2022 - 23

CLASS 12 (PCB)

Please fill the following details immediately

Name _____

Hall Ticket No._____

Questions : 60   **Time : 60 minutes**

INSTRUCTIONS

Read all instructions carefully before attempting any question.

- Ensure that the 'Class' printed here and inside, is the same as the test you are appearing for.
- You must complete the paper within the time allotted.
- Do not open this question paper until you are permitted to.
- You are not allowed to use a calculator.
- Figures herein are not to scale. Hence, you cannot depend on the estimate of size or measurement. Use your knowledge of the subject.
- Rough work shall be carried out only in the space provided for the same throughout this booklet. No separate sheets are allowed for the same.
- Return your answer sheet to the invigilator soon after completion and before leaving the examination hall. Take the question paper with you.
- There is no negative marking.
- Results would be made available on **www.unifiedcouncil.com**

01 Some insecticides are particularly detrimental to ecosystems because they accumulate in the bodies of consumers other than the pests they target. Which of the following fails to explain why this occurs ?

(A) Such insecticides cannot be removed by the kidneys.

(B) Such insecticides are lipid-soluble and thus persist in the fatty tissues.

(C) Such insecticides serve as food sources for certain consumers.

(D) Such insecticides are not broken down by decomposers.

02 It is often suggested that the most energy-efficient method to sustain the human population is for humans to consume more cereals and grains rather than fish and meat. Why might this be the case ?

(A) Cereals and grains are digested a lot more efficiently.

(B) A shorter food chain would be less efficient.

(C) A greater proportion of energy in the ecosystem would be available to humans.

(D) Crop plants would provide more suitable nutrients for humans.

Space for rough work

03 Which of the following processes would lead to an increase in variation among individuals of a population ?

(A) propagation of the species by underground tubers

(B) exchange of chromatid segments during meiosis

(C) independent behaviour of chromosomes during mitotic divisions

(D) drastic change in environmental conditions

04 Which of the following states the most crucial reason for a cell to minimise errors in cell division ?

(A) To maximise the rate of cell division and hence growth

(B) To avoid wasting resources on damaged cells

(C) To minimise time required to reverse errors that arise

(D) To prevent future generation of cells from inheriting mutations that might lead to cancer

05 Tay Sachs disease, which typically causes death in young children by the age of four, is caused by an abnormal allele of a single gene. Which is the most likely reason for why the disease has persisted in the human population ?

(A) The patients pass on their genes to subsequent generations.

(B) It is caused by a dominal allele that is powerful and can be passed on more successfully.

(C) It is caused by a recessive allele that does not show its effect in carriers.

(D) The disease can be transmitted to other individuals via means other than genetic inheritance.

06 What is the relationship between a gene and a chromosome ?

(A) A gene is a unique segment of a chromosome.

(B) A gene is a portion of the chromosome that is repeated many times.

(C) A gene is a unit of inheritance that makes up an entire chromosome.

(D) Multiple chromosomes make up a specific gene.

07 Which of the following best describes 'sister chromatids' ?

(A) Two identical DNA double helices held together at the centromere

(B) Four identical DNA double helices held together at the centromere

(C) A pair of DNA double helices that exchange genetic material with each other during crossing over

(D) a pair of DNA double helices with the same genes but different alleles

08 What is an mRNA sequence that would give this tripeptide: Asp-His-Val ?

(A) CGCCAUCAU   (B) AACACAGUA

(C) GAUCAUGCU   (D) GACCACGUG

Space for rough work

09 Which of the following is a valid comparison between transcription and translation ?

(A) Transcription occurs in the cytoplasm but translation occurs in the nucleus.

(B) Translation occurs more frequently than transcription since all cells require more protein than RNA.

(C) The product of transcription is RNA but the product of translation is protein.

(D) Both transcription and translation requires nucleotides as the main raw materials.

10 Which of the following best describes the function of tRNA in cells ?

(A) To bring suitable amino acids into the nucleus for translation

(B) To match specific amino acids to specific codons.

(C) To pair up anticodons with codons correctly

(D) To catalyse the formation of peptide bonds during translation

Space for rough work

11 A recessive allele is one whose _____ effect is not expressed in a _____ .

(A) genotypic; heterozygote

(B) genotypic; homozygote

(C) phenotypic; heterozygote

(D) phenotypic; homozygote

12 Which of the following processes involve(s) mitosis ?

> 1. Production of new sperm cells
> 2. Propagation of carrot plants by underground roots
> 3. Development of the zygote into an embryo
> 4. Replacement of worn-out muscle tissue

(A) 2 only (B) 3 only

(C) 2, 3 and 4 only (D) 1, 2, 3 and 4

13 Which of the following best describes a 'bivalent'?

(A) a pair of sister chromatids undergoing synapsis and crossing over with each other

(B) a pair of chromosomes undergoing synapsis and crossing over with each other

(C) two homologous chromosomes that align next to each other along the spindle equator

(D) two chromosomes that are being pulled to opposite poles of the spindle during meiosis

Space for rough work

14 Why is meiosis important for living organisms ?

(A) It produces new daughter cells that are genetically identical to the parent cell.

(B) It produces new daughter cells that are highly similar to the parent cell.

(C) It allow organisms to undergo reproduction by sexual means, produce egg and sperm cells.

(D) It produces two daughter cells from every parent cell.

15 Which factor(s) might cause variation in the duration of the menstrual cycle ?

1. Fatigue.
2. Consumption of high-iron foods.
3. Hormonal imbalances.
4. Dietary deficiencies.

(A) 1 only

(B) 2 and 4 only

(C) 1, 3 and 4 only

(D) 1, 2, 3 and 4

Space for rough work

16 Which of the following is the correct order of events in human reproduction ?

(A) Fertilisation → ovulation → implantation → birth

(B) Ovulation → fertilisation → implantation → birth

(C) Fertilisation → birth → implantation → ovulation

(D) Fertilisation → implantation → ovulation → birth

17 The umbilical cord in humans contains

(A) one umbilical artery and one umbilical vein.

(B) one umbilical artery and two umbilical vein.

(C) two umbilical arteries and one umbilical vein.

(D) two umbilical arteries and two umbilical veins.

18 Which structure in a flowering plant is analagous to the testes of an animal ?

(A) Pollen grain   (B) Anther

(C) Filament   (D) Ovary

Space for rough work

19 Which of the following is NOT an example of an enzymatic reaction ?

(A) Break down of proteins into polypeptides in duodenum

(B) Curdling of milk in the stomach

(C) Digestion of cellulose by bacteria

(D) Emulsification of fats

20 Pomato was produced by hybridization of potato and tomato using

(A) Interspecific hybridization

(B) Intergeneric hybridization

(C) Somatic hybridization

(D) Cybridization

21 Identify the odd series.

(A) Endometrium, Graafian follicle, polar body

(B) Spermatocyte, prostate, spermatid, acrosome

(C) Ovaries, vagina, Bartholin's gland, corpus luteum

(D) Vas deferens, fallopian tube, epididymis, Cowper's gland

───────────────(Space for rough work)───────────────

22 In which type of egg, total cleavage is possible ?

(A) Telolecithal   (B) Oligolecithal

(C) Centrolecithal   (D) Macrolecithal

23 How many types of gametes will be produced in F_2 generation of a monohybrid cross of Mendel ?

(A) 3   (B) 4

(C) 8   (D) 16

24 Which of the following is a base analogue ?

(A) Caffeine   (B) Nitrous acid

(C) Colchicine   (D) 5-Bromouracil

25 If the root cell in wheat plant has 42 chromosomes, then the number of chromosomes in the synergid cells is

(A) 14   (B) 28

(C) 42   (D) 21

Space for rough work

26 To what temperature a certain length of silver wire initially at 20° C should be heated so that its resistance becomes twice that at 20° C. Temperature coefficient of resistance of silver at 0° C is 3.8×10^{-3} °C^{-1}.

    (A) 173° C   (B) 255° C

    (C) 303° C   (D) 418° C

27 An alternating e.m.f. 100 cos 100 t volt is connected in series to a resistance of 10 ohm and inductance 100 mH. What is the phase difference between the current in the circuit and the e.m.f ?

    (A) $\dfrac{\pi}{4}$ (B) Zero   (C) π (D) $\dfrac{\pi}{2}$

28 The incorrect statement regarding the lines of force of the magnetic field B is

    (A) Magnetic intensity is a measure of lines of force passing through unit area held normal to it

    (B) Magnetic lines of force form a close curve

    (C) Inside a magnet, its magnetic lines of force move from north pole of magnet towards its south pole

    (D) Due to a magnet, magnetic lines of force never cut each other

────────────(Space for rough work)────────────

29 In a certain region of surface, there exists a uniform electric field of $2 \times 10^3 \, \hat{k}$ V/m. A rectangular coil of dimensions 10 cm × 20 cm is placed in x-y plane. The electric flux through the coil is

(A) zero

(B) 30 V-m

(C) 40 V-m

(D) 50 V-m

30 Imagine an atom is made up of proton and a hypothetical particle of double the mass of electron, but having the same charge as that of electron. Apply the Bohr atom model and consider all possible transitions of this hypothetical particle to the first excited level. The longest wavelength photon that will be emitted has wavelength λ, (given in terms of Rydberg constant R for hydrogen atom) equal to

(A) $\dfrac{9}{5R}$

(B) $\dfrac{36}{5R}$

(C) $\dfrac{18}{5R}$

(D) $\dfrac{4}{R}$

31 A solenoid 30 cm long and 6 cm diameter is made using a copper wire of resistance of 0.01 ohm per m. The total number of turns in the solenoid is 150. The solenoid is connected across a 12 V battery. Find the magnetic field inside the solenoid in Tesla.

(A) 0.0168

(B) 0.0277

(C) 0.0345

(D) 0.0593

Space for rough work

32 If a clear liquid has a refractive index of 1.45 and a transparent solid has an index of 2.90 then, for total internal reflection to occur at the interface between these two media, which of the following must be true ?

	Incident beam originates in the	At an angle of incidence greater than
(A)	Solid	30
(B)	Liquid	30
(C)	Solid	60
(D)	Liquid	60

33 Half-lives of two radioactive substances X and Y are respectively 20 minutes and 40 minutes. Initially, the sample of X and Y have equal number of nuclei. After 80 minutes the ratio of remaining number of X and Y nuclei is

(A) $1:16$

(B) $4:1$

(C) $1:4$

(D) $1:1$

34 Two Nicol-prisms are first crossed and then one of them is rotated through 60°. The percentage of incident light transmitted is :

(A) 50

(B) 25.0

(C) 37.5

(D) 75

Space for rough work

35 Given that $C_1 = 2\,\mu F$, $C_2 = 4\,\mu F$, and $C_3 = 6\,\mu F$, as per the figure shown below.

Calculate the equivalent capacitance for the above combinations in μF.

(A) 1.2

(B) 2.5

(C) 3.8

(D) 4.4

36 An electromagnetic wave of frequency $v = 3.0$ MHz passes through vacuum into a delectric medium with permittivity $\epsilon = 4.0$. Then wavelength

(A) is doubled and the frequency remains unchanged

(B) is doubled and the frequency becomes half

(C) is halved and the frequency remains unchanged

(D) and frequency both remain unchanged

37 If the work function for a certain metal is 3.2×10^{-19} J and it is illuminated with light of frequency $v = 8 \times 10^{14}$ Hz, the maximum kinetic energy of the photoelectron would be

(A) 2.1×10^{-19} J

(B) 3.2×10^{-19} J

(C) 5.3×10^{-19} J

(D) 8.5×10^{-19} J

38 The coil of a moving coil galvanometer is wound over a metal frame in order to

(A) reduce hysteresis

(B) provide electromagnetic damping

(C) increase the moment of inertia

(D) increase the sensitivity

39 A cylinder of radius R and length l is placed in a uniform electric field E parallel to the axis of the cylinder. The total flux over the curved surface of the cylinder is

(A) Zero

(B) $\pi R^2 E$

(C) $2\pi R^2 E$

(D) $E/\pi R^2$

40 Two co-axial solenoids are made by winding thin insulated wire over a pipe of cross-sectional area A = 10 cm² and length = 20 cm. If one of the solenoids has 300 turns and the other 400 turns, their mutual inductance is, ($\mu_0 = 4\times 10^{-7}$ T m A^{-1})

(A) $2.4\pi \times 10^{-4}$ H

(B) $2.4\pi \times 10^{-5}$ H

(C) $4.8\pi \times 10^{-4}$ H

(D) 4.8×10^{-5} H

Space for rough work

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41 The e.m.f. of the cell

Zn | Zn²⁺ (0.01 M) || Fe²⁺ (0.001 M) | Fe at 298 K is
0.2905 volt. Then the value of equilibrium constant for
the cell reaction is

(A) $e^{\frac{0.32}{0.0295}}$

(B) $10^{\frac{0.32}{0.0295}}$

(C) $10^{\frac{0.26}{0.0295}}$

(D) $10^{\frac{0.32}{0.0591}}$

42 a $K_2Cr_2O_7$ + b KCl + c $H_2SO_4 \longrightarrow$ x CrO_2Cl_2 + y $KHSO_4$ + z H_2O

(A) a = 2, b = 4, c = 6 and x = 2, y = 6, z = 3

(B) a = 4, b = 2, c = 6 and x = 6, y = 2, z = 3

(C) a = 6, b = 4, c = 2 and x = 6, y = 3, z = 2

(D) a = 1, b = 4, c = 6 and x = 2, y = 6, z = 3

43 An organic compound A reacts with methyl magnesium iodide to form an addition product which on hydrolysis forms the compound B. Compound B gives blue colour salt in Victor Meyer's test. The compounds A and B respectively are

(A) Acetaldehyde, tertiary butyl alcohol

(B) Acetaldehyde, ethyl alcohol

(C) Acetaldehyde, isopropyl alcohol

(D) Acetone, isopropyl alcohol

44 In the first order reaction, half of the reaction is completed in 100 secs. The time for 99% reaction to occur will be

(A) 664.64 sec.

(B) 646.6 sec.

(C) 660.9 sec.

(D) 654.5 sec.

45 The two isomers X and Y with the formula $Cr(H_2O)_5ClBr_2$ were taken for experiment on depression in freezing point. It was found that one mole of X gave depression corresponding to 2 moles of particles and one mole of Y gave depression due to 3 moles of particles. The structural formulae of X and Y respectively are

(A) $[Cr(H_2O)_5Cl]Br_2; [Cr(H_2O)_4Br_2]Cl.H_2O$

(B) $[Cr(H_2O)_5Cl]Br_2; [Cr(H_2O)_3ClBr_2]2H_2O$

(C) $[Cr(H_2O)_5Br]BrCl; [Cr(H_2O)_4ClBr]Br.H_2O$

(D) $[Cr(H_2O)_4Br_2]Cl.H_2O; [Cr(H_2O)_5Cl]Br_2$

46 A 5% solution (by mass) of cane sugar in water has freezing point of 271 K and freezing point of pure water is 273.15 K. The freezing point of a 5% solution (by mass) of glucose in water is

(A) 271 K

(B) 273.15 K

(C) 269.07 K

(D) 277.23 K

Space for rough work

47 Consider the following reaction sequence :

$$C_4H_6O_4 \xrightarrow{\Delta} C_3H_6O_2 \xrightarrow[\Delta]{\text{Soda-lime}} C_2H_6$$

(A) and (B) respectively are :

(A) $CH_3 - CH(COOH)_2$, CH_3CH_2COOH

(B) $\begin{matrix} CH_2COOH \\ | \\ CH_2COOH \end{matrix}$, $CH_3 - CH_2COOH$

(C) $\begin{matrix} COOCH_3 \\ | \\ COOCH_3 \end{matrix}$, CH_3COOCH_3

(D) $\begin{matrix} COOC_2H_5 \\ | \\ COOH \end{matrix}$, $H - COOC_2H_5$

48 For a reaction $A + 2B \longrightarrow C + D$, the following data were obtained.

	Expt. Initial concentration (moles litre^{-1})		Initial Rate of formation of D (moles litre^{-1} min^{-1})
	[A]	[B]	
1.	0.1	0.1	6.0×10^{-3}
2.	0.3	0.2	7.2×10^{-2}
3.	0.3	0.4	2.88×10^{-1}
4.	0.4	0.1	2.4×10^{-2}

The correct rate law expression will be

(A) Rate = k [A] [B]   (B) Rate = k [A] [B]^2

(C) Rate = k [A]^2 [B]^2 (D) Rate = k [A]^2 [B]

49 Which of the following statements regarding the S_N1 reaction shown by alkyl halide is not correct ?

(A) The added nucleophile plays no kinetic role in S_N1 reaction.

(B) The S_N1 reaction involves inversion of configuration of the optically active substrate.

(C) The S_N1 reaction on the chiral starting material ends up with racemization of the product.

(D) The more stable the carbocation intermediate faster is the S_N1 reaction.

50 Which of the following statements is incorrect ?

(A) Molecular weight of $NaCl$ found by osmotic pressure measurements is half of the theoretical value.

(B) Molecular weight of CH_3COOH in benzene found by cryoscopic methods is double of the theoretical value.

(C) Osmotic pressure 0.1 M glucose solution is half of that of 0.1 M $NaCl$ solution

(D) Molecular weight of HCl found by any colligative property will be same in the aqueous solution and benzene solution.

51 Number of electrons transferred in each case when $KMnO_4$ acts as an oxidising agent to give MnO_2, Mn^{2+}, $Mn(OH)_3$ and MnO_4^{2-} are respectively.

(A) 3, 5, 4 and 1

(B) 4, 3, 1 and 5

(C) 1, 3, 4 and 5

(D) 5, 4, 3 and 1

OLYMPIADS

52 Identify the set of reagent/reaction conditions 'X' and 'Y' in the following set of transformations :

$$CH_3 - CH_2 - CH_2Br \xrightarrow{\ X\ } Product \xrightarrow{\ Y\ } CH_3 - \underset{\underset{Br}{|}}{CH} - CH_3$$
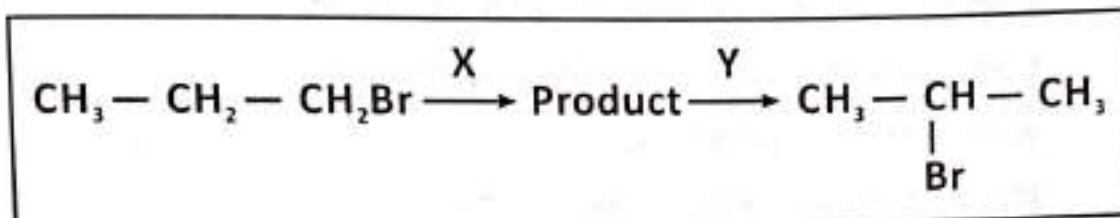
(A) X = dilute aqueous NaOH, 20° C ;

   Y = HBr/acetic acid, 20° C

(B) X = concentrated alcoholic NaOH, 80° C ;

   Y = HBr/acetic acid, 20° C

(C) X = dilute aqueous NaOH, 20° C ;

   Y = Br$_2$ / CHCl$_3$, 0° C

(D) X = concentrated alcoholic NaOH, 80° C ;

   Y = Br$_2$ / CHCl$_3$, 0° C

53 The half-cell reactions for rusting of iron are

$2H^+ + \frac{1}{2}O_2 + 2e^- \longrightarrow H_2O$, E° = + 1.23 V

$Fe^{2+} + 2e^- \longrightarrow Fe\,(s)$, E° = – 0.44 V
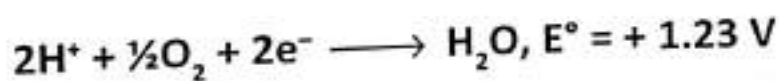
$\Delta G°$ (in kJ) for the reaction is

(A) –76   (B) –322

(C) –122   (D) –176

———{ **Space for rough work** }———

54 P, Q and R are three complexes of chromium (III) with the empirical formula $H_{12}O_6Cl_3Cr$. All the three complexes have water and chloride ion as ligands. Complex P does not react with concentrated H_2SO_4, whereas complexes Q and R lose 6.75% and 13.5% of their original weight respectively, on treatment with concentrated H_2SO_4. Identify P, Q and R.

(A) P is $[Cr(H_2O)_6]Cl_3$, Q is $[Cr(H_2O)_5Cl]Cl_2.H_2O$, R is $[Cr(H_2O)_4Cl_2].Cl_2H_2O$

(B) P is $[Cr(H_2O)_6]Cl_3$, Q is $[Cr(H_2O)_4Cl_2].Cl.2H_2O$, R is $[Cr(H_2O)_5Cl_2].Cl.H_2O$

(C) P is $[CrCl_3(H_2O)_3].3H_2O$, Q is $[Cr(H_2O)_5 Cl]Cl_2.H_2O$, R is $[Cr(H_2O)_4Cl_2].Cl.2H_2lO$

(D) Both (A) and (B)

55 Which of the following reaction can produce R – CO – Ar ?

(A) $ArCOCl + H-Ar \xrightarrow{AlCl_3}$

(B) $RCOCl + ArMgX \longrightarrow$

(C) $ArCOCl + RMgX \longrightarrow$

(D) $RCOCl + H-Ar \xrightarrow{AlCl_3}$

Space for rough work

56 There are two components to this question.

1. A grid which describes the function of a series of switches.

2. A flowchart showing: input - switches - output.

Each of the switches acts to alter the input before the next switch in the series.

Switch	Function	Fault	Code
✗	Allows all colours to pass	Allows only red to pass	A
Ω	Allows only red & yellow to pass	Allows only green & blue to pass	B
)(	Turns on red & green	Turns on yellow & blue	C
⌘	Toggles all colours	Toggles red & blue	D
	No Faults		E

This grid shows four switches and their effect on four coloured inputs which may be either on or off.

[R] - Red   [Y] - Yellow   [G] - Green   [B] - Blue   [ ] = on   [ ] = off

Which switch is showing a fault ?

(A) A   (B) B

(C) C   (D) D

57 Read the passage and answer the following question.

Up until recently, the village of ramdegi was bustling farming community in central India's famous Tiger Reserve. Today, the village's human population stands at exactly zero. As part of an on-going effort to reduce human conflict with wildlife, the Indian government has been encouraging communities living in and around nature reserves to relocate for the sake of peaceful coexistence. Last month, everyone in Ramdegi did just that: some 200 families agreed to accept incentive packages and move beyond the reserve's borders, freeing the land to be reclaimed by the surrounding biodiversity.

A little over a month after the last human departed, Ramdegi is now home to herds of deer, antelope and boars - grazing on the meadows that were once cropland and cattle farms. Even a tiger has been spotted prowling the grounds of the empty village, free from dangerous and often deadly conflicts with humans that have driven the species to "endangered" status.

Which one of the following is an assumption made by the author in the second paragraph ?

(A) Humans can be violent towards animals

(B) Tigers are quiet animals

(C) Tigers usually kill humans

(D) Humans are considerate of wildlife

Space for rough work

58 Which shape can be assembled using all of the individual shapes shown ?

(A)

(B)

(C)

(D)
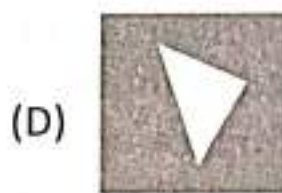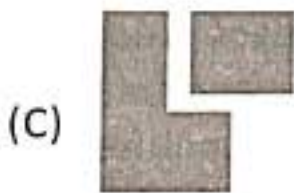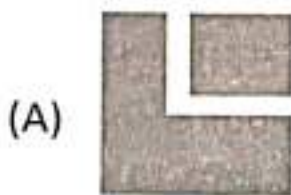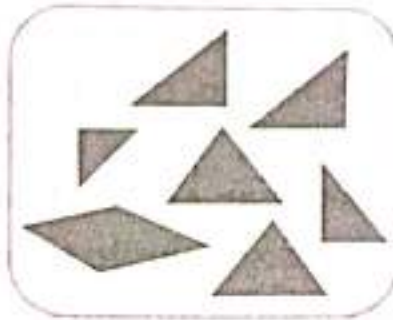
59 Which option is true for the given statements ?

Statements:

1. M is brother of Kiran and Trisha is sister of Kiran.

2. Kiran's mother is married to Janu's husband who has one son and two daughters.

(A) I alone is sufficient while II alone is not sufficient

(B) II alone is sufficient while I alone is not sufficient

(C) Either I or II is sufficient

(D) Neither I nor II is sufficient

Space for rough work

60 Read the Passage carefully and answer the following question.

We are tempted to assume that technological progress is the real progress and that material success is the criterion of civilisation. If the eastern people become fascinated by machines and techniques and use them as western nations do, to build industrial organisations and large military establishments, they will get involved in power politics and drift into the danger of death. Scientific and technological civilization brings opportunities and great rewards but also great risks and temptations. If machines get into the saddle, all our progress will have been in vain. The problem facing us is a universal one. Both east and west are threatened with the same danger and face the same destiny. Science and technology are neither good nor bad. They are not to be tabooed but tamed and assigned their proper place. They become dangers only if they become idols.

Which of the following statements is are true in the context of the passage ?

1. Science and technology are neither good nor bad.

2. Through machines, man can achieve all progress.

3. Science and technology bring great risks and temptations.

(A) 1 and 2

(B) 1 and 3

(C) 2 and 3

(D) 1, 2 and 3

Space for rough work