reactor is generated by applying powerful magnetic field to a contained loop of hot plasma. The plasma can reach temperature of more than 150-million-degree Celsius.**

Q.2) Consider the following statements with respect to the difference between Pressurised Heavy Water Reactors (PHWRs) and Fast Breeder Reactors (FBRs):

1. While PHWR uses natural uranium as fuel, a fast breeder reactor uses thorium to produce electricity.
2. While PHWRs have a neutron moderator, it is not present in FBR.
3. Unlike FBR, PHWRs produce less radioactive waste as they use heavy water as coolant.

Which of the statements given above is/are correct?

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

Ans) b

Exp) Option b is correct

Nuclear reactors generate energy through fission, the process by which an atomic nucleus splits into two or more smaller nuclei. During fission, a small amount of mass is converted into energy, which can be used to power a generator to create electricity.

Statement 1 is incorrect. The Pressurised Heavy Water Reactors (PHWRs) **uses natural Uranium as fuel**. PHWRs not only produce energy from natural uranium but also produce fissile plutonium (Pu)-239. The **Fast Breeder Reactors (FBRs) use plutonium-239 (and not thorium)** for generating electricity. Once a sufficient amount of plutonium-239 is built up, thorium will be used in the reactor, to produce Uranium-233.

Statement 2 is correct. PHWR uses **heavy water (deuterium oxide D₂O) as its coolant and neutron moderator**. The heavy water coolant is kept under pressure, allowing it to be heated to higher temperatures without boiling. The heavy water creates greatly enhanced neutron economy, allowing the reactor to **operate without fuel-enrichment facilities** (offsetting the additional expense of the heavy water) and enhancing the ability of the reactor to make use of alternate fuel cycles. **FBRs do not have a neutron moderator, and use less-moderating coolants** such as liquid sodium, so its neutrons remain high-energy. Breeder reactors use a small core, which is important to sustain chain reactions.

Statement 3 is incorrect. The increased rate of fuel movement through the PHWR results in **higher volumes of spent fuel**. However, **fast reactors** have the potential to **produce less radioactive waste** because fuel is highly enriched in fissile material. There is no need of large quantity of fuel materials for the annual external feed in FBR and thus **eliminates the need for large capacity waste storage spaces** with complex construction features.

Q.3) Regarding the Indus Valley Civilization, consider the following statements:

1. It was predominantly a secular civilization and the religious element, though present, did not dominate the scene
2. During this period, cotton was used for manufacturing textiles in India

Which of the statements given above is/are correct?

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

Ans) c

Exp) Option c is correct.

Option c is correct. Farmers in Indus valley civilization were the first to weave cotton textiles. It was predominantly a secular civilisation and the religious element, though present, did not dominate the scene.

Q.4) Which of the following characterizes / characterize the people of Indus Civilization?

1. They possessed great palaces and temples.
2. They worshipped both male and female deities.
3. They employed horse-drawn chariots in warfare.

Select the correct statement/statements using the codes given below.

- a) 1 and 2 only
- b) 2 only
- c) 1, 2 and 3
- d) None of the above.

Ans) b

Exp) Option b is correct.

Statement 1 is incorrect. No building has been discovered at any Harappan site that can be positively identified as a temple, but the Great Bath at Mohenjo-daro may have been used for ritual purposes.

Statement 2 is correct. A seal with male figure sitting in a logic posture with a trident-like headgear, surrounded by animals, has been found. Figurines resembling a female deity have been found. They suggest worship of Mother Goddess.

Statement 3 is incorrect. There is no proof to conclude that people of Indus Valley Civilization employed horses.

Q.5) Consider the following statements:

1. Lothal was the only port-town of the Indus Valley Civilisation.
2. Bhrigukachchha was a trading port during the ancient India.

Which of the statements given above is/are correct?

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

Ans) b

Exp) Option b is correct.

Statement 1 is incorrect: Port towns in the Indus Valley Civilization were `Lothal (Gujarat, India), Balakot (Sindh, Pakistan), Khirasa (Kutch, India), Kuntasi (Rajkot, India)

Statement 2 is correct: The lengthy coastline of Gujarat is dotted with several ports, which have been engaged in overseas trade since the 3rd millennium B.C. **Dwarka and Bhrigukachchha (Broach) were active trading ports during the Vedic times.**