Botany - Section A

1. When plants like potato and sugarcane are cultivated, the site of origin of the new plantlets
1. is invariably the nodes present in the modified stems
2. is usually the nodes present in the modified stems but can sometimes be the internodes as well
3. is usually the internodes present in the modified stems but can sometimes be the nodes as well
4. is invariably the internodes present in the modified stems

2. What is incorrect regarding the pollen in an angiosperm?
1. Pollen itself is the male gamete.
2. Pollen is a gametophyte
3. Pollen can be considered an entire organism
4. Pollen produces male gamete

3. A pollen tube is not expected to be seen in:
I. Pteridophytes
II. Gymnosperms
III. Perennial angiosperms
1. Only I
2. Only I and II
3. Only II and III
4. I, II, and III

4. Identify the incorrectly matched pair:

I.	Conidia	Asexual reproductive structure in *Penicillium*
II.	Gemmules	Internal buds involved in asexual reproduction in *Hydra*
III.	Bulbil	Vegetative propagule in *Eicchornia*
IV.	Rhizome	Vegetative propagule in ginger

1. I and III only
2. II and III only
3. Only II
4. Only IV

5. Identify the correct statements:
I. In castor and maize, autogamy is prevented but not geitonogamy
II. In papaya, both autogamy and geitonogamy are prevented
1. Both I and II
2. Only I
3. Only II
4. Neither I nor II

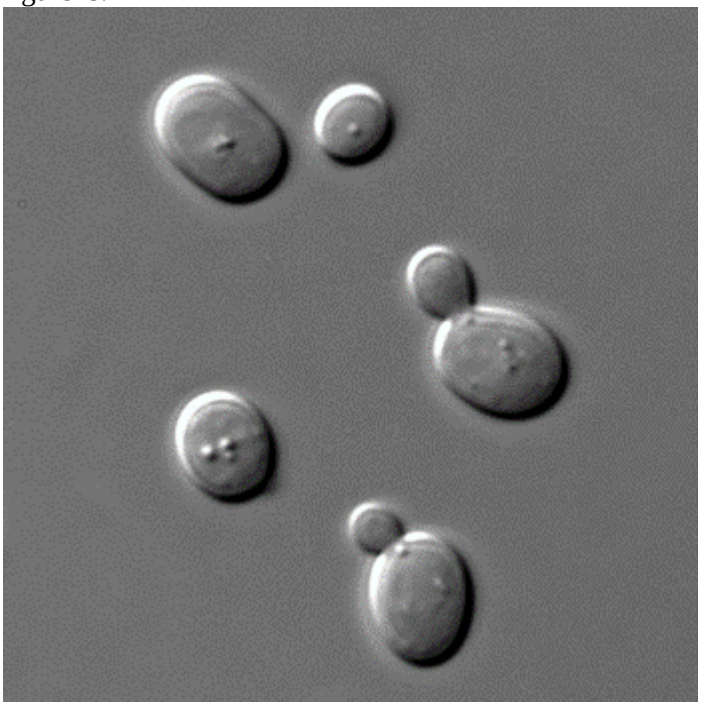
6. The number of dioecious plants in the given list are

Papaya, Cucurbits, *Marchantia*, *Chara*, Date palm, Coconut

1. 2
2. 3
3. 4
4. 5

7. A plant with only male flowers and a unisexual male flower are respectively called as:
1. Monoecious and Staminate
2. Dioecious and Staminate
3. Staminate and Monoecious
4. Staminate and Dioecious

8. The mode of asexual reproduction shown in the given figure is:



1. Budding
2. Fission
3. Fragmentation
4. Parthenogenesis

9. The embryo of grass seed is enclosed within:
1. a single protective sheath: the coleoptile
2. a single protective sheath: the coleorrhiza
3. two protective sheaths: a coleoptile covering the young shoot and the coleorrhiza covering the young root
4. two protective sheaths: a coleoptile covering the young root and the coleorrhiza covering the young shoot

10. Match each item in Column I with one in Column II and select the correct match from the codes given:

	COLUMN I		**COLUMN II**
A	Groundnut	P	Lack endosperm
B	Coconut	Q	Endosperm persists in mature seeds
C	Orchids	R	Endosperm is completely consumed by developing embryo

Codes

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

11. The outer layer of endosperm cells, present in all small grains and retained in many dicots with transient endosperm is called as:
1. Nucellus
2. Helobial endosperm
3. Aleurone
4. Perisperm

12. The given diagram shows:

1. antheridial head on the male gametophyte in *Marchantia*
2. archegonial head on the female gametophyte in *Marchantia*
3. antheridial head on the sporophyte in *Marchantia*
4. archegonial head on the sporophyte in *Marchantia*

13. A collective term for the parts of a flower that produce ovules and ultimately develop into the fruit and seeds is
1. Pistil
2. Megasporophyll
3. Gynoecium
4. Carpel

14. Parthenocarpy is undesirable in:
1. Banana
2. Pineapple
3. Orange
4. Pistachio

15. *Parthenium hysterophorus:*
1. is a native of India
2. frequently causes pollen allergy
3. first appeared as a contaminant in imported rice
4. is vegetatively propagated by offset

16. The need for pollinators is not obligatory in:
1. chasmogamous flowers
2. cleistogamous flowers
3. geitonogamy
4. xenogamy

17. Vegetative apomixis where the flowers are replaced by bulbils which frequently germinate while still on the plant is important in:
1. *Agave*
2. *Citrus*
3. Mango
4. *Euphorbia*

18. Sporulation is seen in:
1. amoeba when it undergoes encystment in unfavourable conditions
2. encysted amoeba on the return of favourable conditions
3. binary fission in amoeba
4. the formation of buds in amoeba

19. Which of the following is the correct description of an anther?
1. Pollen sac
2. The pollen-producing reproductive organ of a flower
3. The male gametophyte of angiosperms
4. The part of a stamen that contains the pollen

20. In algae with haplontic life cycle:
I. Zygotes are the only diploid cells
II. Mitosis occurs only in the haploid phase
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

21. In the embryo sac of an angiosperm:
1. Two cells called synergids flank the egg at the chalazal end
2. Three antipodal cells guide the entry of the pollen tube into the embryo sac
3. at maturity there are 8 cells and 7 nuclei
4. polar nuclei share the cytoplasm of the large central cell

22. Identify the correct relationship of an ovary and an ovule in angiosperms:
1. ovary is the enlarged apical portion of the pistil; the ovary contains ovules, which develop into seeds upon fertilization
2. ovary is the enlarged basal portion of the pistil; the ovary contains ovules, which develop into seeds upon fertilization
3. ovary is the enlarged basal portion of the pistil; the ovary contains ovules, which develop into fruits upon fertilization
4. ovary is the enlarged apical portion of the pistil; the ovary contains ovules, which develop into fruits upon fertilization

23. The relative inefficiency of wind pollination in angiosperms is compensated by:
1. saving resources by not making nectar
2. promoting self-pollination
3. production of copious amounts of pollen grains
4. being heavily scented

24. In some species, such as coffee, the endosperm does not develop. Instead, the nucellus produces a nutritive tissue termed:
1. Perisperm
2. Cotyledon
3. Albumen
4. Scutellum

25. Identify the incorrect statement:
1. In vegetative reproduction, the offsprings are produced from the somatic cells
2. There are usually two germ pores in the pollen wall of dicots
3. In over 60 percent of angiosperms, the pollen grains are shed at 2 celled stage
4. No enzyme that can degrade sporopollenin is so far known

26. The generative cell of the pollen grain:
1. is larger than the vegetative cell
2. divides by meiosis to produce male gametes
3. is never “free” of the vegetative cell
4. is a syncytium

27. Consider the following two statements:
I. Vegetative reproduction is a type of asexual reproduction.
II. Vegetative propagation is usually considered a cloning method.
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

28. Gametes are haploid and the plant body from which they arise:
1. is always haploid
2. is always diploid
3. may be either haploid or diploid
4. plants produce spores and not gametes

29. Nucellar polyembryony:
I. is a type of apomixis
II. produces embryos that are genetically identical to the parent plant
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

30. The number of male gametes required to produce 200 seeds in a typical angiosperm would be:
1. 50
2. 100
3. 200
4. 400

31. In seagrasses:
1. female flowers remain submerged in water and pollen grains are released inside the water
2. pollen grains are released on the surface of the water, which are passively carried away by water currents; some of them eventually reach the female flower
3. pollination is by wind
4. pollination is by bats

32. The plumule of a eudicot seed consists of all of the following except
1. Epicotyl
2. Shoot apical meristem
3. Young leaves
4. Hypocotyl

33. What is the number of pairs of chromosomes in a somatic cell in Zea mays?
1. 5
2. 10
3. 20
4. 40

34. In the figure given below, you can see plantlets along the margins of a leaf in a certain plant. When they are mature enough, they drop off and root in any suitable soil beneath. The plant can be:

1. *Arabidopsis thaliana*
2. *Eicchornia crassipes*
3. *Kalanchoe daigremontiana*
4. *Ricinus communis*

35. In *Michelia,* the gynoecium:
1. has multiple distinct carpels
2. has multiple carpels fused in a single bundle
3. has a single carpel
4. has multiple carpels fused in multiple bundles

Botany - Section B

36. Consider the two statements:
I. Larger the body size of an organism, larger is the life span
II. Larger body size means more surface area per unit volume and a higher metabolic rate than for the organisms with smaller body size
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

37. Identify the incorrect statement:
1. In Cycads, microsporangia on microsporophylls and megasporangia on megasporophylls, are aggregated into strobili on the same plant.
2. Flowering plants contain microsporangia in the anthers of stamens and megasporangia inside ovules inside ovaries.
3. The microspores become microgametophytes (pollen).
4. The megaspores become megagametophytes (embryo sacs).

38. Consider the given two statements:
I. Flowers of wind pollinated species are often small, green, and inconspicuous and they produce neither scent nor the nectar.
II. Their reproductive success does not depend on attracting pollinators.
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. I is correct but II is incorrect
4. II is correct but I is incorrect

39. The first mitotic division of the zygote in angiosperms divides the fertilized egg into a basal cell and a terminal cell where:
1. the basal cell degenerates and the terminal cell gives rise to both the embryo and the suspensor
2. the terminal cell degenerates and the basal cell gives rise to both the embryo and the suspensor
3. the terminal cell gives rise to most of the embryo and the basal cell produces the suspensor
4. the basal cell gives rise to most of the embryo and the terminal cell produces the suspensor

40. The absence of genetic mechanisms which prevent self-fertilization resulting in plants that can reproduce successfully via both self-pollen and pollen from other individuals is known as:
1. Gametophytic self-incompatibility
2. Sporophytic self-incompatibility
3. Cryptic self-incompatibility
4. Self-compatibility

41. What would be true for *Ophioglossum*?
I. It has the largest number of chromosomes in the known plant kingdom.
II. It has the largest number of chromosomes out of all known organisms.
1. Both I and II
2. Only I
3. Only II
4. Neither I nor II

42. Consider the given two statements:
I. An asexual population has an intrinsic capacity to grow more rapidly with each generation.
II. Asexual reproduction impedes the accumulation of genetic mutations.
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. I is correct but II is incorrect
4. Both I and II are incorrect

43. Pollination by bees is called
1. melittophily
2. phalaenophily
3. ornithophily
4. chiropterophily

44. Consider the given two statements:
I. Mechanical harvesting [removal] is not effective to control large-scale infestations of the water hyacinth.
II. Chemical control is the least desirable method to control water hyacinth.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

45. In *Lilium*, the central cell of the embryo sac is 4N. Therefore, upon fertilization the endosperm will be:
1. 2N
2. 3N
3. 4N
4. 5N

46. Consider the given two statements:
I. Endosperm has an important role within the human diet worldwide.
II. In cereal crops, the nutritious part of the grain is the seed and its endosperm.
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. I is correct but II is incorrect
4. II is correct but I is incorrect

47. In angiosperms:
I. Each anther develops four microsporangia
II. Each microspore mother cell undergoes meiosis and produces four haploid microspores
III. Each microspore gives rise to a male gametophyte
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

48. Consider the given two statements:
I. In angiosperms, the endosperm does not develop in ovules where the egg has not been fertilized
II. This prevents angiosperms from squandering nutrients on an infertile ovule
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. I is correct but II is incorrect
4. II is correct but I is incorrect

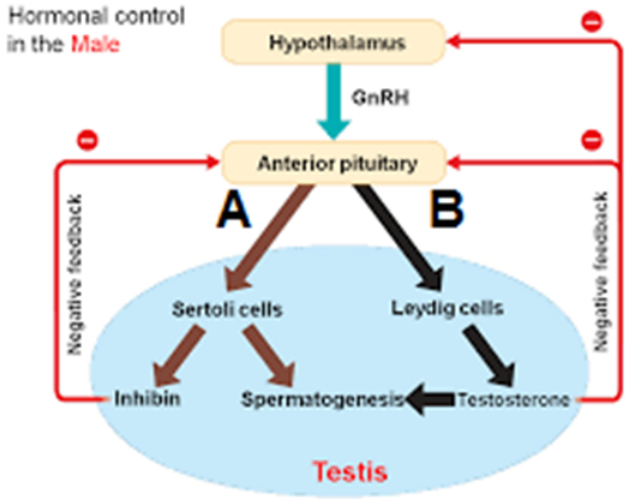
49. Plietesials are plants that grow for a number of years, flower gregariously (synchronously), set seeds, and then die. Such plants will include:
I. Neelakuranji
II. Bamboo
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

50. The PGR, present in the endosperm, which regulates cellular differentiation and embryonic organ formation is:
1. Auxins
2. Cytokinins
3. Gibberellins
4. ABA

Zoology - Section A

51. What would be a normal finding on semen analysis of a male suspected of infertility?
I. A count of 10 million sperms per ml of semen
II. 60 percent sperms have normal shape and size
III. 60 percent sperms show vigorous motility
1. Only II
2. Only I and II
3. Only II and III
4. I, II and III

52. The hormones represented by A and B in the given figure will be:



1. LH and FSH
2. FSH and LH
3. LH and LH
4. FSH and FSH

53. What is incorrect regarding the ovary in humans?
1. The surface is covered with simple cuboidal epithelium, called the germinal epithelium.
2. Follicles in various phases of development are seen in the ovarian cortex
3. It is connected to the uterus and pelvic floor by tendons
4. It is a primary sex organ

54. Match each item in Column I with one in Column II and select the correct match from the codes given:

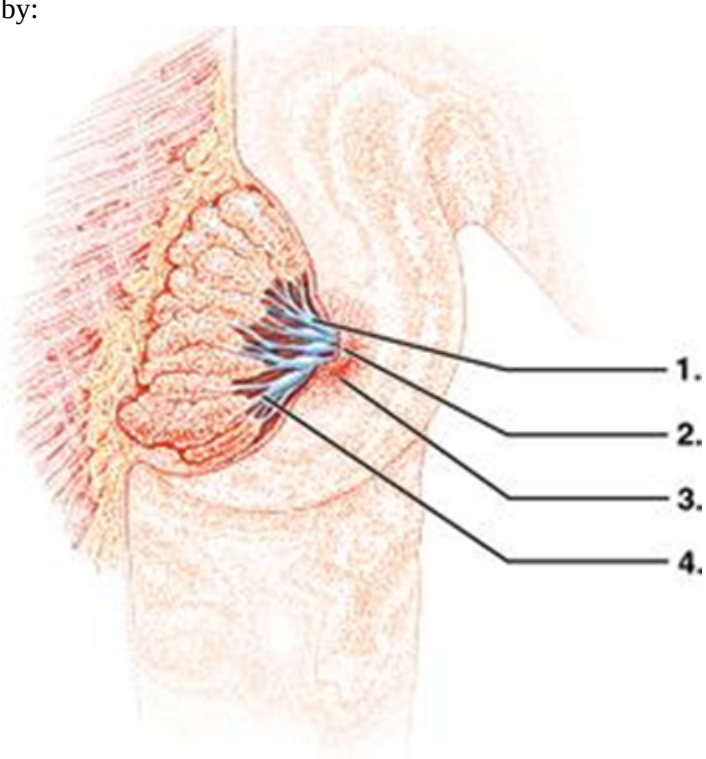
	COLUMN I		COLUMN II
A	Spermatogonia	P	Secretion of androgens
B	Leydig cells	Q	Spermiogenesis
C	Sertoli cells	R	Undifferentiated germ cells

Codes

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

55. Consider the given two statements:
I. Secondary oocyte is fertilized by the sperm.
II. At fertilization, the secondary oocyte completes Meiosis-II
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

56. The mammary ampulla in the given diagram is shown by:



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

57. Sertoli cells:
I. nourish the developing sperm cells through the stages of spermatogenesis
II. secrete inhibin
III. are activated by luteinizing hormone
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III are correct

58. Consider the two statements:
I. During pregnancy, there is no menstruation.
II. Corpus luteum degenerates early in the event of fertilization
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. I is correct but II is incorrect
4. I is incorrect but II is correct

59. Identify the incorrect statement:
1. CDRI, located at Lucknow, has developed 'Saheli' – a non-steroidal oral contraceptive pill
2. Amniocentesis is statutorily banned in India for Pre Natal Sex Determination
3. An ideal contraceptive should both be effective and reversible
4. Increasing birth rate is the main cause of the increase in the population of India today

60. As their primary mechanism of action, combined oral contraceptive pills:
1. inhibit follicular development and prevent ovulation
2. increase sperm penetration of cervix by making the cervical secretions thick
3. make uterine endometrium hostile to implantation
4. slow down tubal motility and ova transport interfering with fertilization

61. Vasectomy:
I. is the most effective permanent form of contraception available to men.
II. protects against sexually transmitted infections.
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

62. Consider the given two statements:
I. The presence or absence of hymen is not a reliable indicator of virginity or sexual experience.
II. It is a membrane that often covers the opening of vagina partially.
1. Both I and II are correct and II explains I
2. Both I and II are correct and II explains I
3. I is correct and II is incorrect
4. Both I and II are incorrect

63. An infertile couple has been suggested Artificial Insemination into the uterus [IUI]. This should be done:
1. just after the completion of the menstrual flow
2. near the time of ovulation
3. in the middle of the follicular phase
4. after corpus luteum starts the synthesis of progesterone

64. Polar bodies:
1. are formed during both spermatogenesis and oogenesis
2. serve no function
3. act as dumping ground for extra chromosomes
4. are two in number, first is diploid and second is haploid

65. The last of the germ layers to appear in the human embryonic development is the:
1. Ectoderm
2. Endoderm
3. Mesoderm
4. All the three germ layers appear simultaneously

66. What is correct regarding both spermatogenesis and oogenesis?
1. Begin after the onset of puberty
2. The resultant cells of meiosis I are equal in size
3. The resultant cells of meiosis I are unequal in size
4. The resultant gametes are haploid

67. Copper releasing IUDs:
I. are not effective as emergency contraceptives
II. damage sperms and disrupt their motility
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

68. The foetus is actually differentiated from:
1. the inner cell mass of the blastocyst
2. the trophoblast cells of the blastocyst
3. partly the trophoblast cells but mainly the inner cell mass of the blastocyst
4. theca cells and granulosa cells of the antral follicle

69. Absence of a menstrual period in a woman of reproductive age is called as:
1. Menopause
2. Dysmenorrhoea
3. Menorrhagia
4. Amenorrhoea

70. Epididymis:
I. connects the efferent ducts from the rear of each testicle to its vas deferens
II. store sperms
III. is the place of final maturation of sperms
1. Only I is correct
2. Only I and II are correct
3. Only II and III are correct
4. I, II and III are correct

71. Identify the correct statements:
I. Fertilization occurs in the ampulla of the fallopian tube
II. Implantation occurs at the stage of blastocyst
III. First movements of the foetus are usually observed during the fifth month
1. Only II
2. Only I and II
3. Only II and III
4. I, II and III

72. Although estrogen levels vary through the menstrual cycle, the highest level will be seen:
1. in the middle of the follicular phase after the appearance of LH.
2. near the end of the follicular phase just before ovulation.
3. in the middle of the secretory phase when the corpus luteum is most developed.
4. near the end of the secretory phase just before the onset of the next menstrual cycle.

73. A functional mammary gland is a characteristic feature of:
1. all mammals
2. all female mammals
3. only primate female mammals
4. all female vertebrates

74. Regarding fallopian tubes:
I. The isthmus sits next to the opening of the fallopian tube into the uterus.
II. The ampulla is typically where the fertilization occurs.
1. Both I and II are correct
2. Only I is correct
3. Only II is correct
4. Both I and II are incorrect

75. Human chorionic gonadotropin:
1. is secreted by the ovary and has functions similar to FSH
2. is secreted by the placenta and has functions similar to FSH
3. is secreted by the ovary and has functions similar to LH
4. is secreted by the placenta and has functions similar to LH

76. Match each item in Column I with one in Column II and select the correct match from the codes given:

	COLUMN I [Part of a sperm]		**COLUMN II**
A	Acrosome	P	Hydrolytic enzymes
B	Neck	Q	Centrioles
C	Head	R	Haploid nucleus
D	Middle piece	S	Mitochondria

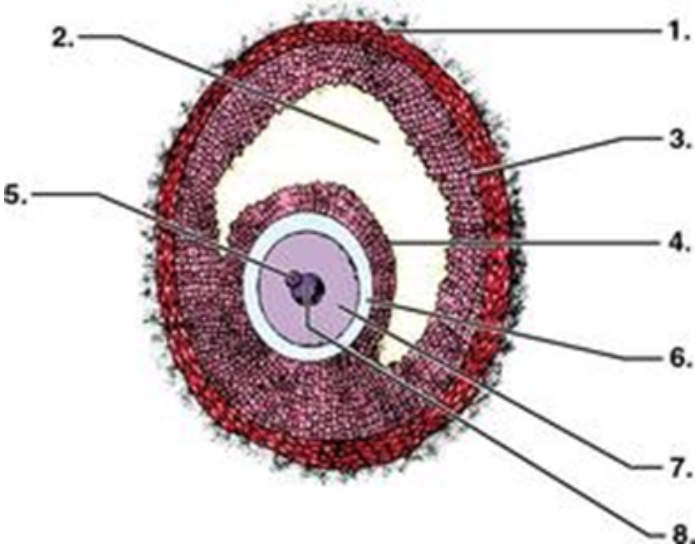
Codes

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

77. The testes of a male child aged four years will have:
1. primary spermatocytes
2. immature sperms
3. spermatogonia
4. spermatids

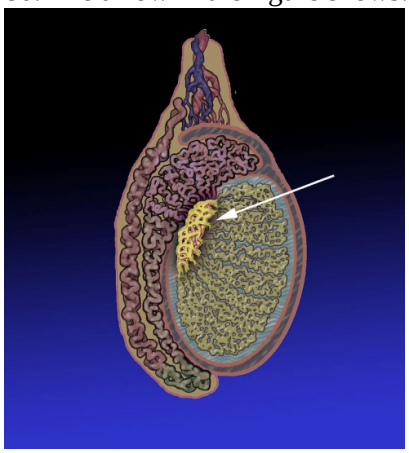
78. All the following statements regarding Medical Termination of Pregnancy are correct except:
1. It accounts for about 1/5th of the total number of pregnancies conceived in a year
2. It was legalized by the Government of India in 1975
3. It is considered safe during the first trimester of pregnancy
4. It is legalized induced abortion

79. In the given diagram, the granulosa cells and the zona pellucida are represented respectively by:



	Granulosa cells	Zona pellucida
1.	4	6
2.	3	4
3.	3	6
4.	4	7

80. The arrow in the figure shows:



1. Rete testis
2. Caput epididymis
3. Cauda epididymis
4. Vasa efferentia

81. During puberty, the increased secretion of which of the following causes the male secondary sexual characters to be manifested?
1. GnRH from the hypothalamus
2. FSH from the anterior pituitary
3. LH from the anterior pituitary
4. Testosterone from the testes

82. Spermatogenesis:
1. is enhanced at temperatures slightly less than core body temperature.
2. is enhanced at temperatures slightly more than core body temperature.
3. is reduced at temperatures slightly less than core body temperature.
4. is not affected by the ambient temperature.

83. Consider the given two statements:
I. Sexually transmitted infections can lead to pelvic inflammatory disease.
II. Pelvic inflammatory disease increases the risk of ectopic pregnancy.
1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

84. The first meiotic division in the primary oocyte:
1. occurs after the onset of puberty
2. is completed before the birth
3. begins in foetal life
4. occurs at the time of fertilization

85. Which hormone, also called the ‘birth hormone’, initiates and sustains labour contractions during parturition?
1. Progesterone
2. Oxytocin
3. Estrogen
4. Relaxin

Zoology - Section B

86. In a menstrual cycle, several days, in the beginning, are infertile [pre-ovulatory] followed by a period of fertility, and then several days just before the next menstruation that are infertile [post-ovulatory]. To find the estimated length of the pre-ovulatory infertile phase, eighteen (18) is subtracted from the length of the woman's shortest cycle. To find the estimated start of the post-ovulatory infertile phase, eleven (11) is subtracted from the length of the woman's longest cycle.
A woman whose menstrual cycles ranged in length from 30 to 36 days would be estimated to be fertile:
1. for the first 11 days of her cycle
2. on days 12–25
3. on day 26 onwards
4. for the first 5 days of the cycle

87. Which of the following hormones is most important for supporting pregnancy in a human female?
1. LH
2. FSH
3. Progesterone
4. Estrogen

88. The hormone, mainly, secreted by the ruptured Graafian follicle is :
1. LH
2. FSH
3. Estrogen
4. Progesterone

89. Consider the two statements:
I. In women, abnormally high prolactin level is often associated with amenorrhea.
II. Corpus luteum degenerates early in the event of fertilization
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. I is correct but II is incorrect
4. I is incorrect but II is correct

90. Menstrual bleed is causally most directly the reset of withdrawal of :
1. Progesterone
2. Estrogen
3. LH
4. FSH

91. In males, the Follicle Stimulating Hormone:
I. stimulates primary spermatocytes to undergo the first division of meiosis, to form secondary spermatocytes.
II. enhances the production of androgen-binding protein by the Sertoli cells of the testes
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

92. Identify the incorrect statement:
I. Females produce hundreds of oocytes each month in comparison to the millions of sperm cells produced in the same age male.
II. The testes in the male and ovaries in the female can both be found in the pelvic cavity of an early fetus.
1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

93. What is incorrect regarding the human placenta?
1. The first hormone released by the placenta is called the human chorionic gonadotropin hormone.
2. The placenta intermediates the transfer of nutrients between mother and fetus.
3. Deoxygenated fetal blood passes through umbilical veins to the placenta.
4. It is chorioallantoic.

94. The substrate that is used by the sperms for their metabolism is contributed in the secretions of:
1. Seminal vesicles
2. Prostate
3. Bulbourethral glands
4. Glands of Littre

95. The hormone responsible for the fact that the basal body temperature in a female rises at the time of ovulation is
1. Estrogen
2. Progesterone
3. LH
4. FSH

96. Measuring the levels of which of the following hormones would have the strongest prediction of ovulation timing in a female?
1. LH
2. FSH
3. Estrogen
4. Progesterone

97. The hormone, present in the fluid surrounding the released secondary oocytes, helps establish a chemical concentration gradient responsible for most sperms reaching the following tube where the secondary oocyte is present, is
1. LH
2. FSH
3. Estrogen
4. Progesterone

98. Consider the two statements:
I. Often, HCG medication is used as an LH substitute
II. It activates the same receptor.
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. I is correct but II is incorrect
4. I is incorrect but II is correct

99. The mass of spongy tissue surrounding the male urethra within the penis is called
1. corpus spongiosum
2. corpus cavernosam
3. corpus luteum
4. macula lutea

100. Zona pellucida:
I. is made up of glycoproteins
II. helps prevent polyspermy
III. helps prevent ectopic pregnancy
1. Only I and II
2. Only I and III
3. Only II and III
4. I, II and III

Chemistry - Section A

101. Case study :
A compound is made up of A, B, and C atoms. In a cubic unit cell, A atoms are present on alternate corners, B atoms are present on alternate faces and C atoms are present on alternate edges.
The simplest formula of the compound is:
1. AB_2C
2. A_2BC
3. AB_2C_2
4. ABC_2

102. Case study :
A compound is made up of A, B and C atoms. In a cubic unit cell, A atoms are present on alternate corners, B atoms are present on alternate faces and C atoms are present on alternate edges.
A rectangular plane is placed in the unit cell and all the atoms are removed which are touching the rectangular plane. After the removal of atoms, the simplest formula of the compound cannot be
1. AB_2C_2
2. AB_2
3. AC_2
4. ABC_2

103. Case study :
A compound is made up of A, B, and C atoms. In a cubic unit cell, A atoms are present on alternate corners, B atoms are present on alternate faces and C atoms are present on alternate edges.
A body diagonal line is placed in the unit cell and all the atoms are removed which are touching the body diagonal line. After removal of atoms, the simplest formula of the compound is :
1. $A_3B_4C_8$
2. AB_2C_2
3. $A_3B_8C_4$
4. $A_3B_8C_8$

104. Assertion: Due to metal deficiency defect, ZnO gives the appearance of yellow color
Reason: O^{2-} ion occupies anion vacancy and forms F - center

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

105. In a face-centered cubic unit cell, the relation between radius (r) and cell edge length (a) is
1. $4r = a\sqrt{3}$
2. $4r = a\sqrt{2}$
3. $r = a/2$
4. $4r = a/\sqrt{2}$

106. The correct statement regarding ferrimagnetic substance is
1. The observed magnetic moment is equal to the theoretical magnetic moment
2. The observed magnetic moment is less than the theoretical magnetic moment
3. The observed magnetic moment is more than the theoretical magnetic moment
4. All of the above

107. The number of Ca^{2+} ions and F^- ions in the unit cell of CaF_2, respectively, are
1. 8 & 4
2. 1 & 2
3. 2 & 4
4. 4 & 8

108. In CsCl structure, the cell edge length (a) and radius of Cl^- ion (r^-) is 400 pm and 200 pm respectively. The radius of Cs^+ ion (r^+) will be
1. 73.2 pm
2. 146.4 pm
3. 219.6 pm
4. None of these

109. Our of the following, the most unsymmetrical crystal system and bond parameters of this crystal system, respectively, are -
1. Monoclinic and $a \neq b \neq c$
2. Triclinic and $a \neq b = c$
3. Monoclinic and $a \neq b = c$
4. Triclinic and $a \neq b \neq c$

110. Which of the following solutions has the highest freezing point?
1. 0.02 M NaCl
2. 0.05 M Urea
3. 0.01 M $MgCl_2$
4. 0.01 M KCl

111. If A (volatile solute) and B (volatile solvent) form an azeotropic mixture then the correct statement regarding the above azeotropic mixture will be -
1. Mole fraction of A in the vapour phase is more than the mole fraction of A or B in liquid phase
2. Mole fraction of A or B in the vapour phase is more than the mole fraction of A or B in liquid phase
3. Mole fraction of A or B in the vapour phase is same as the mole fraction of A or B in liquid phase
4. Mole fraction of A and B in the vapour phase is less than the mole fraction of A or B in liquid phase

112. The molarity of $NaNO_3$ solution is 2M. The density of solution is 1.2 gram/ml. The molality of solution will be (Molar weight of $NaNO_3$ = 85)
1. 1.94 m
2. 2 m
3. 2.06 m
4. 1.85 m

113. The correct formula of Roult's law for non-volatile and electrolyte solute is
P = Vapour pressure of pure solvent
P_s = vapour pressure of solution
i = Van't Hoff Factor
n = Moles of solute
N = Moles of solvent
1. $\frac{P-P_s}{P} = i\left(\frac{n}{n+N}\right)$
2. $\frac{P-P_s}{P_s} = i\left(\frac{n}{n+N}\right)$
3. $\frac{P-P_s}{P} = \frac{in}{in+N}$
4. $\frac{P-P_s}{P_s} = \frac{in}{in+N}$

114. A volatile solute (A) is mixed with a volatile solvent (B). For this solution vapour pressure is represented as
$P = 125\ X_A + 45$
(X_A = Mole fraction of A in liquid phase)
The vapour pressures of A and B in a pure state, respectively, are
1. 125 torr & 45 torr
2. 170 torr & 45 torr
3. 125 torr & 170 torr
4. 45 torr & 170 torr

115. The vapour pressures of benzene and toluene in pure states are 700 mm of Hg and 600 mm of Hg respectively. If equal masses of benzene and toluene are mixed together then the total vapour pressure of the solution will be approximately
1. 620 mm of Hg
2. 640 mm of Hg
3. 654 mm of Hg
4. 674 mm of Hg

116. The boiling point of 1M Urea solution is 101°C. At the same temperature, the boiling point of 1M KCl solution will be
1. 101°C
2. 102°C
3. 202°C
4. Cannot be predicted (Insufficient Data)

117. Which metal evolves hydrogen gas with dilute HNO_3?
1. Mn
2. Zn
3. Cu
4. Fe

118. Consider the galvanic cell Pt, H_2 | H^+|| H^+| H_2, Pt. If two solutions whose pH values are 3 and 5 are given then which solution should be kept at cathode for a spontaneous cell and e.m.f (electromotive force) of this spontaneous cell, respectively will be ($\frac{2.303RT}{F}$=0.059)
1. solution of pH = 3 and +0.118 V
2. solution of pH = 5 and +0.118 V
3. solution of pH = 3 and +0.059 V
4. solution of pH = 5 and +0.059 V

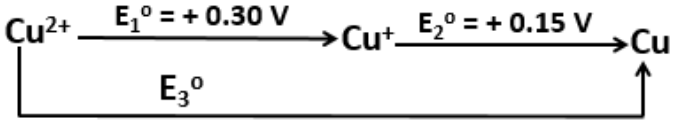
119. The standard reduction potential of Zn^{2+}/Zn and Cu^{2+}/Cu is -0.76 and +0.34 V respectively. The oxidising agent and reducing agent, respectively, are

1. Cu & Zn^{2+}
2. Zn & Cu
3. Cu^{2+} & Zn^{2+}
4. Cu^{2+} & Zn

120. When an electrolytic solution is diluted then the incorrect statement from the following is-

1. Specific conductivity increases
2. Molar conductivity increases
3. Equivalent conductivity increases
4. Specific conductivity decreases

121.



The value of E_3^o for the above reaction will be
1. +0.45 V
2. +0.15 V
3. +0.225 V
4. -0.225 V

122. Aqueous NaCl solution is electrolyzed using platinum electrodes. It can be concluded that the pH of the solution
1. Increases
2. Decreases
3. Unchanged
4. Can't be predicted

123. When a 10-ampere current is passed through acidulated water (H_2O containing some H_2SO_4), 2.24 litres H_2 gas is evolved at NTP. The duration for which current is passed through acidulated water is
1. 965 seconds
2. 1930 seconds
3. 3860 seconds
4. 7720 seconds

124. When $CuSO_4$ solution using inert electrodes is electrolysed then the correct statement amongst the following is
1. Weight of anode decreases
2. H_2 gas is evolved at cathode
3. pH of the solution decreases
4. pH of the solution is unchanged

125. Consider the following cell:
Ag | AgCl || Cl^- (C_1), AgCl | Ag.
The solubility product of AgCl is K_{sp}. The E_{cell} of the above cell will be ($\frac{2.303RT}{F}$ = 0.059)
1. $\frac{0.059}{2}\log\frac{C_1}{\sqrt{K_{sp}}}$
2. $\frac{0.059}{1}\log\frac{C_1}{\sqrt{K_{sp}}}$
3. $\frac{0.059}{2}\log\frac{K_{sp}}{C_1}$
4. $\frac{0.059}{1}\log\frac{\sqrt{K_{sp}}}{C_1}$

126. The molar conductivity of 0.05 M NH_4Cl is 20 S cm^2 mol^{-1}. The molar conductivities of NH_4^+ and Cl^- ion at infinite dilution are 74 S cm^2 mol^{-1} and 26 S cm^2 mol^{-1}, respectively. The dissociation constant of NH_4Cl will be
1. 2.5×10^{-3}
2. 2×10^{-3}
3. 2.5×10^{-4}
4. 2×10^{-4}

127. Assertion: Inversion of cane sugar is a first-order reaction
Reason: It is the pseudo unimolecular reaction
1. Both assertion and reason are true, and the reason is the correct explanation of the assertion
2. Both assertion and reason are true, but the reason is not the correct explanation of the assertion
3. Assertion is true but the reason is false
4. Both assertion and reason are false

128. Consider the following reversible reaction

$$N_2 + 3H_2 \underset{K_2}{\overset{K_1}{\rightleftharpoons}} 2NH_3$$

(K_1 is the rate constant for the forward reaction and K_2 is the rate constant for the backward reaction). The rate law for the appearance of NH_3 is

1. $K_2[NH_3]^2 - K_1[N_2][H_2]^3$
2. $2\,K_1\left[N_2\right][H_2]^3 - 2\,K_2[NH_3]^2$
3. $2\,K_2[NH_3]^2 - 2\,K_1\left[N_2\right][H_2]^3$
4. $K_1\left[N_2\right][H_2]^3 - K_2[NH_3]^2$

129. The temperature coefficient of a reaction is 2.5. How many times the rate of reaction increases when the temperature is increased from 30 ^oC to 60 ^oC?
1. 7.5
2. 15.625
3. 6.25
4. 32.5

130. For an exothermic reaction, the value of activation energy for forward reaction is
1. Less than ΔH
2. More than ΔH
3. Equal to ΔH
4. All of the above are possible

131. Consider the reaction, A + B → Products. On keeping concentration of B as fixed and increasing the concentration of A 3 times. The rate of reaction increases 27 times. Now the concentration of A and B both are doubled and it is found that the rate of reaction becomes 8 times. The order with respect to A and B, respectively, are
1. 3 and 1
2. 2 and 1
3. 3 and 0
4. 2 and 0

132. The half-life period of a radioactive substance is 69.3 minutes. In how much time will it disintegrate to 20% of its original amount?
1. 80.5 minutes approximately
2. 161 minutes approximately
3. 192 minutes approximately
4. 235 minutes approximately

133. For the reaction, A + B → Products

Experiment	[A]	[B]	Rate (mole litre^{-1} min^{-1})
1.	0.01	0.01	2×10^{-4}
2.	0.02	0.01	4×10^{-4}
3.	0.01	0.02	8×10^{-4}

The rate law and unit of rate constant respectively, are

1. Rate = K [A]^2 [B] and litre^2 mole^{-2} min^{-1}
2. Rate = K [A]^3 and litre^2 mole^{-2} min^{-1}
3. Rate = K [A] [B]^2 and litre mole^{-1} min^{-1}
4. Rate = K [A] [B]^2 and litre^2 mole^{-2} min^{-1}

134. If the concentration of a reactant increases 2 times then the half-life of the same reactant is observed to decrease 4 times. The order of the reaction will be
1. 1
2. 2
3. 3
4. Cannot be predicted

135. A first order reaction completes 20% in 10 minutes. The time required for 99.9% completion of the reaction will be

1. 100 minutes approximately
2. 200 minutes approximately
3. 300 minutes approximately
4. 400 minutes approximately

Chemistry - Section B

136. How many carbon atoms are present in a cubic unit cell of diamond?
1. 2
2. 4
3. 6
4. 8

137. AB salt has a similar structure as rock salt structure. The radius of the cation is 0.32 Å. The maximum radius of the anion can be
1. 77.29 pm
2. 0.4371 Å
3. 0.57 Å
4. 97 pm

138. The incorrect statement regarding inverse spinel structure (Fe_3O_4) is

1. O^{2-} ions occupy ccp lattice
2. Fe^{3+} ions are equally distributed between tetrahedral and octahedral voids
3. The occupancy of octahedral voids is 50%
4. The occupancy of tetrahedral voids is 25%

139. At what percentage composition do ethanol and water form an azeotropic mixture?
1. 50% Ethanol and 50% water
2. 95.6% Ethanol and 4.4% water
3. 4.4% Ethanol and 95.6% water
4. None of the above

140. How much ice will be separated if 30 grams of a non-volatile and non-electrolyte solute is added in 400 gm of water at -10 ^oC? (Molar weight of solute = 62 , K_f for H_2O = 1.86 K/m)
1. 110 gm
2. 220 gm
3. 310 gm
4. 360 gm

141. 9.5 gram $MgCl_2$ is dissolved in 500 g of water. The difference in boiling point and freezing point of solution will be (K_b for H_2O = 0.52 K/m, K_f for H_2O = 1.86 K/m, Molar weight of $MgCl_2$ = 95) (assume that $MgCl_2$ is 100% dissociated)
1. 103.57 ^oC
2. 102.428 ^oC
3. 374.428 K
4. 372.196 K

142. Acetic acid dimerises in benzene . The value of Van't Hoff factor (i) for the dimerisation of acetic acid is 0.7. The percetage dimerisation of acetic acid will be-
1. 30%
2. 60%
3. 70%
4. 90%

143. The vapour pressure of a solution is 2% less than the vapour pressure of pure water. The molality of the solution is approximately
1. 0.92
2. 1.11
3. 1.26
4. 1.52

144. Which of the following is a feasible reaction?
1. $2KCl + Br_2 \rightarrow 2KBr + Cl_2$
2. $2KBr + I_2 \rightarrow 2KI + Br_2$
3. $2KClO_3 + I_2 \rightarrow 2KIO_3 + Cl_2$
4. $2KIO_3 + Br_2 \rightarrow 2KBrO_3 + l_2$

145. When $CuSO_4$ solution using copper electrodes is electrolyzed then the incorrect statement amongst the following is
1. Weight of cathode increases
2. O_2 gas is evolved at the anode
3. Weight of anode decreases
4. pH of the solution remains same

146. Consider the following cells
Cell-1 $\rightarrow$ Zn | Zn^{2+} || Cu^{2+} | Cu
Cell-2 $\rightarrow$ Cu | Cu^{2+} || Zn^{2+} | Zn

$$\left(E^o_{Cu^{2+}/Cu} = +0.34\ V,\ E^o_{Zn^{2+}/Zn} = -0.76\ V, \left[Zn^{2+}\right] = 1\ M\right)$$

The maximum approximate concentration of $[Cu^{2+}]$ for the working of cell-2 would be
1. 10^{-15} M
2. 10^{-25} M
3. 10^{-37} M
4. Cell-2 cannot work at any concentration of $[Cu^{2+}]$

147. The value of rate constant depends on
1. Concentration
2. Catalyst
3. Temperature
4. Both (2) and (3)

148. The maximum value of the rate constant can be achieved by
1. Decreasing the activation energy to zero
2. Increasing the temperature up to infinity
3. Both (1) and (2)
4. None of the above

149. The correct statement regarding inversion of cane sugar is

1. Molecularity of reaction is two and order of reaction is one

2. Molecularity as well as order of reaction, both are one

3. Molecularity as well as order of reaction, both are two

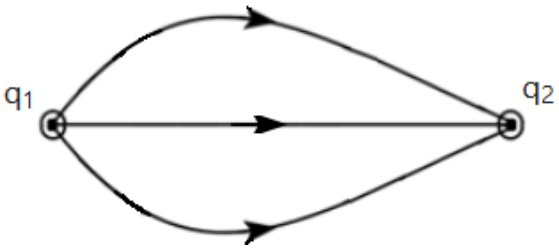
4. Molecularity of reaction is one and order of reaction is two

150. Consider the following first order reaction:
$A(g) \rightarrow B(g) + C(g) + D(g)$
The initial pressure is P and the pressure at a time 't' is P_t ($P_t > P$). The value of rate constant (K) will be

1. $\frac{2.303}{t} log \frac{P}{P_t}$
2. $\frac{2.303}{t} log \frac{P}{2P-P_t}$
3. $\frac{2.303}{t} log \frac{2P}{3P-P_t}$
4. $\frac{2.303}{t} log \frac{2P}{2P-P_t}$

Physics - Section A

151.



A pair of field lines are drawn, connecting the charges q_1, q_2 in addition to the straight field line connecting them. From the above diagram,

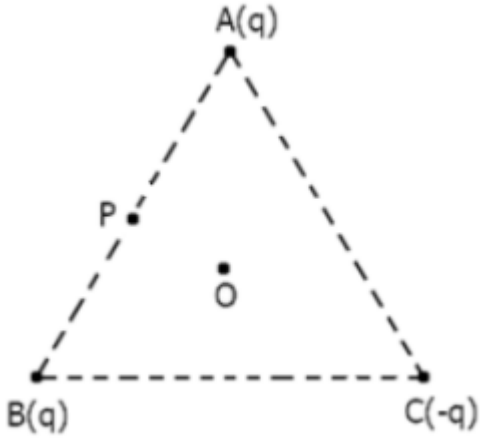
1. $q_1 > 0$, $q_2 < 0$ and $|q_1| > |q_2|$

2. $q_1 < 0$, $q_2 > 0$ and $|q_1| > |q_2|$

3. $q_1 > 0$, $q_2 < 0$ and $|q_1| < |q_2|$

4. $q_1 < 0$, $q_2 > 0$ and $|q_1| < |q_2|$

152. Three charges q, q, -q are placed at the three corners of an equilateral triangle ABC, of side 'a'.



The mid-point of side AB is P while the circumcenter of ABC is O. Let the electric field at P be E_P and that at O be E_O.
Then, $E_O : E_P$ =

1. $\frac{2}{9}$

2. $\frac{4}{9}$

3. $\frac{9}{2}$

4. $\frac{9}{4}$

153. A point charge 'q' is placed at the center of a spherical cavity at the center of a conducting sphere. The sphere is initially uncharged. The radius of the cavity is 'a' and that of the sphere is '2a'. Let the charge on the outer surface of the sphere be Q.
Then,

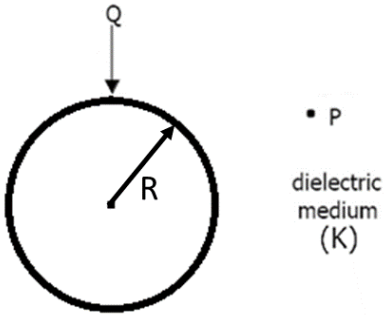
1. q, Q are of the same sign and |q| = |Q|

2. q, Q are of opposite sign and |q| = |Q|

3. q, Q are of same sign and |q| < |Q|

4. q, Q are of opposite sign and |q| > |Q|

154. A uniformly charged sphere carrying a charge Q distributed uniformly on its outer surface is placed in an isotropic medium of dielectric constant 'K'.



The electric field within the medium due to the charge Q at some point P is $\overrightarrow{E}_Q$. The Electric field at the same point P due to induced charge within the medium is $\overrightarrow{E}_m$. Then,

1. $|\vec{E}_m| = \left|\frac{\vec{E}_Q}{K}\right|$, and the two fields are in opposite directions

2. $|\vec{E}_Q| = \left|\frac{\vec{E}_m}{K}\right|$, and the two fields are in the same direction

3. $|\vec{E}_Q + \vec{E}_m| = \left|\frac{\vec{E}_Q}{K}\right|$, and the two fields are in opposite directions

4. $|\vec{E}_Q + \vec{E}_m| = \left|\frac{\vec{E}_m}{K}\right|$, and the two fields are in the same direction

155. Identical point charges (q each), are placed at the eight corners of a cube of side 'a'. When one of the charges is removed, the electric field at the center becomes E_c.
Now, identical point charges (same magnitude q each), are placed at the four corners of a square of side 'a'. When one of the charges is removed, the electric field at the center becomes E_s. Then,

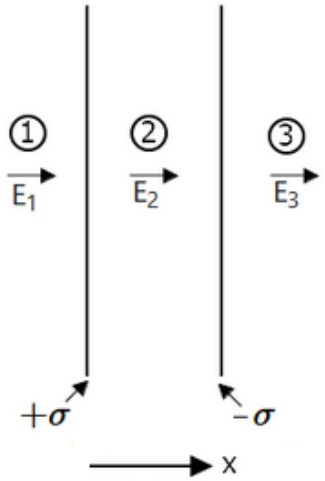
1. $\frac{E_s}{2} = \frac{E_C}{3}$

2. $\frac{E_s}{3} = \frac{E_C}{2}$

3. $\frac{E_s}{\sqrt{2}} = \frac{E_C}{\sqrt{3}}$

4. $\frac{E_s}{\sqrt{3}} = \frac{E_C}{\sqrt{2}}$

156. Two infinitely large plane parallel sheets carry uniform surface charge densities $+\sigma$, $-\sigma$ and are placed a distance 'd' apart. The electric fields in the regions ①, ②, ③ are E_1, E_2, E_3 along the direction 'x' which is perpendicular to the two planes.



Then,

1. $E_1 < 0, E_2 > 0, E_3 < 0$

2. $E_1 < 0, E_2 = 0, E_3 < 0$

3. $E_1 = 0, E_2 > 0, E_3 = 0$

4. $E_1 < 0, E_2 > 0, E_3 > 0$

157. A charged particle of charge q and mass 'm' is projected vertically upward with a speed u. Acceleration due to gravity ('g') acts downwards, while a uniform Electric field E acts along the horizontal. The speed of the projectile's impact on the horizontal is v, while the horizontal range is R. Then,

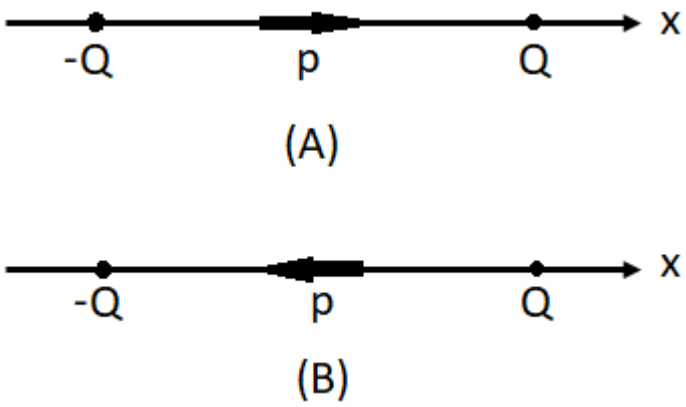
1. $v^2 = u^2 + 2gR$

2. $v^2 = u^2 + 2gR\left(\frac{qE}{mg}\right)$

3. $v^2 = u^2 + gR$

4. $v^2 = u^2 + gR\left(\frac{qE}{mg}\right)$

158. A dipole (p) is placed so that it is always aligned along the x-axis but it can undergo displacement along the x-axis. The dipole is placed exactly midway between two fixed charges -Q and Q, in two possible ways.



Then, the dipole is

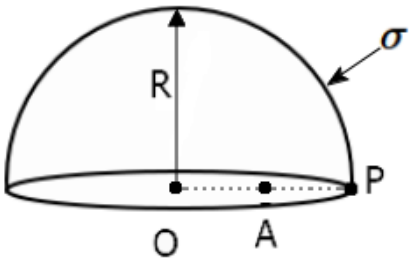
1. stable in both A, B

2. stable in A, unstable in B

3. unstable in A, stable in B

4. unstable in both A, B

159. Consider a uniformly charged hemispherical shell of radius R, carrying a surface charge of density σ. The potential at a point P on the inner rim of the hemisphere is V_P, while that at the center is V_O, and the potential at the mid-point (A) of OP is V_A. Then,



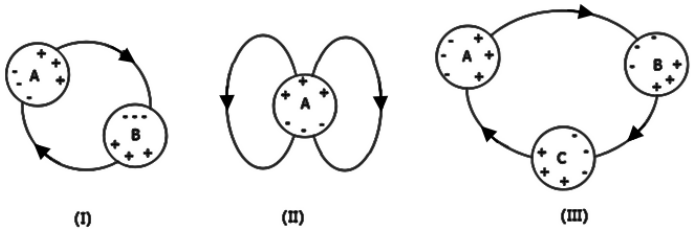
1. $V_O > V_A > V_P$

2. $V_O < V_A < V_P$

3. $V_A > V_O$, $V_A > V_P$

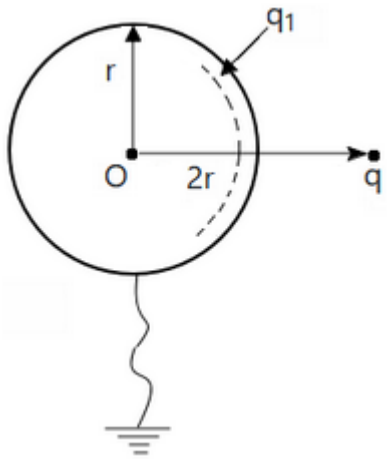
4. $V_O = V_A = V_P$

160. Which of the following field configurations is/are possible?
Note: A, B, C are conductors. Other charges may be present in the vicinity.



1. I, III
2. II
3. I, II, III
4. none of I, II, III

161. A point charge 'q' is placed at a distance 2r from the center of a conducting sphere of radius r, and the sphere is earthed. The conducting sphere acquires a charge q_1, which resides on its surface. Then,



1. $q_1 = -q$

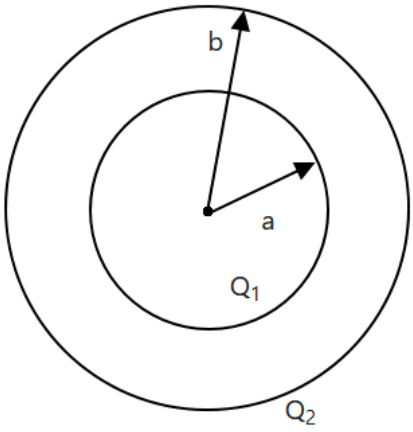
2. $q_1 = -\frac{q}{2}$

3. $q_1 = -\frac{q}{4}$

4. $q_1 = -2q$

Hint: Use the fact that the potential at the center of the sphere is zero.

162. A pair of concentric conducting spherical shells of radii a, b are given charges Q_1, Q_2 respectively.



If Q_1 = +Q and Q_2 = -Q, and the potential difference between the spheres be V, the ratio $\frac{Q}{V}$ is their capacitance. The capacitance of this configuration is: ($A_a = 4\pi a^2$, $A_b = 4\pi b^2$, separation = d = b - a)

1. $\varepsilon_0 \frac{A_a}{d}$

2. $\varepsilon_0 \frac{(A_a+A_b)/2}{d}$

3. $\varepsilon_0 \frac{\sqrt{A_a A_b}}{d}$

4. $\varepsilon_0 \frac{A_b}{d}$

163. Two metallic plates are placed parallel to each other, at a separation 'd'. A dielectric (K = 2) of width d/3 is inserted into space between the plates, parallel to plates: the separation between the plates being d. The capacitance of the plates

1. increases by 20%

2. decreases by 20%

3. increases by 33%

4. decreases by 25%

164. A metallic sphere of radius R is given a charge Q. The energy stored in the sphere due to this charge is

1. $\frac{Q^2}{4\pi\varepsilon_0 R}$

2. $\frac{2Q^2}{4\pi\varepsilon_0 R}$

3. $\frac{1}{2}\frac{Q^2}{4\pi\varepsilon_0 R}$

4. $\frac{Q^2}{16\pi\varepsilon_0 R}$

165. Two identical capacitors, each of capacitance C, are connected in series and are charged by means of an ideal battery of emf E. They are disconnected and reconnected in parallel and connected to the same battery. During this reconnection, the positive terminals of the capacitors are connected to the positive terminal of the battery and their negative terminals are similarly connected together. Let, the work done by the battery during the first connection be W_1, and during the second be W_2. Then,

1. $W_1 = W_2$

2. $2W_1 = W_2$

3. $W_1 = 2W_2$

4. $4W_1 = W_2$

166. N capacitances, C each, are available to be connected in series or in parallel. The ratio of the minimum (C_{min}) and maximum (C_{max}) capacitance that can be formed from these is $\frac{C_{max}}{C_{min}} =$

1. N

2. N^2

3. N^3

4. $\sqrt{N}$

167. A dielectric slab is inserted between the plates of an isolated charged capacitor. Which of the following remains unchanged?
(I) The charge on the plates
(II) The potential difference between the plates
(III) The energy stored in the capacitor

1. I only

2. I, II

3. I, III

4. I, II, III

168. A parallel plate capacitor (C) is charged by connecting it to a battery (emf E). A dielectric slab is inserted into the space between the plates.
(I) The charge on the plates increases.
(II) The energy stored in the capacitor increases.
(III) Work is done by the battery as the slab is inserted.

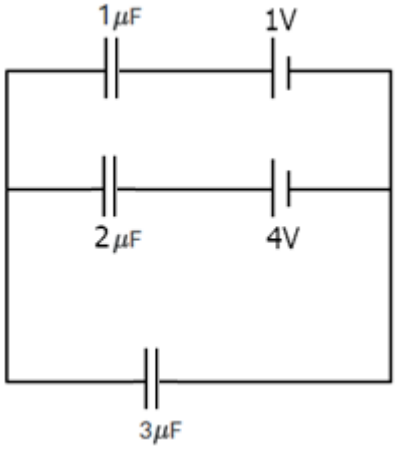
1. I, II are true

2. I, III are true

3. Only I is true

4. I, II, III are true

169. Find the charge on the 3μF capacitor.



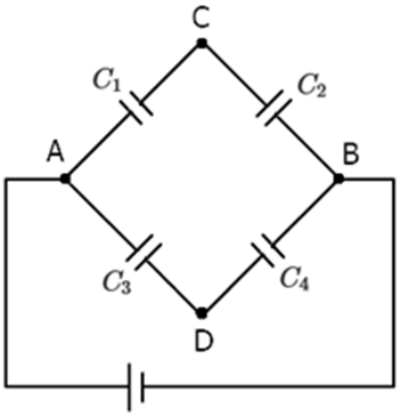
1. 1.5 μC

2. 3 μC

3. 4.5 μC

4. 9μC

170. Initially, uncharged capacitors are connected in a circuit, as shown in the diagram. The potentials at C, D satisfy: $V_C = V_D$
Then,



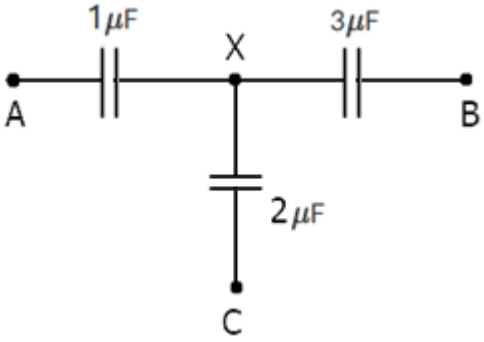
1. $C_1C_2 = C_3C_4$

2. $\frac{C_1}{C_4} = \frac{C_2}{C_3}$

3. $\frac{C_1}{C_3} = \frac{C_2}{C_4}$

4. $C_1C_3 = C_2C_4$

171. The capacitors are initially uncharged. The three points A, B, C are maintained at potentials V_A = 4V, V_B = 1V and V_C = 1V. The potential at X, V_X =



1. 2 V

2. 1.5 V

3. 3 V

4. 0.5 V

172. Two capacitors, one of 3μF and the other of 1μF are charged to 2V, 4V and are connected to each other in either of the two ways: their like terminals together (A) or unlike (i.e. oppositely charged) terminals together (B). The potential differences are V_A, V_B in these cases. Then,

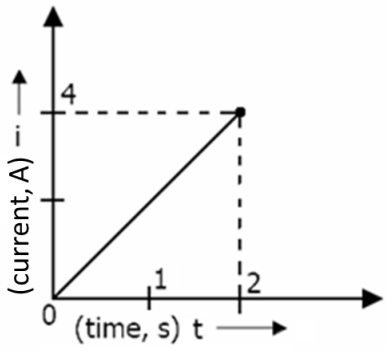
1. $V_A = 2V_B$

2. $V_A = 4V_B$

3. $V_A = 5V_B$

4. $V_A = 6V_B$

173. A uniformly increasing current flows through a 30Ω resistance, as shown in the graph.



The thermal energy generated in the resistance due to Joule heating is

1. 240 J

2. 480 J

3. 160 J

4. 320 J

174. Two non-ideal batteries are connected in parallel: Battery of EMF E_1, resistance r_1 and of EMF E_2, resistance r_2. The resulting equivalent battery has EMF 'E', resistance r. If $r_1 < r_2$,

1. $|E - E_1| < |E - E_2|$

2. $|E + E_1| < |E + E_2|$

3. $|E - E_1| > |E - E_2|$

4. $|E + E_1| > |E + E_2|$

175. Several resistances R_1, R_2,.....R_n are connected in parallel. The equivalent resistance of the combination is R.

Assertion: The fractional error in R is most affected by that of the smallest resistance in the combination, other things being equal.

Reason: In parallel, the conductances add. The contribution to the overall error in the conductance is largest for the largest conductance or the smallest resistance.

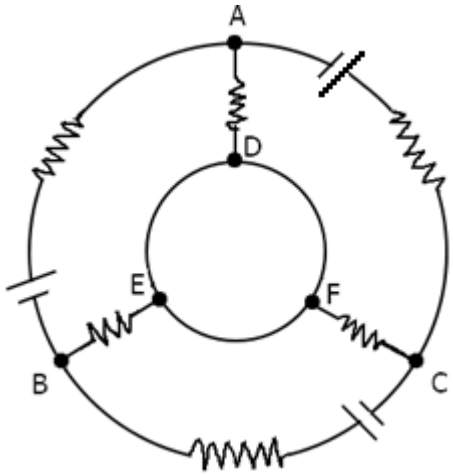
1. Both assertion and reason are true, and reason is the correct explanation of the assertion.

2. Both assertion and reason are true, but reason is not the correct explanation of the assertion.

3. Assertion is true but reason is false.

4. Assertion is false but reason is true.

176. All the resistances shown in the network are equal to 1 Ω, while the EMFs of the cells are 2V. The current flowing through the branch AC is



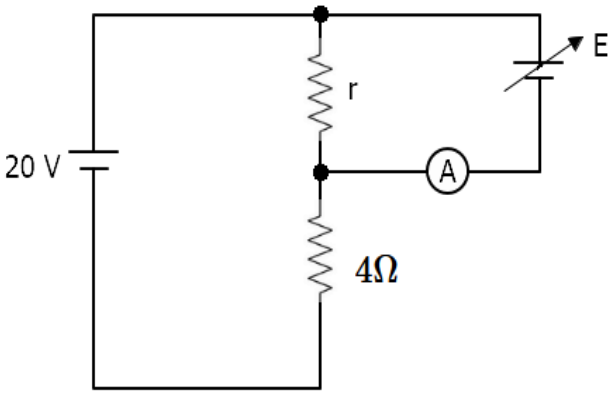
1. 1 A

2. 2 A

3. 4 A

4. 6 A

177. In the circuit shown in the diagram, the resistance 'r' is unknown but fixed. The EMF 'E' can be varied and the current (i) passing through the ammeter A can be measured in magnitude only.



When the EMF 'E' is adjusted so that the current in the ammeter A is zero, then the value of this EMF is E_0.

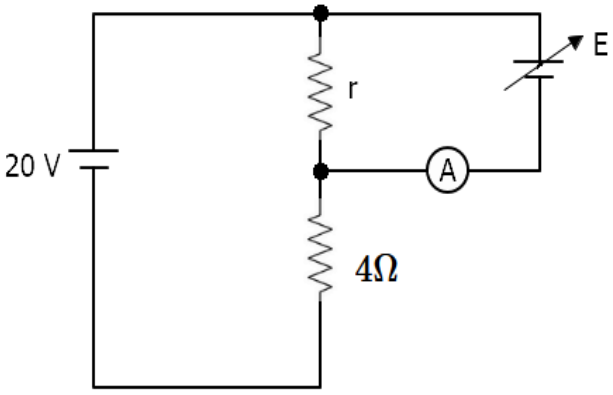
1. E_0 = 16 V if r = 8Ω

2. E_0 = 10 V if r = 2Ω

3. E_0 = 5 V if r = 1Ω

4. E_0 < 20 V no matter what the value of r.

178. In the circuit shown in the diagram, the resistance 'r' is unknown but fixed. The EMF 'E' can be varied and the current (i) passing through the ammeter A can be measured in magnitude only.



For a particular situation, it is observed that when E = 4.8 V and when E = 3.2 V, the ammeter gives the same reading in magnitude. Then, the value of the resistance r is

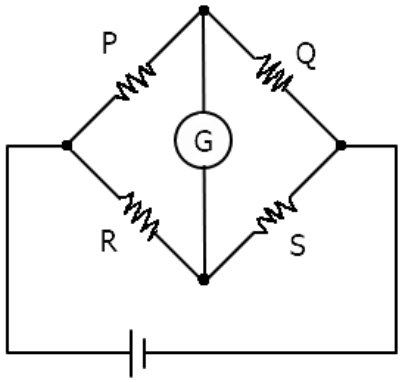
1. 1 Ω

2. 2 Ω

3. 1.6 Ω

4. 4 Ω

179. In a Wheatstone Bridge arrangement, as shown in the figure, the bridge is balanced. However, when the resistances in the arms P, Q are switched, the bridge is balanced only when R is replaced by 4R in the other two arms. If the value of R is 100 Ω, that of S is



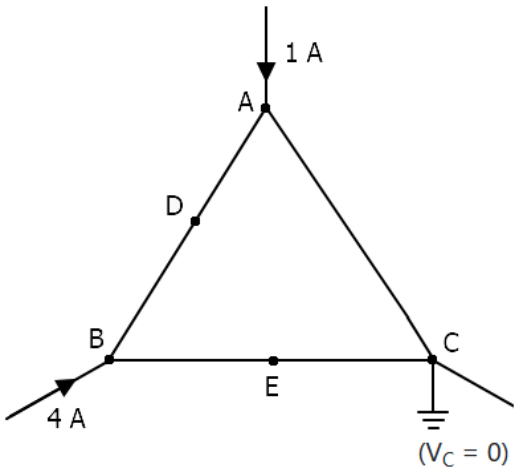
1. 100 Ω

2. 50 Ω

3. 200 Ω

4. 400 Ω

180. A wire is connected to form an equilateral triangle ABC, each side having a resistance of 4Ω. The vertex C is maintained at zero volt (V_C = 0), currents flowing in at A and B are as shown in the figure. The ratio of the potentials at D and E $\left(i.e.\ \frac{V_D}{V_E}\right)$ equals



1. $\frac{3}{1}$

2. $\frac{2}{1}$

3. $\frac{1}{1}$

4. $\frac{5}{3}$

181. A capacitor is being charged through a resistance, R. The capacitor was initially uncharged, and gets 75% charged in 20 s. If the capacitor is now allowed to discharge, it will lose 50 % of its initial charge in
(Take $\left(\frac{3}{4}\right)^{2.4} \approx \frac{1}{2}$, if required)

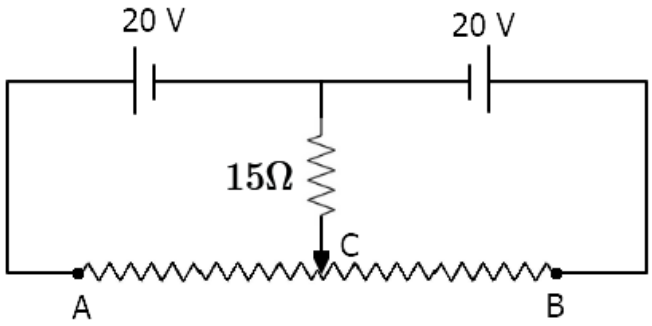
1. 20 s

2. 48 s

3. 10 s

4. 24 s

182. AB is a 20Ω resistor with a tapping point C that can be moved along AB. The resistances in AC, BC are proportional to the lengths AC, BC. Initially, C is at the mid-point of AB and the circuit is switched on.



If the tapping point C is moved so that the length BC is reduced to half its initial value, then the voltage across the 15Ω resistor

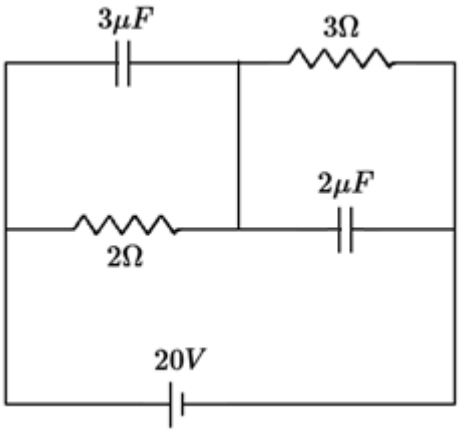
1. increases by 1 V

2. decreases by 1 V

3. increases by 3 V

4. decreases by 3 V

183.



In the above circuit, let the charges stored in the two capacitors 3μF, 2μF be q_1, q_2. Then, the ratio $q_1 : q_2$ is

1. 1

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

3. $\frac{9}{4}$

4. $\frac{4}{9}$

184. The potential difference between the ends of a 12 V battery when it is being charged by a 2 A charger is found to be 13.2 V.
If this battery is connected in a circuit with a 6Ω resistance, the current will be nearly

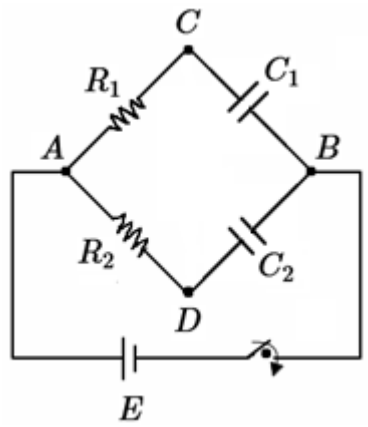
1. 2 A

2. 1 A

3. 1.8 A

4. 2.2 A

185. The circuit shown in the adjacent diagram is switched on with the capacitors uncharged. It is observed that $V_C = V_D$ at all times. Then,



1. $\frac{R_1}{R_2} = \frac{C_1}{C_2}$

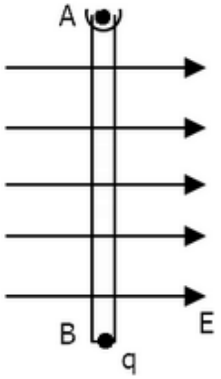
2. $\sqrt{\frac{R_1}{R_2}} = \frac{C_1}{C_2}$

3. $\frac{R_1}{R_2} = \sqrt{\frac{C_1}{C_2}}$

4. $\frac{R_1}{R_2} = \frac{C_2}{C_1}$

Physics - Section B

186. A thin uniform rod of mass M and length L is suspended from one of its ends, 'A', so that it can rotate freely about it. A charge 'q' is fixed to its lower end B. A uniform horizontal Electric field is switched on and the rod rotates about A, finally coming to equilibrium – making an angle of 45° with the vertical. If the acceleration due to gravity is 'g', then



1. qE = Mg

2. 2qE = Mg

3. qE = 2Mg

4. $\sqrt{2}$qE = Mg

187. Two very long insulated glass rods are charged uniformly by giving them identical charges 'q', each. The rods have lengths L each and are placed parallel to each other at a distance 'r' apart, where r $\ll$ L. Then, the electric force acting between the rods is proportional to

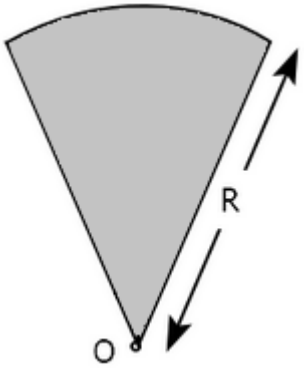
1. $\frac{1}{r^2}$

2. $\frac{1}{r}$

3. r

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

188. A sector of a circle (radius : R) carries a uniform surface charge Q distributed over it. The potential, due to this charge, at the center of curvature if the sector (o) is



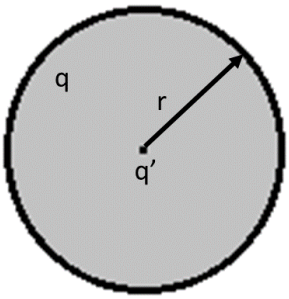
1. $\frac{kQ}{R}$

2. $\frac{kQ}{2R}$

3. $\frac{2kQ}{R}$

4. $\frac{kQ}{R} ln\, 2$

189. A charge 'q' is uniformly distributed within a spherical volume of radius R. A negative point charge q' is placed at the center of this sphere so that the electric field of the overall distribution (i.e. q and q' together) – vanishes at the mid-point of the radius of the sphere.



If the potential at the surface of the sphere with 'q alone' is V_1 and with q, q' together is V_2, then

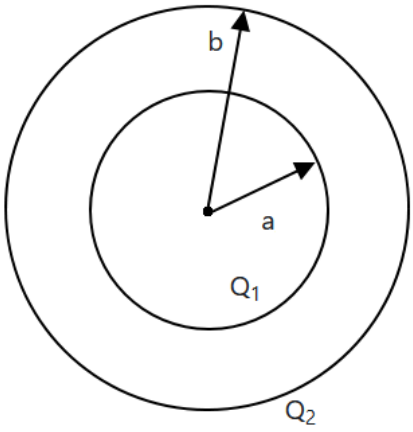
1. $\frac{V_1}{V_2} = \frac{2}{1}$

2. $\frac{V_1}{V_2} = \frac{4}{3}$

3. $\frac{V_1}{V_2} = \frac{4}{1}$

4. $\frac{V_1}{V_2} = \frac{8}{7}$

190. A pair of concentric conducting spherical shells of radii a, b are given charges Q_1, Q_2 respectively.



The potential of the outer sphere depends on

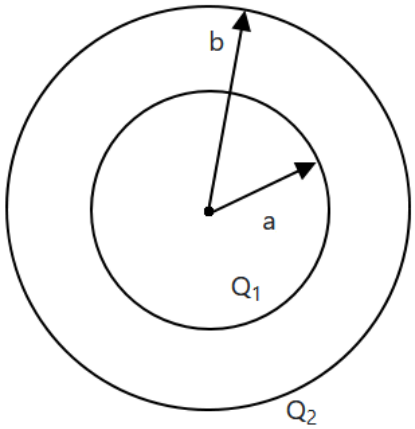
1. Q_2 only

2. Q_1 - Q_2

3. Q_1 + Q_2

4. Q_1 only

191. A pair of concentric conducting spherical shells of radii a, b are given charges Q_1, Q_2 respectively.



The potential difference between the two spheres depends on

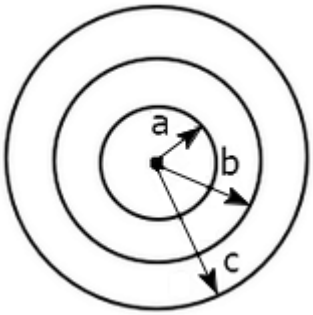
1. Q_2 only

2. Q_1 - Q_2

3. Q_1 + Q_2

4. Q_1 only

192. Three concentric spherical conducting shells of radii a, b, c (a<b<c) are placed as shown. Let C_{ab} be the capacitance when a, b spheres are charged with +Q, -Q and similarly, let C_{bc} be the capacitance between b, c spheres while C_{ac} be the capacitance between a, c sphere. Then:



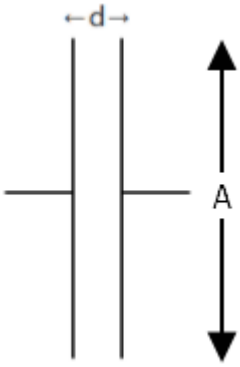
1. $C_{ab} + C_{bc} = C_{ac}$

2. $\frac{1}{C_{ab}} + \frac{1}{C_{bc}} = \frac{1}{C_{ac}}$

3. $\sqrt{C_{ab} \cdot C_{bc}} = C_{ac}$

4. $C_{ab} - C_{bc} = C_{ac}$

193. Consider a parallel plate capacitor of plate area 'A', plate separation 'd'. Suppose that the plates are given charges +Q, -Q respectively. The force between the two plates is proportional to



1. $\frac{Q^2}{d^2}$

2. $\frac{Q^2}{A}$

3. $\frac{Q^2}{d\sqrt{A}}$

4. $\frac{Q^2\sqrt{A}}{d^3}$

194. A capacitor is constructed by taking metallic circular discs of radius 'r' placed face-to-face with a separation of 'd'. A dielectric slab is inserted into the space between the plates so that it fills the entire width, but only half the area between the plates. The dielectric constant is K. Then, the capacitance is

1. $\frac{K\varepsilon_0\pi r^2}{d}$

2. $\frac{K\varepsilon_0\pi r^2}{2d}$

3. $\frac{K+1}{2}\frac{\varepsilon_0\pi r^2}{d}$

4. None of the above

195. An uncharged capacitor (C) is connected to a battery of emf E. Once it is fully charged, it is connected to a second battery of emf 2E. The positive terminal of the capacitor and battery are connected and their negative terminals are similarly connected together. The energy dissipated as heat, when the second battery is connected is

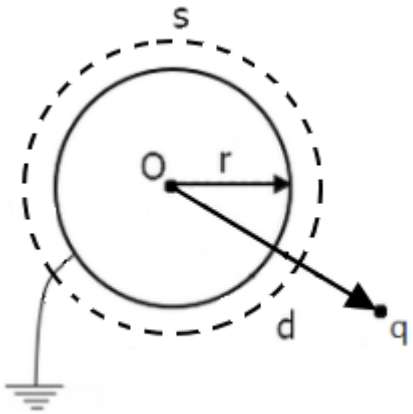
1. $\frac{3}{2}CE^2$

2. $\frac{1}{2}CE^2$

3. CE^2

4. $\frac{5}{2}CE^2$

196. Consider a spherical conductor of radius r, centered at the point O. A point charge q (q > 0) is placed outside the sphere, at a distance 'd' from its center (O) (d > r) and the sphere is earthed.

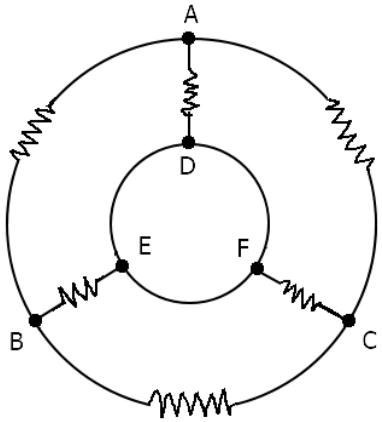


Assertion: The electric flux due to the external charge q and the induced charges on the sphere through the spherical surface S shown dotted in the diagram, is ($-q/\varepsilon_0$).

Reason: Negative charges are induced on the surface of the conducting sphere due to the positive charge q in the vicinity, and the potential of the conducting sphere is zero.

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 the correct explanation of the assertion.
3. Assertion is true but reason is false.
4. Assertion is false but reason is true.

197. All the resistances shown in the network are equal to 1Ω. Find the resistance of the network measured between A and D.



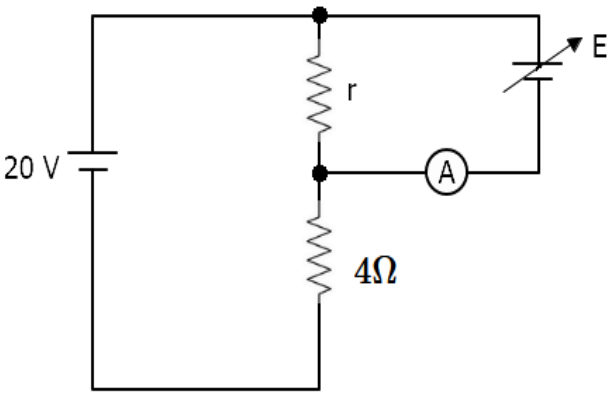
1. $1\ \Omega$

2. $2\ \Omega$

3. $\frac{1}{2}\ \Omega$

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

198. In the circuit shown in the diagram, the resistance 'r' is unknown but fixed. The EMF 'E' can be varied and the current (i) passing through the ammeter A can be measured in magnitude only.



When the EMF 'E' is negligible (i.e. practically zero) the ammeter reading will

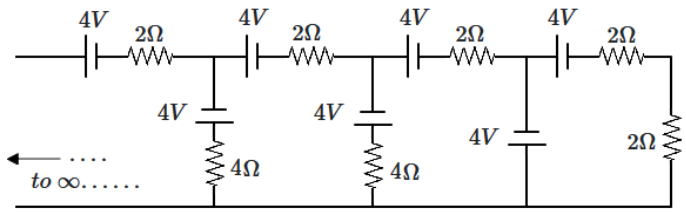
1. be 5 A, independent of r

2. be 2.5 A, independent of r

3. be less than 5 A, decreasing with r

4. be more than 5 A, increasing with r

199. Find the current through the rightmost 2Ω resistor.



1. 1 A

2. 2 A

3. 0.5 A

4. 0.25 A

200. A battery of emf E is used to charge an uncharged capacitor C, through a resistance R. The time constant of the circuit is $\tau = RC$.
Assertion: When the voltage across the capacitor reaches 50% of its maximum value, the rate of heat dissipation in the resistor falls to $\frac{1}{4}$ of its initial value.
Reason: The voltage across the capacitor is proportional to the charge on its plates, while the rate of flow of charge is the current (i). This current (i) falls exponentially with a time constant T, and it falls to 50% of its initial value when the capacitor is 50% charged. The rate of heat dissipation, being proportional to i^2, falls to $\frac{1}{4}$ of its initial value.

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 the correct explanation of the assertion.

3. Assertion is true but reason is false.

4. Assertion is false but reason is true.

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