

JEE Main 2024 Question Paper Feb 1 Shift 2 (B.E./B.Tech)

JEE Main Physics Questions

Ques 1. Two trains run on North-South parallel tracks. Train A moves with velocity 20 m/s towards North and train B moves with velocity 30 m/s towards South. Then find the velocity of train B with respect to train A.

Ans. 50 m/s

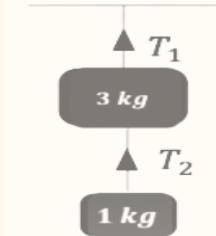
Ques 2. A body of mass of 4kg experiences two forces $\vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$, & $\vec{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k}$ then acceleration acting on the body R

Ans. $\sqrt{6}$

Ques 3. A source produced electromagnetic wave of frequency 60MHz. Find the wavelength of this wave in air.

Ans. 5 m

Ques 4. In the figure shown, find the ratio of tensions in the strings, T_1/T_2



A. $\frac{1}{4}$

- B. $\frac{1}{2}$
- C. $\frac{1}{3}$
- D. 4

Ans. D

Ques 5. A Big drop is formed by coalescing 1000 small droplets of water. The surface water. The surface energy will become.

Ans. 1/10.

Ques 6. A solid sphere is rolling purely with speed v on horizontal surface. It rolls up an incline surface and stops at height h . Then height h is [g is the acceleration due to gravity]:

- A. $3v^2/10g$
- B. $7v^2/10g$
- C. $5v^2/7g$
- D. $7v^2/5g$

Ans. B

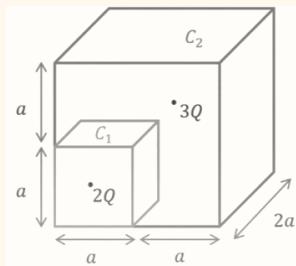
Ques 7. If the power of a light source is P and frequency of photons emitted is f .

Find number photons emitted in time t .

- A. $Pt/2hf$
- B. Pt/hf
- C. $1pf/2ht$
- D. Pf/ht

Ans. B

Ques 8. There are two cubical Gaussian surface carrying charges as shown. Find ratio of fluxes through surface C_1 and C_2 :



- A. 1:1
- B. 2:5
- C. 5:2
- D. 2:3

Ans. B

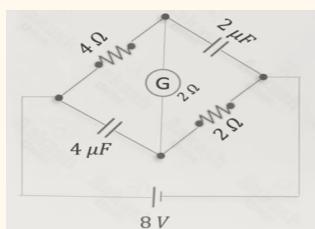
Ques 9. Find the number of significant digits in the value 10.05 :

Ans. 4

Ques 10. A ball of mass 120 g moving with initial velocity 25 m/s is stopped by an external force F in 0.15 sec. Find value of F in newton :

Ans. 20

Ques 11. Find the ratio of the charge on 4 μF to that on 2 μF in steady state.



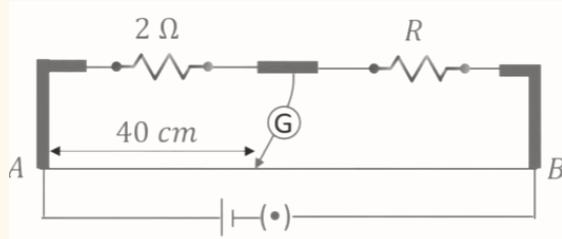
Ans. 3

Ques 12. If the rms velocity of hydrogen gas molecules is V_0 , find the rms velocity of oxygen molecules at same temperature :

- A. V_o
- B. $V_o/2$
- C. $V_o/4$
- D. $V_o/3$

Ans. C

Ques 13. In the meter bridge shown below, the null point is at 40 cm from
 A. If R is shunted by 22, find the distance of new balance point from A



- A. 22.7 cm
- B. 60 cm
- C. 62.5 cm
- D. 60.5 cm

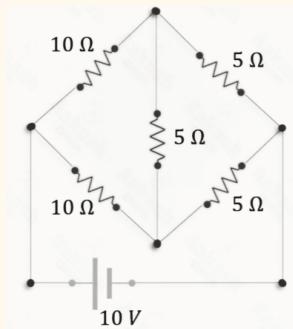
Ans. C

Ques 14. A particle is moving in circular path of radius r speed v such that speed is proportional to radius as $V \propto r^{3/2}$. Then how does time period of revolution depends on r i.e $T r^n$ then n is.

- A. $-\frac{1}{2}$
- B. $\frac{5}{2}$
- C. $-\frac{5}{2}$
- D. $\frac{1}{2}$

Ans. B

Ques 15. In the given circuit, find electric current drawn from battery:
 In the given circuit, find electric current drawn from battery:



- A. $\frac{3}{4} \text{ A}$
- B. $\frac{4}{3} \text{ A}$
- C. $\frac{4}{5} \text{ A}$
- D. $\frac{5}{4} \text{ A}$

Ans. B

JEE Main Chemistry Questions

Ques 1. Number of radial nodes present in 3p are

- A. 0
- B. 1
- C. 2
- D. 4

Ans. B

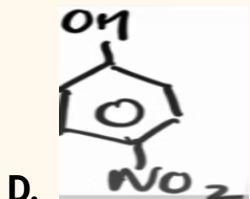
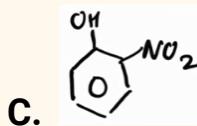
Ques 2. Which of the following compounds have colour due to d-d transition?

- A. KMnO₄
- B. K₂Cr₂O₇
- C. K₂CrO₄
- D. CuSO₄.5H₂O

Ans. D

Ques 3. Which of the following compounds has intramolecular hydrogen bonding in it?

- A. NH₃
- B. H₂O



Ans. B

Ques 4. Which of the following has the highest 3rd ionization energy?

- A. Mn
- B. V
- C. Cr
- D. Fe

Ans. A

Ques 5. A 10 mL hydrocarbon (C_xH_y) on combustion give 40 mL CO₂ and 50 mL H₂O. Calculate the value of x+y

Ans. 14

Ques 6. Solubility of $\text{Ca}_3(\text{PO}_4)_2$ in 100 mL of pure water is W gm. Find out K_{sp} of $\text{Ca}_3(\text{PO}_4)_2$ is:
(M: Molecular mass of $\text{Ca}_3(\text{PO}_4)_2$)

- A. $108 * (\text{W}/\text{M})^5$
- B. $108 * 10^5 * [\text{W}/\text{M}]^5$
- C. $108 * 10^4 * [\text{W}/\text{M}]^5$
- D. $108 * 10^6 * [\text{W}/\text{M}]^5$

Ans. B

Ques 7. Which of the following sets of elements can be detected by Lassaigne's Test ?

- A. N and S only
- B. N, P and S only
- C. P and halogens only
- D. N, P, S and halogens

Ans. D

Ques 8. Which of the following compounds in 3d series does not show +3 oxidation state?

- A. V
- B. Cr
- C. Mn
- D. Cu

Ans. D

Ques 9. What is the order of reducing character for AsH_3 , NH_3 , PH_3 (group 15 hydrides)?

- A. $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3$

- B. $\text{PH}_3 > \text{NH}_3 > \text{AsH}_3$
- C. $\text{AsH}_3 > \text{PH}_3 > \text{NH}_3$
- D. $\text{NH}_3 > \text{AsH}_3 > \text{PH}_3$

Ans. C

Ques 10. Which of the following compounds has the highest boiling point?

- A. Butanol
- B. Diethylether
- C. Butane
- D. Butanol

Ans. A

Ques 11. Consider the following two statements

Statement I: π 2p bonding molecular orbital has low electron density above & below internuclear axis

Statement II: $\pi^*2\text{p}$ antibonding molecular orbital has only one nodal plane

- A. Both Statement I and Statement II are correct
- B. Both Statement I and Statement II are incorrect
- C. Statement I is incorrect, but Statement II is correct
- D. Statement I is correct, but Statement II is incorrect

Ans. B

Ques 12. Consider the following two statements

Statement I: SiO_2 and GeO_2 are acidic, SnO and PbO are amphoteric

Statement II: Allotropes of carbon are formed due to catenation and $\delta\pi - \rho\pi$ bond

- A. Both Statement I and Statement II are correct
- B. Both Statement I and Statement II are incorrect
- C. Statement I is correct, but Statement II is incorrect
- D. Statement I is incorrect, but Statement II is correct

Ans. C

Ques 13. Consider the following two statements

Statement I: In p and d block both metals and non - metals are present

Statement II: Electronegativity and ionisation enthalpy of metals is greater than non - metals

- A. Both Statement I and Statement II are correct**
- B. Both Statement I and Statement II are incorrect**
- C. Statement I is correct, but Statement II is incorrect**
- D. Statement I is incorrect, but Statement II is correct**

Ans. B

Ques 14. Ethylene glycol of x kg is mixed with 18.6 kg of solvent, $24\text{ }^{\circ}\text{C}$ depression in freezing point takes place.

Calculate value of x .

(Given: $K_f = 1.6\text{ }^{\circ}\text{C/molal}$ M.W. of ethylene glycol = 62 g/mol)

Ans. 17

Ques 15. Find out charge (in C) required for electrolysis of 1 mole of H_2O to produce O_2 on one of the electrodes. ($F = 96500\text{ C}$)

Ans. 193000

JEE Main Mathematics Questions

Ques 1. Let α and β be the roots of equation $px^2 + qx - r = 0$, where $P \neq 0$. If p, q, r be the consecutive term of non constant G.P and $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{3}{4}$ then the value of $(\alpha - \beta)^2$ is:

Ans. 80/9

Ques 2. If the mirror image of the point $P(3,4,9)$ in the Line

$$\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-2}{1}$$

is (α, β, γ) then find $14(\alpha + \beta + \gamma)$ is:

Ans. 108

Ques 3. The number of solution of the equation

$$4\sin^2 x - 4\cos^3 x + 9 - 4\cos x = 0, x \in [-2\pi, 2\pi]$$

is:

Ans. 0

Ques 4. If the domain of the function

$$f(x) = \frac{\sqrt{x^2 - 25}}{(\sqrt{4-x^2})} + \log(x^2 + 2x - 15) \text{ is } (-\infty, \alpha) \cup (\beta, \infty), \text{ then}$$

$\alpha^2 + \beta^2$ is equal to b

Ans. 50

Ques 5. Let the system of equations $x+2y+3z = 5$, $2x+3y+z = 9$, $4x+3y+\lambda z = \mu$ have an infinite number of solutions. Then $\lambda + 2\mu$ is equal to

Ans. 17

Ques 6. The value of integrate $\int_0^1 (2x^3 - 3x^2 - x + 1)^{1/3} dx$ is :

- A. -1
- B. 1
- C. 0
- D. 2

Ans. 0

Ques 7. The probability that Ajay will not go to office is $\frac{1}{5}$ and probability that Ajay and Vijay will not go to the office is $\frac{2}{7}$, if their visits to office is independent of each other, then find the probability that Ajay will go to the office, but Vijay will not go, is

- A. 12/28
- B. 13/35
- C. 18/35
- D. 24/35

Ans. C

Ques 8. $\int_0^{\frac{\pi}{3}} \cos^4 x dx$ is equal to $a\pi + b\sqrt{3}$, then $a^2 + b$ is equal to:

- A. $\frac{1}{2}$
- B. $\frac{1}{8}$
- C. $\frac{1}{4}$
- D. 1

Ans. B

Ques 9. Let m and n be the coefficient of 7th and 13th term in expansion of $(1/3x^{1/3} + 1/2x^{2/5})^{18}$, then $(m/n)^{1/3}$ is:

- A. $\frac{1}{4}$
- B. $4/7$

- C. 1/9
- D. 4/9

Ans. D

$$\left| z + \frac{3+4i}{2} \right|$$

Ques 10. The minimum value of $\left| z + \frac{3+4i}{2} \right|$, $|z| \leq 1$ is,

- A. 3/2
- B. 5/2
- C. 3
- D. 5

Ans. A

Ques 11. Let vertex A(2, 3, 1), B(3, 2, -1), C(-2, 1, 3). If AD is angle bisector of angle A, then projection of $\rightarrow AD$ on $\rightarrow AC$ is equal to:

- A. $\sqrt{3}/2$
- B. $\sqrt{(\frac{2}{3})}$
- C. $\sqrt{(3/2)}$
- D. $2/\sqrt{3}$

Ans. B

Ques 12. $dy/dx = (1-x-y^2)/y$ and $x(1)=1$, then $5x(2)$ is equal to ____.

Ans. 5

Ques 13. There are 20 lines numbered as 1, 2, 3, ..., 20. And the odd numbered lines intersect at a point and all the even numbered lines are parallel. Find the maximum number of point of intersections

Ans. 101

Ques 14. Let $a_1, a_2, a_3, \dots, a_n$, be in A. P. and S_n denotes the sum of first n terms of this A. P. is $S_{10} = 390$, $a_{10}/a_{50} = 15/7$, then $S_{15} - S_5 = \underline{\hspace{2cm}}$.

Ans. 365

Directions for the following 4 (four) items :

Read the following two passages and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

According to the Food and Agriculture Organization, one-third of food produced for human consumption is lost or wasted globally. Food is lost or wasted throughout the supply chain, from initial agricultural production to final household consumption. The increasing wastage also results in land degradation by about 45%, mainly due to deforestation, unsustainable agricultural practices, and excessive groundwater extraction. The energy spent over wasted food results in about 5 billion tonnes of carbon dioxide production every year. Decay also leads to harmful emissions of other gases in the atmosphere. Addressing the loss and wastage of food in forms is critical to complete the cycle of food efficiency and food sustainability.

1. Which of the following statements best reflect the most logical and rational inferences that can be made from the passage?

1. The current methods of food distribution are solely responsible for the loss and wastage of food.
2. Land productivity is adversely affected by the prevailing trend of food loss and wastage.

3. Reduction in the loss and wastage of food results in lesser carbon footprint.
4. Post-harvest technologies to prevent or reduce the loss and wastage of food are not available.

Select the correct answer using the code given below.

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

2. Based on the above passage, the following assumptions have been made :

1. The food distribution mechanism needs to be reimagined and made effective to reduce the loss and wastage of food.
2. Ensuring the reduction of wastage and loss of food is a social and moral responsibility of all citizens.

Which of the assumptions given above is/are valid?

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

Passage—2

As inflation rises, even governments previously committed to budget discipline are spending freely to help households. Higher interest rates announced by central banks are supposed to help produce modest fiscal austerity, because to maintain stable debts while paying more to borrow, governments must cut spending or raise taxes. Without the fiscal backup, monetary policy eventually loses traction. Higher interest rates become inflationary, not disinflationary, because they simply lead governments to borrow more to pay rising debt-service costs. The risk of monetary unmooring is greater when public debt rises, because interest rates become more important to budget deficits.

3. Which of the following statements best reflects/reflect the most logical and rational inference/inferences that can be made from the passage?

1. Central banks cannot bring down inflation without budgetary backing.
2. The effects of monetary policy depend on the fiscal policies pursued by the government.

Select the correct answer using the code given below.

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

4. Based on the above passage, the following assumptions have been made:

1. Fiscal policies of governments are solely responsible for higher prices.
2. Higher prices do not affect the long-term government bonds.

Which of the assumptions given above is/are valid?

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

5. What is the least possible number of cuts required to cut a cube into 64 identical pieces?

- (a) 8
- (b) 9
- (c) 12
- (d) 16

6. In the expression $5 * 4 * 3 * 2 * 1$, * is chosen from +, -, \times each at most two times. What is the smallest non-negative value of the expression?

- (a) 3
- (b) 2
- (c) 1
- (d) 0

7. A certain number of men can complete a piece of work in $6k$ days, where k is a natural number. By what percent should the number of men be increased so that the work can be completed in $5k$ days?

(a) 10%

(b) $(50/3)\%$

(c) 20%

(d) 25%

8. X, Y and Z can complete a piece of work individually in 6 hours, 8 hours and 8 hours respectively. However, only one person at a time can work in each hour and nobody can work for two consecutive hours. All are engaged to finish the work. What is the minimum amount of time that they will take to finish the work?

(a) 6 hours 15 minutes

(b) 6 hours 30 minutes

(c) 6 hours 45 minutes

(d) 7 hours

9. How many consecutive zeros are there at the end of the integer obtained in the product $1^2 \times 2^4 \times 3^6 \times 4^8 \times \dots \times 25^{50}$?

(a) 50

(b) 55

(c) 100

(d) 200

10. On January 1st, 2023, a person saved ₹ 1. On January 2nd, 2023, he saved ₹ 2 more than that on the previous day. On January 3rd, 2023, he saved ₹ 2 more than that on the previous day and so on. At the end of which date was his total savings a perfect square as well a perfect cube?

(a) 7th January, 2023

(b) 8th January, 2023

(c) 9th January, 2023

(d) Not possible

Directions for the following 4 (four) items :

Read the following **two passages** and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

Today, if we consider cities such as New York, London and Paris as some of the most iconic cities in the world, it is because plans carrying a heavy systems approach were imposed on their precincts. The backbone of the systems theory is the process of translating social, spatial and cultural desirables into mathematical models using computing, statistics, optimization and an algorithmic way of formulating and solving problems. The early universities of the West which began to train professionals in planning, spawned some of the most ingenious planners, who were experts in these domains. This was because these very subjects were absorbed into the planning curriculum that had its roots in the social sciences, geography and architecture. Planning in India, and its education differ from the West.

11. Which one of the following statements best reflects the most logical and rational inference that can be made from the above passage?

- (a) Curriculum for urban planning courses should have diverse and interdisciplinary approach.
- (b) In India, city administration is under bureaucracy which lacks formal training in urban planning and management.

- (c) In India, the management of urban areas is a local affair with a chronic problem of insufficient funds.
- (d) With high density of population and widespread poverty in our urban areas, planned development in them is very difficult.

12. Based on the above passage, the following assumptions have been made :

- 1. India needs a new generation of urban professionals with knowledge relevant to modern urban practice.
- 2. Indian universities at present have no capacity or potential to impart training in systems approach.

Which of the assumptions given above is/are correct?

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

Passage—2

Not every voice on the internet commands the same kind of audience. When anonymous private entities with high capital can pay for more space for their opinions, they are effectively buying a louder voice. If political discourse in the digital sphere is a matter of outshining one's opponent till the election is won, then the quality of politics suffers. The focus of social media is restricted to the

promotion of content that generates more user engagement, regardless of how inflammatory the content may be.

13. Which one of the following statements best reflects the central idea of the above passage?

- (a) Constructed as a marketplace of views, social media ensures instant access to information.
- (b) Social media are not ideal or moral institutions but the products built by companies to make profits.
- (c) Social media have been created to strengthen democracies.
- (d) In today's world, social media are inevitable for well-informed social life.

14. Based on the above passage, the following assumptions have been made :

- 1. Internet is not inclusive enough.
- 2. Internet can adversely affect the quality of politics in a country.

Which of the assumptions given above is/are valid?

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

15. $222^{333} + 333^{222}$ is divisible by which of the following numbers?

- (a) 2 and 3 but not 37
- (b) 3 and 37 but not 2
- (c) 2 and 37 but not 3
- (d) 2, 3 and 37

16. What percent of water must be mixed with honey so as to gain 20% by selling the mixture at the cost price of honey?

- (a) 20%
- (b) 10%
- (c) 5%
- (d) 4%

17. What is the rightmost digit preceding the zeros in the value of 30^{30} ?

- (a) 1
- (b) 3
- (c) 7
- (d) 9

18. 421 and 427, when divided by the same number, leave the same remainder 1. How many numbers can be used as the divisor in order to get the same remainder 1?

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

19. A can X contains 399 litres of petrol and a can Y contains 532 litres of diesel. They are to be bottled in bottles of equal size so that whole of petrol and diesel would be separately bottled. The bottle capacity in terms of litres is an integer. How many different bottle sizes are possible?

- (a) 3
- (b) 4
- (c) 5
- (d) 6

20. Consider the following statements in respect of the sum $S = x + y + z$, where x, y and z are distinct prime numbers each less than 10 :

- 1. The unit digit of S can be 0.
- 2. The unit digit of S can be 9.
- 3. The unit digit of S can be 5.

Which of the statements given above are correct?

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

irections for the following 3 (three) items :

ead the following **two passages** and answer
e items that follow the passages. Your
nswers to these items should be based on
e passages only.

Passage—1

y the time children reach class 8, the bulk of
hem tend to be in the age range of 13 years to
5 years. But in our country, about a quarter of
ll children in class 8 struggle with reading
imple texts and more than half are still unable
o do basic arithmetic operations like division.
every year about 25 million young boys and
irls from elementary school move into the life
hat lies for them beyond compulsory schooling.
They cannot enter the workforce at least in
he organized sector till they are 18. For many
amilies, these children are the first from their
amilies ever to get this far in school. Parents
and children expect that such 'graduates' from
chool will go on to high school and college.
hardly anyone wants to go back to agriculture.
On the other hand, abilities in terms of
academic competencies are far lower than
they should be even based on curricular
expectations of class 8.

21. Based on the above passage, the following assumptions have been made :

1. For effective school education, parents have greater role than the governments.
2. School curriculum that conforms to today's requirements and is uniform for the entire country may address the issues brought out.

Which of the assumptions given above is/are valid?

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

22. Which one of the following statements best reflects the central idea conveyed by the passage?

- (a) Total eradication of poverty in the country will resolve the issue of under-performance of our schoolchildren.
- (b) Monetary incentives to parents and teachers is a strategy to improve the children's academic performance.
- (c) Public policy should ensure that competencies and achievements of young people are aligned with their expectations.
- (d) India is not going to take advantage of the demographic dividend unless some school pass-outs go back to agriculture.

Passage—2

We take it for granted now that science has a social responsibility. The idea would not have occurred to Newton or Galileo. They thought of science as an account of the world as it is, and the only responsibility that they acknowledged was to tell the truth. The idea that science is a social enterprise is modern, and it begins at the industrial revolution. We are surprised that we cannot trace a social

Directions for the following 4 (four) items :

Read the following **two passages** and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

"The history of science is the real history of mankind." In this striking epigram, a nineteenth-century writer links science with its background. Like most epigrams, its power lies in emphasizing by contrast an aspect of truth which may be easily overlooked. In this case, it is easy to overlook the relations between science and mankind, and to treat the former as some abstract third party, which can sometimes be praised for its beneficial influences, but frequently and conveniently blamed for the horrors of war. Science and mankind cannot be divorced from time to time at men's convenience. Yet we have seen that, in spite of countless opportunities of improvement, the opening years of the present period of civilization have been dominated by international conflict. Is this the inevitable result of the progress of science or does the fault lie elsewhere?

31. Which of the following is/are emphatically conveyed by the author of the passage?

1. Without science, mankind could not have continued to exist till today.
2. It is the science that will ultimately determine the destiny of mankind.

Select the correct answer using the code given below.

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

32. Based on the above passage, the following assumptions have been made:

1. The horrors of modern life are the inevitable result of the progress of science.
2. The aspect of truth likely to be overlooked is that science is what man has made it.

Which of the assumptions given above is/are correct?

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

Passage—2

Only with long experience and opening of his wares on many a beach where his language is not spoken, will the merchant come to know the worth of what he carries, and what is parochial and what is universal in his choice. Such delicate goods as justice, love and honour, courtesy, and indeed all the things we care for, are valid everywhere but they are variously moulded and often differently handled, and sometimes nearly unrecognizable if you meet them in a foreign land, and the art of learning fundamental common values is perhaps the greatest gain of travel to those who wish to live at ease among their fellows.

33. When we meet other people while we travel, we learn to differentiate between

- (a) imagination and understanding
- (b) communities and nationalities
- (c) local values and universal values
- (d) friends and foes

use further back, because we nurse the illusion that the industrial revolution ended golden age.

23. Which one of the following statements best reflects the thinking of the author about the science?

- (a) Science must value the commitment of the scientists.
- (b) Science is a product of civilized society and must be used for the promotion of scientific awareness in people.
- (c) Industrial revolution was made possible by the advancements in science.
- (d) Science must pursue truth but be responsible for social welfare.

24. Consider the sequence

A _ BCD _ BBCDABC _ DABC _ D

that follows a certain pattern. Which one of the following completes the sequence?

- (a) B, A, D, C
- (b) B, A, C, D
- (c) A, A, C, D
- (d) A, A, D, C

25. Two persons P and Q enter into a business. P puts ₹ 14,000 more than Q, but P has invested for 8 months and Q has invested for 10 months. If P's share is ₹ 400 more than Q's share out of the total profit of ₹ 2,000, what is the capital contributed by P?

- (a) ₹ 30,000
- (b) ₹ 26,000
- (c) ₹ 24,000
- (d) ₹ 20,000

26. P's salary is 20% lower than Q's salary which is 20% lower than R's salary. By how much percent is R's salary more than P's salary?

- (a) 48.75%
- (b) 56.25%
- (c) 60.50%
- (d) 62.25%

27. A number is mistakenly divided by 4 instead of multiplying by 4. What is the percentage change in the result due to this mistake?

- (a) 25%
- (b) 50%
- (c) 72.75%
- (d) 93.75%

28. In an examination, 80% of students passed in English, 70% of students passed in Hindi and 15% failed in both the subjects. What is the percentage of students who failed in only one subject?

- (a) 15%
- (b) 20%
- (c) 25%
- (d) 35%

29. A father said to his son, "n years back I was as old as you are now. My present age is four times your age n years back". If the sum of the present ages of the father and the son is 130 years, what is the difference of their ages?

- (a) 30 years
- (b) 32 years
- (c) 34 years
- (d) 36 years

30. Consider the following :

1. 1000 litres = 1 m^3
2. 1 metric ton = 1000 kg
3. 1 hectare = 10000 m^2

Which of the above are correct?

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

34. With reference to the above passage, the following assumptions have been made :

1. Travel leads to an understanding of humans.
2. Travel helps those who wish to learn fundamental common values.
3. A person with long experience in travel can resolve differences amongst people.

Which of the assumptions given above are valid?

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

35. Let X be a two-digit number and Y be another two-digit number formed by interchanging the digits of X . If $(X + Y)$ is the greatest two-digit number, then what is the number of possible values of X ?

- (a) 2
- (b) 4
- (c) 6
- (d) 8

36. Consider the following :

$$\begin{aligned}\text{Weight of 6 boys} &= \text{Weight of 7 girls} \\ &= \text{Weight of 3 men} = \text{Weight of 4 women}\end{aligned}$$

If the average weight of the women is 63 kg, then what is the average weight of the boys?

- (a) 40 kg
- (b) 42 kg
- (c) 45 kg
- (d) 63 kg

37. How many times the hour hand and the minute hand coincide in a clock between 10:00 a.m. and 2:00 p.m. (same day)?

- (a) 3 times
- (b) 4 times
- (c) 5 times
- (d) 6 times

38. The calendar for the year 2025 is same for

- (a) 2029
- (b) 2030
- (c) 2031
- (d) 2033

39. Let p, q, r and s be distinct positive integers. Let p, q be odd and r, s be even. Consider the following statements :

1. $(p - r)^2(qs)$ is even.
2. $(q - s)q^2s$ is even.
3. $(q + r)^2(p + s)$ is odd.

Which of the statements given above are correct?

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

40. What is the angle between the minute hand and hour hand when the clock shows 4:25 hours?

- (a) $12\cdot5^\circ$
- (b) 15°
- (c) $17\cdot5^\circ$
- (d) 20°

Directions for the following 4 (four) items :

Read the following **two passages** and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

Conventional classrooms, by emphasizing fixed duration over learning effectiveness, resign themselves to variable outcomes. The tyranny of the classroom is that every learner is subjected to the same set of lectures in the same way for the same duration. In the end, a few learners shine, some survive, and the rest are left behind. After the fixed duration, the classroom model moves on, with not a thought spared for those left behind. This is how we end up with 10 percent employability in our graduates after a decade and half of formal education. Repeating the same ineffectual script in the realm of skill education will not produce different results.

- 41.** Which of the following statements best reflects/reflect the most logical and rational inference/inferences that can be made from the passage?

1. In conventional classroom learning, the central goal is duration of learning rather than attainment of competency.
2. Conventional classrooms encourage one-size-fits-all approach and stamp out all differentiation.

Select the correct answer using the code given below.

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

- 42.** Based on the above passage, the following assumptions have been made :

1. As a large number of workers in our country are employed in unorganized sector, India does not need to change its present conventional classroom system of education.
2. Even with its present conventional classroom system of education, India produces sufficient number of skilled workers to fully realize the benefits of demographic dividend.

Which of the assumptions given above is/are valid?

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

Passage—2

When a child reaches adolescence, there is apt to be a conflict between the parents and the child, since the latter considers himself to be by now quite capable of managing his own affairs, while the former are filled with parental solicitude, which is often a disguise for love of power. Parents consider, usually, that the various moral problems which arise in adolescence are peculiarly their province. The options they express, however, are so

dogmatic that the young seldom confide in them, and usually go their own way in secret.

43. Based on the above passage, the following assumptions have been made :

1. The adolescent does not feel comfortable with his parents because they tend to be dominating and assertive.
2. The adolescent of modern times does not have much respect for parents.

Which of the assumptions given above is/are valid?

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

44. Which one of the following statements best reflects the central idea of the above passage?

- (a) Parents in general may not be of much help when children are on their way to becoming adults.
- (b) When children reach adolescence, involvement of parents in their lives is unnecessary.
- (c) Modern-day nuclear families are not capable of bringing up children properly.
- (d) In modern societies, adolescents tend to be stubborn, disobedient and careless.

45. What is the number of fives used in numbering a 260-page book?

- (a) 55
- (b) 56
- (c) 57
- (d) 60

46. What is the sum of the first 28 terms in the following sequence?

$$1, 1, 2, 1, 3, 2, 1, 4, 3, 2, 1, 5, 4, 3, 2, \dots$$

- (a) 83
- (b) 84
- (c) 85
- (d) 86

47. A person buys three articles P , Q and R for ₹ 3,330. If P costs 25% more than R and R costs 20% more than Q , then what is the cost of P ?

- (a) ₹ 1,000
- (b) ₹ 1,200
- (c) ₹ 1,250
- (d) ₹ 1,350

48. If the sum of the two-digit numbers AB and CD is the three-digit number $1CE$, where the letters A , B , C , D , E denote distinct digits, then what is the value of A ?

- (a) 9
- (b) 8
- (c) 7
- (d) Cannot be determined due to insufficient data

49. Three numbers x , y , z are selected from the set of the first seven natural numbers such that $x > 2y > 3z$. How many such distinct triplets (x, y, z) are possible?

- (a) One triplet
- (b) Two triplets
- (c) Three triplets
- (d) Four triplets

50. The total cost of 4 oranges, 6 mangoes and 8 apples is equal to twice the total cost of 1 orange, 2 mangoes and 5 apples. Consider the following statements :

1. The total cost of 3 oranges, 5 mangoes and 9 apples is equal to the total cost of 4 oranges, 6 mangoes and 8 apples.
2. The total cost of one orange and one mango is equal to the cost of one apple.

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

Directions for the following 3 (three) items :

Read the following **three passages** and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

When an international team of scientists pumped a carbon dioxide and water mix into underground basalt rocks, basic chemistry took over. The acidic mixture dissolved rocks' calcium and magnesium and formed limestone. Basically carbon dioxide is converted into stone, exclaimed the scientists.

51. Which one of the following statements best reflects the most logical, rational and practical suggestion implied by the passage?

- (a) It is a cheap and practical method to produce limestone at commercial level for building purposes.
- (b) This can be used as one of the methods of carbon sequestration.
- (c) Basalt rock can be made a good source of calcium and magnesium minerals by this method.
- (d) Good rock-dissolving acid can be produced by mixing carbon dioxide and water.

Passage—2

Geographers analyzed 175 satellite images of ocean colour, which is an indicator of phytoplankton productivity at the ocean's surface, and found that giant icebergs are responsible for storing up to 20 percent of carbon in the Southern Ocean. The researchers discovered that melting water from giant icebergs which contains iron and other nutrients, supports hitherto unexpectedly high levels of phytoplankton growth.

52. Based on the above passage, the following assumptions have been made :

- 1. Giant icebergs have a bearing on primary productivity and food chains of the Southern Ocean.
- 2. Melting of giant icebergs can produce climate change effects and impact world fisheries.

Which of the assumptions given above is/are valid?

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

Passage—3

Evolution has endowed caterpillars that feed on corn with a unique ability, they can induce the plant to turn off its defence against insect predators. This helps caterpillars to eat more and grow faster. The agent that causes this effect is the caterpillar's faeces or frass. The find could throw new light on compounds associated with plant response to pathogens like fungi or bacteria.

- 53.** Which one of the following statements best reflects the most logical, rational and practical message conveyed by the passage?

- (a) Farmers can use caterpillars to feed on weeds in their crop fields/plantations.
 - (b) This finding can help in the development of clinically useful antimicrobial compounds.
 - (c) This finding can help in the development of organic, ecologically sustainable pesticides.
 - (d) Caterpillars can be genetically modified to be predators of the other plant pests.

- 54.** $32^5 + 2^{27}$ is divisible by

55. Let p and q be positive integers satisfying $p < q$ and $p + q = k$. What is the smallest value of k that does not determine p and q uniquely?

- | | |
|--------------|--------------|
| <i>(a)</i> 3 | <i>(b)</i> 4 |
| <i>(c)</i> 5 | <i>(d)</i> 6 |

- 56.** A person walks 100 m straight from his house, turns left and walks 100 m, again turns left and walks 300 m, then turns right and walks 100 m to reach his office. In which direction does he walk initially from his house if his office is exactly in the North-East direction?

- (a) North-West
 - (b) West
 - (c) South
 - (d) South-West

- 57.** A person walks 100 m Westward, then turns left and walks 100 m. He then takes 225° turn clockwise. In which direction is he walking now?

- (a) South-West
 - (b) South-East
 - (c) North-West
 - (d) North-East

58. A Statement is given followed by two Conclusions numbered I and II. Consider the Statement and the Conclusions.

Statement :

India is the world's largest producer of milk.

Conclusion-I :

India is the world's largest exporter of milk.

Conclusion-II :

India does not import milk.

Which one of the following is correct?

- (a) Only Conclusion-I follows
 - (b) Only Conclusion-II follows
 - (c) Both Conclusion-I and Conclusion-II follow
 - (d) Neither Conclusion-I nor Conclusion-II follows

59. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

Question :

What are the values of m and n , where m and n are natural numbers?

Statement-I :

$$m + n > mn \text{ and } m > n.$$

Statement-II :

The product of m and n is 24.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

60. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

Question :

What is the time required to download the software?

Statement-I :

The size of the software is 12 megabytes.

Statement-II :

The transfer rate is 2.4 kilobytes per second.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

Directions for the following 3 (three) items :

Read the following **three passages** and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

In a robust democracy, reality, howsoever inconvenient it may be, finds its expression both in the speech of political leaders and the other social forms of assertion. The existence of the real has to be transparent, both through its circulation in and by the media as well as its argumentative articulation in deliberative democracy. A normatively responsible media through its communication effect has the responsibility to circulate the content of reality without distortion.

61. Which one of the following statements best reflects the crux of the above passage?

- (a) Responsible media should not distort the real in an ideal democracy.
- (b) Fake news seems inherent in the life of an ideal democracy.
- (c) There should not be any kind of restrictions on the freedom of expression in an ideal democracy.
- (d) Irresponsible media and political leaders cannot be effectively controlled in an ideal democracy.

Passage—2

Now-a-days there is a growing trend to use interconnected home devices. As consumers increasingly network their homes, the connected home device manufacturers and service providers will seek to overcome "thin

profit margins by gathering more of our personal data—with or without our agreement—turning the home into a corporate storefront". Corporate marketers will have powerful incentives to observe consumer behaviour to understand the buying needs and preferences of the device owners.

62. Which one of the following statements best reflects the most logical, rational and practical message implied by the passage?

- (a) Knowledge of consumer behaviour leads to more capital expenditure in manufacturing sector.
- (b) Knowledge of consumer behaviour stimulates the growth of commerce and trade and thus helps in the overall economic development of the country.
- (c) Interconnected devices give a lot of comfort to home users and improve the overall quality of life.
- (d) Interconnected devices can be at security risk and home users may have privacy risk.

Passage—3

Green growth involves rethinking growth strategies with regard to the impacts on environmental sustainability and the environmental resources available to poor and vulnerable groups. In rethinking growth, we need to focus on the current reality of a resource-constrained world. Resource intensive and, in particular energy intensive processes will need to make way for more efficient and resource frugal development strategies if we are to avoid an economic dead

end or a world in which only a small elite is able to enjoy affluence in the midst of a sea of poverty.

63. Which one of the following statements best reflects the crux of the above passage?

- (a) Environmental sustainability is inimical to our objective of achieving a high rate of GDP growth.
- (b) Poverty eradication is not possible without a rapid economic growth and the consequent environmental degradation.
- (c) Maintaining high environmental standards is now a prerequisite for achieving a steady, sufficient and inclusive growth.
- (d) With large populations, rampant poverty and limited resources of today's world, environmental degradation cannot be prevented and inequalities are inevitable.

64. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

Question :

What are the unique values of x and y , where x, y are distinct natural numbers?

Statement-I : x/y is odd.

Statement-II : $xy = 12$

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone

- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

65. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

A certain amount was distributed among X, Y and Z .

Question :

Who received the least amount?

Statement-I :

X received $\frac{4}{5}$ of what Y and Z together received.

Statement-II :

Y received $\frac{2}{7}$ of what X and Z together received.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

66. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

If the average marks in a class are 60, then what is the number of students in the class?

Statement-I :

The highest marks in the class are 70 and the lowest marks are 50.

Statement-II :

Exclusion of highest and lowest marks from the class does not change the average.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

67. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

There are three distinct prime numbers whose sum is a prime number.

Question :

What are those three numbers?

Statement-I : Their sum is less than 23.

Statement-II : One of the numbers is 5.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

68. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

Question : Is $(x + y)$ an integer?

Statement-I : $(2x + y)$ is an integer.

Statement-II : $(x + 2y)$ is an integer.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

69. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

A person buys three articles p , q and r for ₹ 50. The price of the article q is ₹ 16 which is the least.

Question :

What is the price of the article p ?

Statement-I :

The cost of p is not more than that of r .

Statement-II :

The cost of r is not more than that of p .

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

70. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

P , Q , R and S appeared in a test.

Question :

Has P scored more marks than Q ?

Statement-I :

The sum of the marks scored by P and Q is equal to the sum of the marks scored by R and S .

Statement-II :

The sum of the marks scored by P and S is more than the sum of the marks scored by Q and R .

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

Directions for the following 2 (two) items :

Read the following **two passages** and answer the items that follow the passages. Your answers to these items should be based on the passages only.

Passage—1

Unlike religion and science, poetry does not posit or expect any belief in absolute truths. Those forces or individuals who claim to have absolute truths in their grasp tend to turn dictatorial and tyrannical. Truth usually does not admit any contradictions or imperfections. It is unitarian. It is, therefore, not of much use for poetry. Poetry abides by the plurality of life and existence. Perhaps poetry follows reality which is plural, anachronistic, full of contradictions. Against the tyranny of truth, poetry remains a partisan of democratic reality. Against the arrogance of power, wealth and hierarchy, poetry proposes both humility and defiance.

71. Which one of the following statements best reflects the most logical and rational message conveyed by the above passage?

- (a) It is the poetry, not science or religion, which recognizes and accepts imperfections in humans.
- (b) Truth is revealed through science or religion and poetry is anathema to truth.
- (c) Poetry is romantic, imaginary and is about feeling whereas science and religion are about truth.
- (d) In a world of violence, tyranny and bigotry, poetry is a form of dynamic resistance.

Passage—2

The flower was not invented to please us. It flaunted its petals and spread its perfume to attract an insect. The insect carries the pollen from flower to flower so that pollen is not carried away by wind and thus not wasted. What we call a flower's beauty is merely a by-product and a human invention. The perfume is not there to please us, it pleases us because it is there and we have been conditioned to it.

72. Based on the above passage, the following assumptions have been made :

- 1. The author of the passage believes that flowers are creations of Nature's luxury.
- 2. The author of the passage does not believe in the usefulness of flowers except as things of beauty.

Which of the assumptions given above is/are valid?

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

73. A Question is given followed by two Statements I and II. Consider the Question and the Statements.

Age of each of P and Q is less than 100 years but more than 10 years. If you interchange the digits of the age of P , the number represents the age of Q .

Question :

What is the difference of their ages?

Statement-I :

The age of P is greater than the age of Q .

Statement-II :

The sum of their ages is $11/6$ times their difference.

Which one of the following is correct in respect of the above Question and the Statements?

- (a) The Question can be answered by using one of the Statements alone, but cannot be answered using the other Statement alone
- (b) The Question can be answered by using either Statement alone
- (c) The Question can be answered by using both the Statements together, but cannot be answered using either Statement alone
- (d) The Question cannot be answered even by using both the Statements together

74. A Main Statement is followed by four Statements labelled P , Q , R and S . Choose the ordered pair of the Statements where the first Statement implies the second, and the two Statements are logically consistent with the Main Statement.

Main Statement :

Pradeep becomes either a Director or a Producer.

Statement P : Pradeep is a Director.

Statement Q : Pradeep is a Producer.

Statement R : Pradeep is not a Director.

Statement S : Pradeep is not a Producer.

Select the correct answer.

- (a) SP only
- (b) RQ only
- (c) Both SP and RQ
- (d) Neither SP nor RQ

75. If $a+b$ means $a-b$; $a-b$ means $a \times b$; $a \times b$ means $a \div b$; $a \div b$ means $a+b$, then what is the value of $10 + 30 - 100 \times 50 \div 25$? (Operations are to be replaced simultaneously)

- (a) 15
- (b) 0
- (c) -15
- (d) -25

76. If P means 'greater than ($>$)'; Q means 'less than ($<$)'; R means 'not greater than (\geq)'; S means 'not less than (\leq)' and T means 'equal to ($=$)', then consider the following statements :

1. If $2x(S)3y$ and $3x(T)4z$, then $9y(P)8z$.
2. If $x(Q)2y$ and $y(R)z$, then $x(R)z$.

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

77. If in a certain code, 'ABCD' is written as 24 and 'EFGH' is written as 1680, then how is 'IJKL' written in that code?

- (a) 11880
- (b) 11240
- (c) 7920
- (d) 5940

78. If in a certain code, 'POT' is written as ATOP and 'TRAP' is written as APART, then how is 'ARENA' written in that code?

- (a) AARENA
- (b) AANREA
- (c) AANEAR
- (d) AANERA

79. What will come in place of * in the sequence 3, 14, 39, 84, *, 258?

- (a) 150
- (b) 155
- (c) 160
- (d) 176

80. In some code, letters P, Q, R, S, T represent numbers 4, 5, 10, 12, 15. It is not known which letter represents which number. If $Q - S = 2S$ and $T = R + S + 3$, then what is the value of $P + R - T$?

- (a) 1
- (b) 2
- (c) 3
- (d) Cannot be determined due to insufficient data