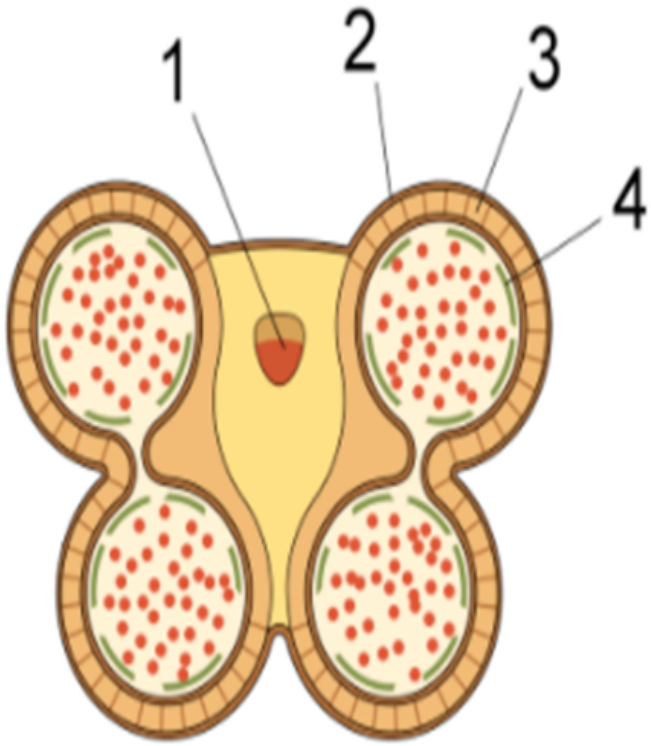
Biology - Section A

1.

In the given diagram showing T.S. of a typical angiosperm anther, the cells of which part are most likely to undergo mitosis, that is not normal, due to which many of them become bi or multinucleate?



1. 1
2. 2
3. 3
4. 4

2.

Identify the option where the term regarding a typical angiosperm ovule is not correctly described:

1.	Anatropous	The micropyle faces the placenta.
2.	Nucellus	After fertilization, it may develop into the endosperm that feeds the embryo.
3.	Integuments	Develop into the seed coat when the ovule matures after fertilization.
4.	Micropyle	Opening that allows a male gametophyte to enter the ovule for fertilization.

3.

Double fertilization, a characteristic feature of angiosperms, was discovered independently by Sergei Nawaschin and Léon Guignard. in France. It involves the joining of a female gametophyte with two male gametes. In double fertilization, the maternal contribution to the genetic constitution of the endosperm is:

1. same that of the embryo
2. double that of the embryo
3. triple that of embryo
4. quadruple that of embryo

4.

Plant species pollinated by water fall into two categories:
(i) Those that distribute their pollen to the surface of water, and
(ii) Those that distribute their pollen beneath the surface of water
The correct examples of the two categories will be:

	(i)	(ii)
1.	*Vallisneria*	Sea grasses
2.	Water hyacinth	Sea grasses
3.	Sea grasses	Water lily
4.	Sea grasses	*Vallisneria*

5.

Given below is the photograph of a Judean date palm [Phoenix dactylifera] nicknamed Methuselah at Ketura, Israel. The primary reason for the fame of this plant is that:

1. It is the first plant whose entire genome has been sequenced.
2. It is the only type of date palm capable of growing outside the Middle East.
3. This plant is the oldest verified human-assisted germination of a seed.
4. It is a genetically modified plant enriched with Vitamin A.

6.

The menstrual cycle in human females involves two cycles - the ovarian cycle and the uterine cycle. While the ovarian cycle describes changes that occur in the follicles of the ovary, the uterine cycle describes changes in the endometrial lining of the uterus. The term that will be descriptive of a phase in the ovarian cycle but not the uterine cycle is:

1. Menstruation
2. Luteal phase
3. Proliferative phase
4. Secretory phase

7.

The hypothalamus and the pituitary gland mainly control the menstrual cycle. A series of physiological and anatomical processes of puberty culminates in menarche. Which of the following is the most important causal reason for the onset of puberty?

1. The release of pulses of GnRH by the hypothalamus
2. The release of gonadotropins by the anterior pituitary
3. Inhibition of GnRH due to increase in circulating gonadotropins
4. Secretion of estrogen by the ovaries in response to pituitary hormones

8.

The testes descend into the scrotum during the foetal life. Undescended testes are associated with reduced fertility. Which of the following, if true, will explain normal fertility in descended testes?

1. About 80% of undescended testes descend by the first year of life.
2. Most such cases are actually anorchia – an absence of testes.
3. The temperature of testes in the scrotum is at least a few degrees cooler than in the abdomen.
4. There is a high rate of anomalies of the epididymis in boys with undescended testes.

9.

Leydig cells, found adjacent to the seminiferous tubules in the testicle, secrete their hormones when stimulated by:

1. Androgens
2. LH
3. FSH
4. GnRH

10.

Normal human semen has pH of 7.2 to 8.0. This pH is vital because:

1. The normal environment of the vagina is very acidic.
2. The mucus in cervix has antibodies against sperms.
3. Calcium ions present in semen are functional in alkaline pH.
4. The male genital tract lacks any protective layers.

11.

Consider the given two statements:

I. Secretion of androgen-binding protein (ABP) by Sertoli cells is very important for effective spermatogenesis.

II. Testosterone is required in large local concentrations to maintain the process.

1. Both I and II are correct and II explains I.
2. Both I and II are correct but II does not explain I.
3. Only I is correct.
4. Both I and II are incorrect

12.

The human placenta apart from playing critical roles in facilitating nutrient, gas and waste exchange between the physically separate maternal and fetal circulations, is an important endocrine organ as well. The functions of which of the following placental hormones are most similar to the functions of luteinizing hormone.

1. hCG
2. Progesterone
3. Insulin
4. hPL

13.

Assisted reproductive technology (ART) has been defined as all treatments or procedures that include the in vitro handling of both human oocytes and sperm, or embryos, for the purpose of establishing a pregnancy. Which of the following, thus, should not be included in ART?

1. In-vitro fertilization
2. Embryo transfer
3. Gamete intra-fallopian transfer
4. Artificial insemination

14.

Consider the given two statements:

I. The term sexually transmitted infection is generally preferred over sexually transmitted disease or venereal disease.

II. There is often shame and stigma associated with Sexually Transmitted diseases.

1. Both I and II are correct and II explains I.
2. Both I and II are correct but II does not explain I.
3. Only I is correct.
4. Both I and II are incorrect

15.

A 2020 [estimate] of demography of India shows:

(a) Birth rate: 18.2 births/1,000 population

(b) Death rate: 7.3 deaths/1,000 population

What would be the growth rate of Indian population according to this 2020 estimate?

1. 0.97 %
2. 1.1 %
3. 1.7 %
4. 2.1 %

16.

Given below [A – E] are suggested causes for the genetic diseases. Select the cause as your answer for the given disease.

A. A single nucleotide mutation results in a polar amino acid being substituted by a non-polar amino acid in the polypeptide.

B. Autosomal recessive inborn error of metabolism where mutation renders a key enzyme involved in amino acid metabolism non-functional.

C. X-linked recessive condition is more common in males than in females.

D. Caused by a primary autosomal non-disjunction event.

E. Caused by a non-disjunction event in sex chromosomes in either of the sexes.

Red-green colour blindness:

1. A
2. B
3. C
4. D

17.

Given below [A – E] are suggested causes for the genetic diseases. Select the cause as your answer for the given disease.

A. A single nucleotide mutation results in a polar amino acid being substituted by a non-polar amino acid in the polypeptide.

B. Autosomal recessive inborn error of metabolism where mutation renders a key enzyme involved in amino acid metabolism non-functional.

C. X-linked recessive condition is more common in males than in females.

D. Caused by a primary autosomal non-disjunction event.

E. Caused by a non-disjunction event in sex chromosomes in either of the sexes.

Sickle cell anaemia:

1. A
2. B
3. C
4. D

18.

Given below [A – E] are suggested causes for the genetic diseases. Select the cause as your answer for the given disease.

A. A single nucleotide mutation results in a polar amino acid being substituted by a non-polar amino acid in the polypeptide.
B. Autosomal recessive inborn error of metabolism where mutation renders a key enzyme involved in amino acid metabolism non-functional.
C. X-linked recessive condition is more common in males than in females.
D. Caused by a primary autosomal non-disjunction event.
E. Caused by a non-disjunction event in sex chromosomes in either of the sexes.

Klinefelter's syndrome:
1. A
2. B
3. D
4. E

19.

Given below [A – E] are suggested causes for the genetic diseases. Select the cause as your answer for the given disease.

A. A single nucleotide mutation results in a polar amino acid being substituted by a non-polar amino acid in the polypeptide.
B. Autosomal recessive inborn error of metabolism where mutation renders a key enzyme involved in amino acid metabolism non-functional.
C. X-linked recessive condition is more common in males than in females.
D. Caused by a primary autosomal non-disjunction event.
E. Caused by a non-disjunction event in sex chromosomes in either of the sexes.

Phenylketonuria:
1. A
2. B
3. C
4. D

20.

Given below [A – E] are suggested causes for the genetic diseases. Select the cause as your answer for the given disease.

A. A single nucleotide mutation results in a polar amino acid being substituted by a non-polar amino acid in the polypeptide.
B. Autosomal recessive inborn error of metabolism where mutation renders a key enzyme involved in amino acid metabolism non-functional.
C. X-linked recessive condition is more common in males than in females.
D. Caused by a primary autosomal non-disjunction event.
E. Caused by a non-disjunction event in sex chromosomes in either of the sexes.

Down's syndrome:
1. A
2. B
3. D
4. E

21.

Human skin colour is a polygenic trait. What proportion of progeny in a mating between a male with the genotype AaBbCC and a female with the genotype AaBbCc will have the genotype AABBcc?
1. 0
2. 6/64
3. 15/64
4. 20/64

22.

In humans born with sex chromosome aneuploidies, the sex of the affected individual is determined:
1. usually by the X/A ratio
2. always by the presence or the absence of Y chromosome
3. always by the presence of two X chromosomes in a female and only one X chromosome in a male
4. by the development of the secondary sexual characters at the onset of puberty

23.

Match each item in Column I with one in Column II and select your answer from the codes given:

	Column I		**Column II**
A	Stage at which more percent of angiosperms shed their pollen	P	3-celled
B	Pollen grains lose viability within 30 minutes of their release in	Q	2-celled
C	Persistent endosperm	R	Some cereals
		S	Some members of Rosaceae
		T	Coconut
		U	Groundnut

Codes:

	A	B	C
1.	P	S	U
2.	P	R	T
3.	Q	R	T
4.	Q	S	U

24.

In strawberry:
I. The fruit is actually not a berry
II. Fleshy part is derived from ovaries
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

25.

In a typical dihybrid cross [assuming independent assortment] the ratio of recombinants produced in the F2 generation is typically:
1. 1 : 1
2. 3 : 1
3. 1 : 1 : 1 : 1
4. 9 : 3 : 3 : 1

26.

A virus that infects and replicates within bacteria and archaea is called as a Bacteriophage. Bacteriophage lambda, discovered by Lederberg, infects Escherechia coli, has a temperate life cycle and its genome is:
1. single-strand linear DNA
2. single-strand linear RNA
3. double-strand circular DNA
4. double-strand linear DNA

27.

A DNA, B DNA and Z DNA are the three DNA conformations believed to be found in nature. Watson and Crick model describes the B DNA believed to be predominant in cells. Given below are structural features of this form of DNA. Identify the one that is not correctly matched.

1.	Helix sense	Right-handed
2.	Rotation/base pair	60^0
3.	Pitch	3.4 nm
4.	Diameter	2.0 nm

28.

In Meselson and Stahl experiment, DNA extracted from the culture, one generation after the transfer from 15N to 14N medium, had a hybrid or intermediate density. With each subsequent round of replication, the percentage of hybrid or intermediate-density DNA molecules extracted from the culture:

1. will remain same
2. will get reduced by half
3. will get increased by half
4. will get doubled

29.

As opposed to DNA replication, transcription:

I. results in an RNA complement that includes the nucleotide uracil (U) in all instances where thymine (T) would have occurred in a DNA complement.

II. creates complementary RNA in 3' – 5' direction

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

30.

The mRNA codon 5' – UGG – 3' codes for the amino acid tryptophan. The sequence of bases in the anticodon of the corresponding charged tRNA molecule will be:

1. 3' – CCT – 5'
2. 3' – CCA – 5'
3. 5' – CCA – 3'
4. 5' – CCT – 3'

31.

Degeneracy of genetic code means redundancy of the genetic code. The codons encoding one amino acid may differ:

1. only in the first position
2. only in the second position
3. only in the third position
4. in any of their three positions

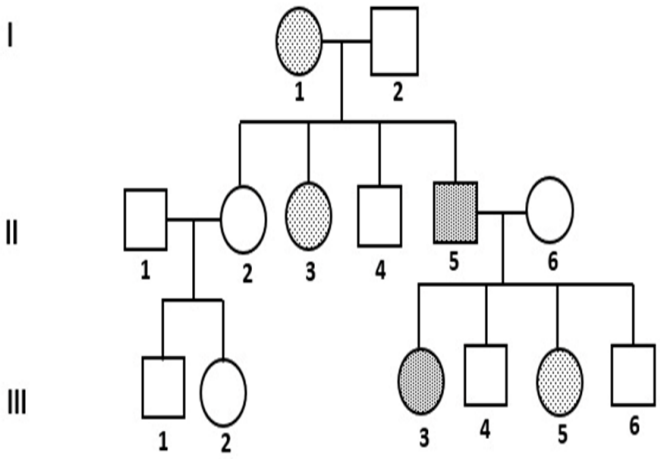
32.

All the following can be seen/observed in a live human foetus at age of 20 weeks except:

1. Heart sounds can be heard through a stethoscope
2. External genital organs are well developed
3. Limbs and digits are developed
4. Eye-lids separate and eyelashes are formed

33.

Study the pedigree given below where filled symbols are individuals affected by a sex-linked dominant genetic disorder:



Which of the following most strongly supports the mode of inheritance given?

1. The progeny of II-1 and II-2 are not affected
2. All female progeny of II-5 are affected
3. 50% male and 50% female progeny of I-1 and I-2 are affected
4. The disorder is seen in all generations

34.

Consider the given two statements:

I. The type of regulation that the lac operon undergoes is referred to as negative inducible.

II. The operon is turned off by the regulatory factor (lac repressor) unless some molecule (lactose) is added.

1. Both I and II are correct and II explains I.
2. Both I and II are correct but II does not explain I.
3. Only I is correct.
4. Both I and II are incorrect

35.

Only two people have twice won the Nobel Prize in the same category. One was John Bardeen in Physics and the other in Chemistry. Identify this other person whose contributions are listed below:
(i) for his work on the structure of proteins, especially that of insulin
(ii) for contributions concerning the determination of base sequences in nucleic acids [genome sequencing]
1. Linus Pauling
2. Marie Curie
3. Paul Berg
4. Frederick Sanger

Biology - Section B

36.

One day in 1910, American geneticist Thomas Hunt Morgan peered through a hand lens at a male fruit fly, and he noticed it didn't look right. Instead of having the normally brilliant red eyes of wild-type *Drosophila melanogaster*, this fly had white eyes. Morgan was particularly interested in how traits were inherited and distributed in developing organisms, and he wondered what caused this fly's eyes to deviate from the norm. Morgan's fly lab at Columbia University was already in the habit of breeding Drosophila so that the researchers there could observe the transmission of genetic traits through successive generations, so Morgan chose to do a simple breeding analysis to find out more about white eyes. Little did Morgan know that, with this white-eyed fly, he was about to confirm the chromosome theory. In doing so, Morgan would also be the first person to definitively link the inheritance of a specific trait with a particular chromosome.

He first performed a cross between the white-eyed male fly and several purebred, red-eyed females and all F1 progeny were red-eyed. Morgan then crossed males and females from the F1 generation.
What was unusual regarding the results he got in the F2 generation?
1. None of the flies had white eyes
2. The ratio did not come out to be 3:1
3. All of Morgan's white-eyed F2 flies were male
4. None of the F2 males had red eyes

37.

Based on paragraph in Question 36, please answer the following:

Morgan was curious as to why female flies never had white eyes, and he considered several possible reasons for this phenomenon. One potential explanation was that white eyes were lethal in female flies. Which of the following crosses will help in refuting this hypothesis?
1. white-eyed male fly X purebred, red-eyed females
2. white-eyed male fly X heterozygous F1 red-eyed females
3. red-eyed male fly X purebred, red-eyed females
4. red-eyed male fly X heterozygous F1 red-eyed females

38.

Based on paragraph in Question 36, please answer the following:

Morgan conducted a final cross that led to the conclusion that the eye colour trait in Drosophila is located on the X chromosome. Which of the following crosses did he raise to come to this conclusion?

1. white-eyed male fly X purebred, red-eyed females
2. white-eyed male fly X heterozygous F1 red-eyed females
3. red-eyed male fly X white-eyed females
4. white-eyed male fly X white-eyed females

39.

Based on paragraph in Question 36, please answer the following:

Now you know that eye colour trait is linked to X chromosome in Drosophila and red eye trait is dominant to white eye. What percent of male offspring of a cross between a pure bred, red-eyed female fruit fly and a white-eyed male will have white eyes?

1. 100
2. 50
3. 25
4. 0

40.

Based on paragraph in Question 36, please answer the following:

Which scientist, who worked throughout his career with Morgan, discovered the principle of genetic mapping?

1. Alfred Sturtevant
2. George Beadle
3. Bateson and Punnett
4. Hugo de Vries

41.

It has been observed that the flowers of plants pollinated by birds usually do not produce odour. Which of the following, if true, will most strongly support the observation?

1. Birds are diurnal
2. Flowers are coloured usually red or orange
3. Birds have a poor sense of smell.
4. Birds have beaks and can reach the nectar easily

42.

A temporary structure in the female ovaries called as corpus luteum secretes mainly progesterone but also some estradiol and inhibin A. What hormone, needed by corpus luteum to maintain itself, is actually suppressed by the hormones secreted by it and causes the degeneration of corpus luteum to corpus albicans?

1. Follicle stimulating hormone
2. Gonadotropin releasing hormone
3. Relaxin
4. Luteinizing hormone

43.

Consider the given statements:

I. Primary oocyte begins meiosis I embryonic development, but gets arrested in the diplotene stage of prophase I until puberty.

II. Immediately after meiosis I, the haploid secondary oocyte initiates meiosis II but gets arrested at metaphase II stage until fertilization, if such should ever occur.

III. If the secondary oocyte is not fertilized it does not complete meiosis II and doesn't become an ovum.

1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

44.

For fertilization to occur, the sperm is guided to the oocyte present in the ampulla of the oviduct by:

1. Progesterone secreted by the cells surrounding the oocyte
2. Estrogen secreted by the cells surrounding the oocyte
3. Prostaglandins present in the semen
4. Calcium ions released by the zona pellucida and acrosome

45.

Emergency contraception refers to methods of contraception that can be used to prevent pregnancy after sexual intercourse. These are recommended for use within 5 days but are more effective the sooner they are used after the act of intercourse. Methods of emergency contraception are the copper-bearing intrauterine devices (IUDs) and the emergency contraceptive pills (ECPs).
The copper-bearing IUD acts primarily by:
1. Preventing fertilization
2. Preventing ovulation
3. Preventing implantation
4. Inducing abortion

46.

In 1928, Frederick Griffith in a series of experiments with Streptococcus pneumoniae, discovered:
I. Bacterial transformation
II. Bacterial transformation is a permanent genetic change
III. Transforming principle is DNA
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

47.

The RNA world is a hypothetical stage in the evolutionary history of life on Earth, in which self-replicating RNA molecules proliferated before the evolution of DNA and proteins. The properties of RNA make the idea of the RNA world hypothesis conceptually plausible and include:
I. RNA is known to form efficient catalysts
II. Its similarity to DNA makes clear its ability to store information
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

48.

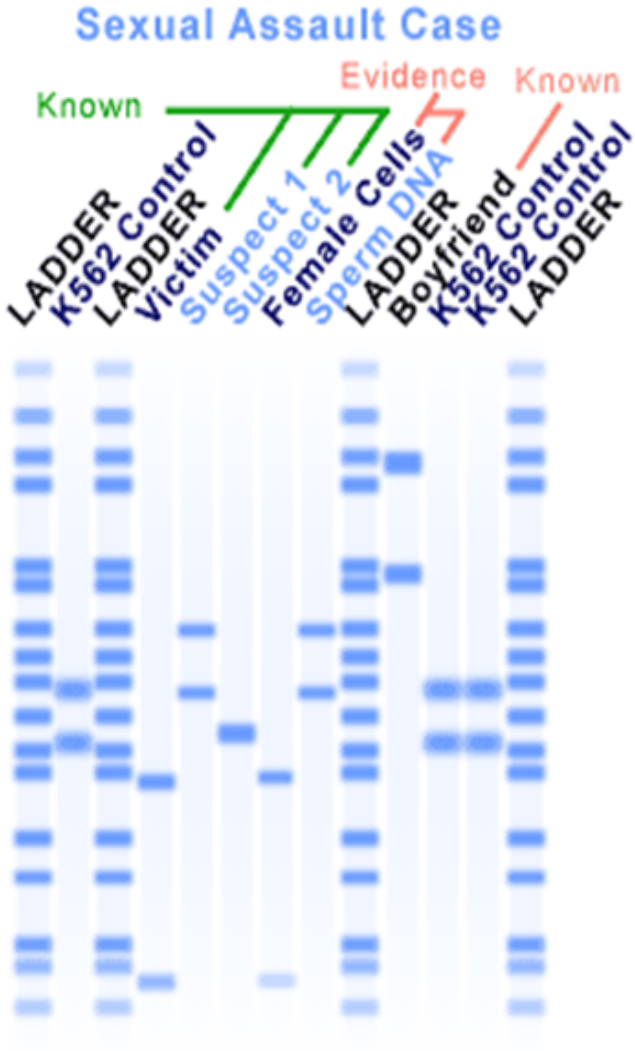
Consider the given statements regarding replication of DNA:
I. DNA is read by DNA polymerase in the 5′ to 3′ direction, meaning the new strand is synthesized in the 3' to 5' direction.
II. The leading strand is the strand of new DNA that is synthesized in the same direction as the growing replication fork.
III. The lagging strand is the strand of new DNA whose direction of synthesis is opposite to the direction of the growing replication fork.
1. Only I and II are correct
2. Only I and III are correct
3. Only II and III are correct
4. I, II and III are correct

49.

The following question is based on a sexual assault case where DNA fingerprinting was used to identify the perpetrator of the crime. DNA samples were taken from:

(a) crime scene
(b) the female victim
(c) two suspects
(d) the victim's boyfriend

Who is likely to be the criminal [ignore ladder and control]?



1. Suspect 1
2. Suspect 2
3. The boyfriend
4. None of them

50.

Match scientists in Column I with their contributions in Column II and select the correct match from the codes given:

	Column I		**Column II**
A.	Georges Gamow	P	First scientist to chemically synthesize oligonucleotides - the world's first synthetic gene
B.	Hargobind Khorana	Q	Discovery of mechanisms in the biological synthesis of RNA and DNA, his lab discovered polynucleotide phosphorylase
C.	Severo Ochoa	R	Proposed the concept of a genetic code and maintained that the code was determined by the order of recurring triplets of nucleotides
D.	Marshall Nirenberg	S	The first step in deciphering the codons of the genetic code and the first demonstration of messenger RNA, using cell-free extracts of *E.coli*

Codes:

	A	B	C	D
1.	P	R	Q	S
2.	P	R	S	Q
3.	R	P	Q	S
4.	R	P	S	Q

Chemistry - Section A

51.

Generally water soluble vitamins i.e. B and C cannot be stored in our body except which of the following vitamins:

1. Vitamin B_1
2. Vitamin B_6
3. Vitamin B_{12}
4. Vitamic C

52.

1 mole NaCl is mixed with 6 mole of H_2O. As a result, relative lowering in vapour pressure is observed to be 0.2. In these conditions, percentage ionisation of NaCl will be

1. 25
2. 50
3. 75
4. 100

53.

In aqueous medium, $K_4[Fe(CN)_6]$ is 40% dissociated. The value of van't Hoff factor (i) for $K_4[Fe(CN)_6]$ will be:

1. 5
2. 3.6
3. 2.6
4. 2

54.

How many end centered unit cells are present in all bravais lattice ?

1. 1
2. 2
3. 3
4. 4

55.

On hydrolysis, which one of the following gives a base as one of the products ?

1. NF_3
2. NCl_3
3. PCl_3
4. BCl_3

56.

Which compound can react with Na as well as NaOH but not with $NaHCO_3$?

1. Ethanol
2. Picric acid
3. Carbolic acid
4. Ethyne

57.

The boiling point of an aqueous solution is $102^{\circ}C$. The freezing point of this solution will be $(\text{Given: } K_b = 0.52\ k/m\ ,\ K_f = 1.86\ k/m)$

1. $-3.58^{\circ}C$
2. $-7.15^{\circ}C$
3. $-1.86^{\circ}C$
4. $3.58^{\circ}C$

58.

If an optically active alkyl halide is reacted with nucleophile through S_N1 mechanism then which of the following statement is correct ?

1. 100% racemisation takes place

2. Maximum racemisation with partial inversion takes place

3. Maximum inversion with partial racemisation takes place

4. 100% inversion takes place

59.

A compound $C_4H_{10}O\ (x)$ can react with sodium. On vigorous oxidation, the compound gives a carboxylic acid $C_4H_8O_2\ (y)$. The compound (x) can be

1. Ether

2. $3^\circ\ Alcohol$

3. $2^\circ\ Alcohol$

4. $1^\circ\ Alcohol$

60.

Match the items of coloumn- I with items of coloumn II

Coloumn I	Coloumn II
A. Kolbe's reaction	1. Heated copper at 573 K
B. Reimer-Tiemann reaction	2. Conversion of phenol to salicylic acid
C. Williamson's synthesis	3. conversion of phenol to salicylaldehyde
D. Conversion of 2° alcohol to ketone	4. Reaction of alkyl halide with sodium alkoxide

1. A-3 , B-1 , C-4 , D-2

2. A -2 , B-3 , C-4 , D-1

3. A-4 , B-3 , C-2 , D-1

4. A-1 , B-2, C-3 , D-4

61.

The correct order of boiling point of the hydrides of 15^{th} group is :

1. $NH_3 > BiH_3 > SbH_3 > AsH_3 > PH_3$

2. $BiH_3 > NH_3 > SbH_3 > AsH_3 > PH_3$

3. $BiH_3 > SbH_3 > NH_3 > AsH_3 > PH_3$

4. $BiH_3 > SbH_3 > AsH_3 > NH_3 > PH_3$

62.

In esterification reaction, H^+ ion attacks on

1. oxygen atom of alcohol

2. doubly bonded oxygen atom of carboxylic acid

3. singly bonded oxygen atom of carboxylic acid

4. Any of the oxygen atom

63.

Which is not the product of hydrolysis of XeF_6 ?

1. XeO_3

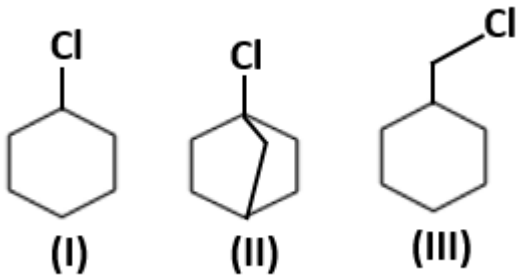
2. XeO_2F_2

3. $XeOF_4$

4. $XeOF_2$

64.

The correct order of reactivity of S_N1 reaction for the following compound will be:



1. II > I > III
2. III > II > I
3. I > II > III
4. I > III > II

65.

When an optically active alcohol is reacted with thionyl chloride then alkyl chloride is formed . In this reaction

1. 100% inversion of configuration takes place
2. 100% retention of configuration takes place
3. Racemic mixture is formed
4. Meso mixture is formed

Chemistry - Section B

66.

Amylopectin is a branched chain polymer of $\alpha - D$ glucose units in which chain is formed by C1-C4 glycosidic linkage while branching occurs by

1. C2-C5 glycosidic linkage
2. C1-C5 gycosidic linkage
3. C1-C6 glycosidic linkage
4. C2-C6 glycosidic linkage

67.

Insulin is a type of protein. How many amino acids form Insulin ?

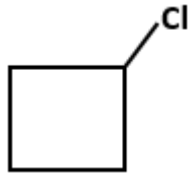
1. 21
2. 31
3. 41
4. 51

68.

When sodium thiosulphate is reacted with I_2 , then the product of sulphur will be:

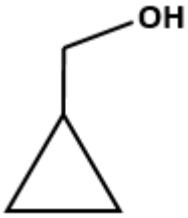
1. Na_2SO_3
2. Na_2SO_4
3. $Na_2S_4O_6$
4. SO_2

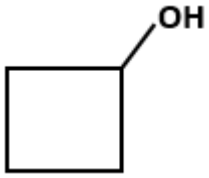
69.

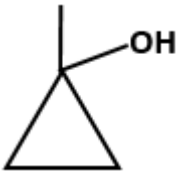


$KOH \xrightarrow{S_N1} A\ (Major)^{+}, \left(aqueous\right)$

A in the above reaction is:

1. 

2. 

3. 

4. $CH_2 = \overset{CH_3}{\underset{|}{C}} - CH_2 - OH$

70.

Ethane is reacted with Cl_2 in presence of sunlight. Number of halogenated alkanes possible out of this reaction are

1. 6
2. 7
3. 8
4. 9

71.

Assertion : Mixture of nitric acid and water forms maximum boiling azeotropes

Reason : Interaction between nitric acid and water is stronger than the interaction between nitric acid and nitric acid or water and water

1. Both assertion and reason are true, and reason is the correct explanation of the assertion
2. Both assertion and reason are true, but reason is not correct explanation of the assertion
3. Assertion is true but reason is false
4. Both assertion and reason are false

72.

Assertion : On hydrolysis, PCl_3 produces a dibasic oxyacid of phosphorous

Reason : H_3PO_2 is a dibasic acid

1. Both assertion and reason are true, and reason is the correct explanation of the assertion
2. Both assertion and reason are true, but reason is not correct explanation of the assertion
3. Assertion is true but reason is false
4. Both assertion and reason are false

73.

Read the passage and answer the following questions .

In the unit cell of sodium chloride, sodium ions (Na^+) are present on all edges and body of the cube. Chloride ions (Cl^-) are present on all corners and faces of the cube

A body diagonal line is placed in the unit cell of sodium chloride and all the ions are removed which are touching to body diagonal line. The simplest formula of sodium chloride after removing the ions will be

1. Na_2Cl
2. NaCl
3. Na_4Cl_5
4. Na_2Cl_3

74.

Based on paragraph in Question 73, please answer the following:

A tetrad axis (an axis on which if the structure is rotated by 90^0, identical structure is obtained) is placed in the unit cell of sodium chloride. All the ions are removed which are touching to tetrad axis. The simplest formula of sodium chloride after removing the ions will be

1. Na_2Cl
2. NaCl
3. Na_4Cl_5
4. $NaCl_2$

75.

Based on paragraph in Question 73, please answer the following:

Number of Na^+ ions and Cl^- ions present in one unit cell are, respectively

1. 6, 4
2. 8, 8
3. 4, 4
4. 4, 6

Physics - Section A

76.

A resistor of 40Ω is connected to the secondary of a step-down transformer, with an input voltage of 200 V and an output of 20 V across the secondary.
The resistance as seen in the primary circuit is: (ignoring power losses)

1. 40 Ω
2. 4 Ω
3. 0.4 Ω
4. 4 kΩ

77.

A wire carrying a current I_o oriented along the vector $\left(3\hat{i}+4\hat{j}\right)$ experiences a force per unit length of $\left(4F\hat{i}-3F\hat{j}-F\hat{k}\right)$. The magnetic field $\overrightarrow{B}$ equals

1. $\frac{F}{I_o}\left(\hat{i}+\hat{j}\right)$
2. $\frac{5F}{I_o}\left(\hat{i}+\hat{j}+\hat{k}\right)$
3. $\frac{F}{I_o}\left(\hat{i}+\hat{j}+\hat{k}\right)$
4. $\frac{5F}{I_o}\hat{k}$

78.

A solid sphere carrying a uniformly distributed charge q within its volume rotates about a diameter (= 2r). So that the speed on its equator is v

The electric field at the outer surface of the sphere is:

1. $\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$
2. $\frac{1}{4\pi\varepsilon_0}\frac{q}{3r^2}$
3. $\frac{1}{4\pi\varepsilon_0}\frac{q}{2r^2}$
4. $\frac{1}{4\pi\varepsilon_0}\frac{2q}{r^2}$

79.

Statement I: The magnetic field due to a segment $\overrightarrow{dl}$ of a current-carrying wire carrying a current, I is given by:

$$\overrightarrow{dB} = \frac{\mu_0}{4\pi} I\overrightarrow{dl} \times \frac{\vec{r}}{r^3},$$

where $\vec{r}$ is the position vector of the field point with respect to the wire segment.

Statement II: The magnetic field of a current-carrying wire is never parallel to the wire.

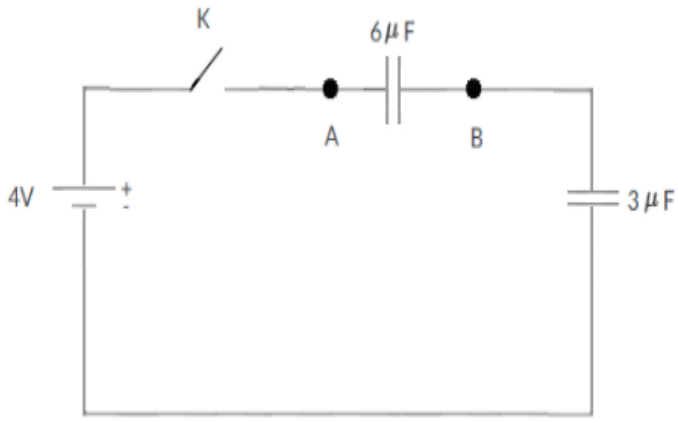
1. Statement I and Statement II are true and Statement I is the correct explanation of Statement II.

2. Statement I and Statement II are true and Statement I is not the correct explanation of Statement II.

3. Statement I is true, Statement II is false

4. Statement I is false, Statement II is true

80.



The 6μF capacitor is initially charged to 2V (i.e. V_B-V_A=2V) while the 3μF capacitor is uncharged. The switch is now closed. The final potential difference across the 3μF capacitor will be

1. $4V$

2. $\frac{4}{3}V$

3. $2V$

4. $\frac{8}{3}V$

81.

An L-R circuit has a time constant of $\frac{1}{2\pi}ms$; when a capacitor is connected in series with it, the circuit resonates with a frequency of 10^6Hz.
The Q-factor if the circuit is (nearly)

1. 100

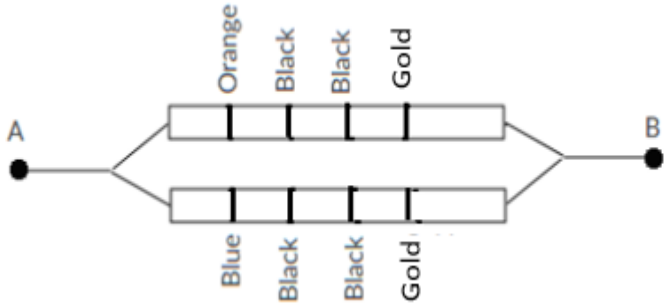
2. 1000

3. 10,000

4. 10

82.

The colour coded resistances shown in the figure are connected as shown. What would be the resistance between A and B?



1. 260 Ω , 5% tolerance

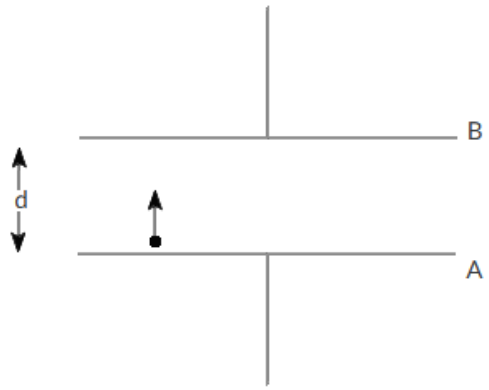
2. 560 Ω , 5% tolerance

3. 200 Ω , 5% tolerance

4. 20 Ω , 5% tolerance

83.

An electron (charge**:** e & mass**:** m) emitted from the positive plate A of the capacitor AB, just manages to reach the negative plate B. If the potential difference between the plates is V_0, then the speed of the electron when it is emitted is:



1. $\sqrt{\frac{eV_0}{m}}$
2. $\sqrt{\frac{eV_0}{2m}}$
3. $\sqrt{\frac{2eV_0}{m}}$
4. $\sqrt{\frac{2eV_0d}{m}}$

84.

Assume that electron orbits around a nucleus in a circular orbit and Newton's Laws are valid. The ratio of the K.E. of the electron to the P.E. in orbit is (in magnitude):

1. 1: 2
2. 2: 1
3. 1: 1
4. none of the above

85.

When a small amount of a substance is placed between the poles of a horseshoe magnet, it is observed that the substance is "pushed out" of the magnetic field. This means that it is:

1. ferromagnetic, with opposite poles
2. paramagnetic
3. diamagnetic
4. antiferromagnetic

86.

When a bar magnet is rotated from its position parallel to the external magnetic field B = 10^{-3} T to a direction opposite to the field (anti-parallel), the work done is 3J. Then, the maximum torque experienced by this magnet in this field is:

1. 3×10^{-3} N-m
2. 3×10^{3} N-m
3. 6 N-m
4. 1.5 N-m

87.

Statement I
Charged particles which undergo acceleration or deceleration radiate their energy away.

Statement II
Therefore, charged particles moving in circular paths in uniform magnetic field should also radiate their energy.

1. Statement I is true, Statement II is true & Statement I implies Statement II
2. Statement I is true, Statement II is true & Statement I does not imply Statement II
3. Statement I is true, Statement II is false
4. Statement I is false, Statement II is true.

88.

Three identical bar magnets, each having dipole moment M, are placed at the origin — oriented along the x-axis, the y-axis and the z-axis respectively. The net magnetic moment of the dipoles has the magnitude

1. $3\ M$
2. $\sqrt{2}\ M$
3. $\sqrt{3}\ M$
4. $Zero$

89.

A small square wire loop of side 'a' is placed at the center of a circular wire of radius 'r', both loops lying in the same plane. The mutual inductance between the two loops varies as

1. $\frac{r^2}{a}$
2. $\frac{a^2}{r}$
3. $a^2\ r^2$
4. $\frac{a^2}{r^2}$

90.

Statement I: The law of conservation of energy is valid in electric circuits

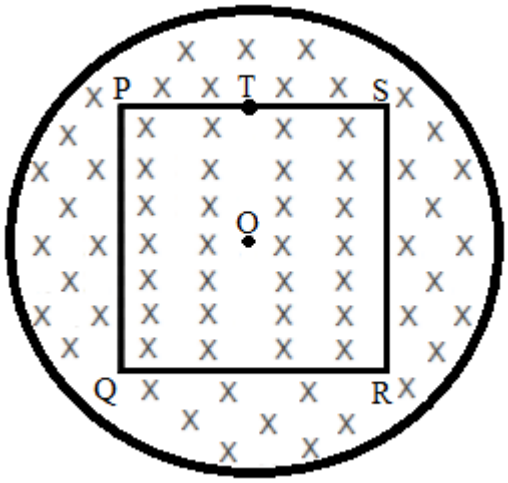
Statement II: Kirchhoff's junction law is applicable to electric circuits

1. Statement I and Statement II are true and Statement I is the correct explanation of Statement II.
2. Statement I and Statement II are true and Statement I is not the correct explanation of Statement II.
3. Statement I is true, Statement II is false
4. Statement I is false, Statement II is true

Physics - Section B

91.

A uniform magnetic field B exists in a cylindrical region; this field varies at a constant rate $\frac{dB}{dt}$. Consider a square loop PQRS centred in this region. The components of the induced E-field along the side of the square, at the points P and T (mid-point of PS) are in the ratio: $\left(i.e.\ \frac{E_P}{E_T} = \right)$



1. 1
2. $\sqrt{2}$
3. $\frac{1}{\sqrt{2}}$
4. 2

92.

Consider a thin conducting spherical shell of radius 2R, within which is placed a second conducting sphere of radius R — the two spheres being concentric. Initially the two spheres are given charges q and 2q respectively: the inner sphere carrying q and the outer sphere 2q.
The potential difference between the two spheres' changes when the inner and outer spheres charges are incremented by $2q_1$ and q_1 respectively. The change in this potential difference is $\left(k = \frac{1}{4\pi\varepsilon_0}\right)$

1. $k \cdot \frac{2q_1}{R} + k\frac{q_1}{2R}$
2. $k \cdot \frac{2q_1}{R}$
3. $k \cdot \frac{2q_1}{2R}$
4. $k \cdot \frac{2q_1}{R} - \frac{kq_1}{2R}$

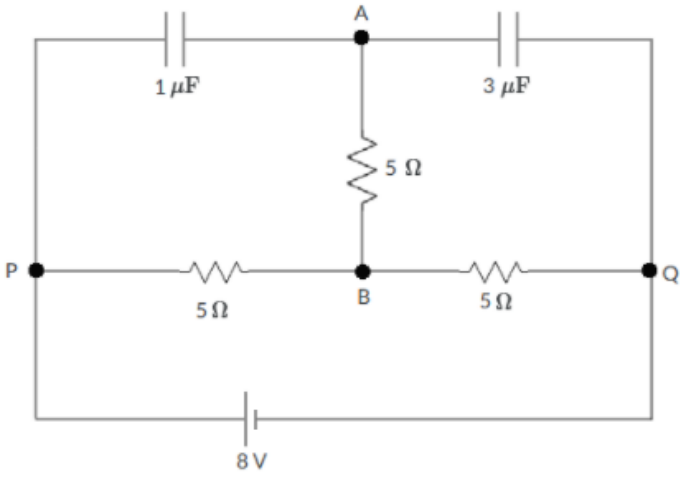
93.

Two charges *q*, - *q* are placed at the two ends of the hypotenuse of an isosceles right angled triangle, the smaller sides being of length, *a*.
A dipole of dipole moment p is placed at the right-angled vertex with its axis pointing towards the positive charge, *q*. The torque acting on the dipole is

1. $\frac{kpq}{a^2}$
2. Zero
3. $\frac{2kpq}{a^2}$
4. $\frac{\sqrt{5}kpq}{a^2}$

94.

The charge on the $3\mu\text{F}$ capacitor is (in the steady-state):

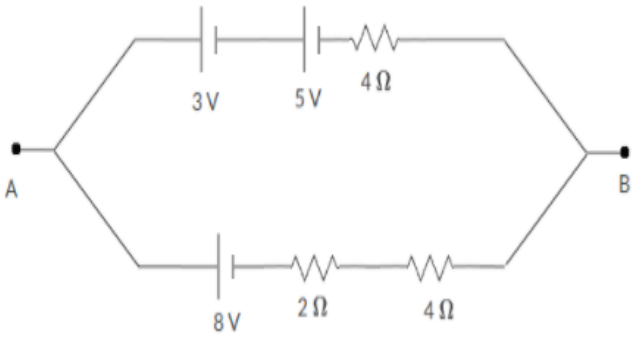


1. 6μ C
2. 9μ C
3. 12μ C
4. 3μ C

Hint: Is there any potential difference across the middle 5Ω resistor?

95.

If the combination of cells and resistances is replaced by a single battery of emf E and resistance r, then:



1. E = 8 V, r = 5 Ω
2. E = 16 V, r = 10 Ω
3. E = 8 V, r = 10 Ω
4. E = 8 V, r = 2.4 Ω

96.

A positively charged light particle of charge *q* and mass m approaches another heavy particle of positive charge Q, coming towards it with an initial speed *u*, when it is far away.

The distance of the closest approach is given by:

1. $\frac{qQ}{4\pi\varepsilon_0 mu^2}$
2. $\frac{qQ}{\pi\varepsilon_0 mu^2}$
3. $\frac{qQ}{2\pi\varepsilon_0 mu^2}$
4. $\frac{4\pi\varepsilon_0 mu^2}{qQ}$

Hint: The heavy particle remains essentially fixed during the process.

97.

An R-C circuit when connected to a DC source of emf 20V gives a current of 2 mA initially. The same circuit when connected to an AC source of voltage 20 V gives a current of 1.2 mA with an angular frequency ω = 100 rad/s. Then:

1. $R = 10^4\Omega,\ C = \frac{3}{5} \times 10^{-6}$ F
2. $R = \frac{5}{3} \times 10^4\Omega,\ C = 10^{-6}$ F
3. $R = \frac{4}{3} \times 10^4\Omega,\ C = \frac{3}{5} \times 10^{-6}$ F
4. $R = 10^4\Omega,\ C = \frac{3}{4} \times 10^{-6}$ F

98.

A cell of emf 10 V is used to charge a 10μF capacitor (A) which capacitor (A) is now disconnected from the cell and connected to a second 10μF capacitor (B) with which it shares its charge.
This process is repeated: the capacitor (A) is taken to the cell to replenish its charge, and then it is disconnected and used to charge the capacitor (B).
Initially, both capacitors are uncharged.

After 2 cycles, the voltage of capacitor B is:

1. 5 V
2. 2.5 V
3. 7.5 V
4. 8.75 V

99.

Based on paragraph in Question 98, please answer the following:

After a very large number of cycles, the total heat dissipated in the entire process is

1. 0.5 mJ
2. 1 mJ
3. 2 mJ
4. 4 mJ

Hint: What will be the final potential difference across the capacitors so that no further charge is transferred?

100.

A toroid with a winding of N-turns and carrying a current I, has a radius r and average cross-section A. The magnetic flux through the toroid equals:

1. $\frac{\mu_0 NIA}{r}$
2. $\frac{\mu_0 NIA}{2\pi r}$
3. $\frac{\mu_0 NIA}{4\pi r}$
4. $\frac{\mu_0 NIA}{2r}$

Fill OMR Sheet*

*If above link doesn't work, please go to test link from where you got the pdf and fill OMR from there

CLICK HERE to get FREE ACCESS for 3 days of ANY NEETprep course