COMMON PRE-BOARD EXAMINATION 2022-23

Subject: BIOLOGY (044)-Answer Key

Date: 19/01/2023 Duration:3 HOURS

TOTAL MARKS: 70

General Instructions:

(i) All questions are compulsory.

(ii) The question paper has five sections and 33 questions. All questions are compulsory.

(iii) Section–A has 16 questions of 1 mark each;

(iv) Section–B has 5 questions of 2 marks each;

(v) Section– C has 7 questions of 3 marks each;

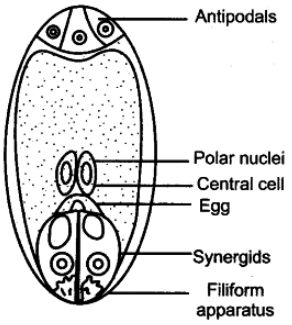
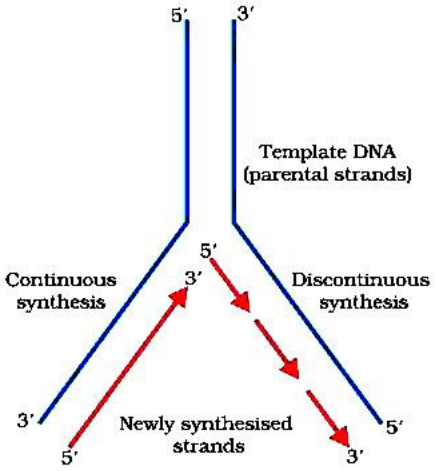
(vi) Section– D has 2 case-based questions of 4 marks each; and

(vii) Section–E has 3 questions of 5 marks each.

(viii) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

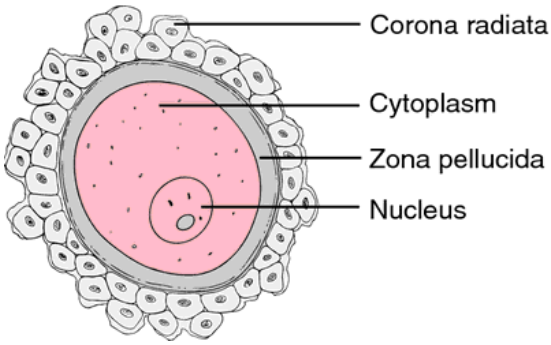
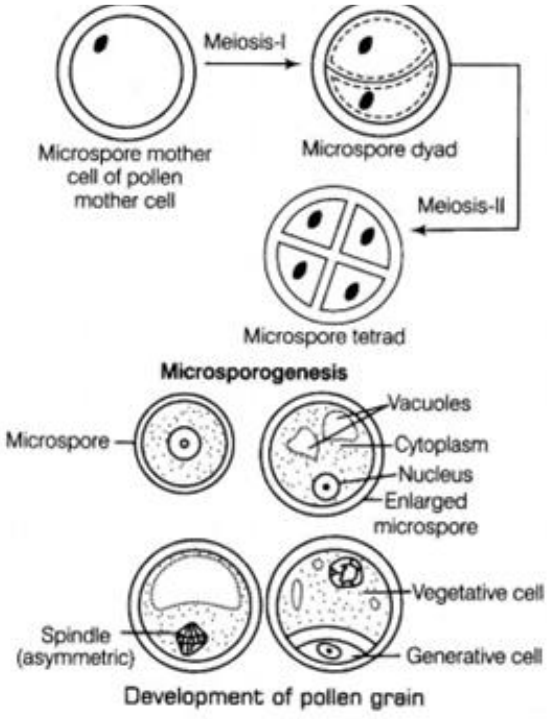
(ix) Wherever necessary, neat and properly labeled diagrams should be drawn.

	SECTION -A	
Q No	Question	Marks
1	c) (ii) and (iii)	1
2	b) Zygote is collected from a female donor and transferred to the fallopian tube	1
3	b) 5’ (upstream) end and 3’ (downstream) end, respectively of the transcription unit	1
4	b) they share a common ancestor	1
5	a) UAAAGG	1
6	d) High fever, weakness, stomach pain, loss of appetite and constipation	1
7	b) Saccharomyces cerevisiae	1
8	b) Child 2	1
9	c) 2.4	1
10	c)have more RBCs and their hemoglobin has a lower binding affinity to O2.	1
11	c) Is always represented as dry weight only	1
12	a) Species confined to a region and not found anywhere else	1
13	a	1
14	c	1
15	b	1
16	d	1
	SECTION -B	
17	a) Role of A (Estrogen) - leads to changes in the ovary and uterus / regeneration of endometrium through proliferation = ½ +½ Role of B (Progesterone) - Maintenance of endometrium for implantation of the fertilized ovum/ maintenance of other events of pregnancy = ½ b) In case of pregnancy = ½	2
18	a) RrYy X rryy = 1 b) Test Cross – to find the unknown genotype of F1-hybrid = 1	2
19	a) Acts as a vector of malaria. = ½ b) Fertilization /syngamy takes place in the mosquito’s intestine =½ c) Salivary glands, the cells being released from it are sporozoites. =1	2
20	a) Template strand = ½ b) Sigma factors are subunits of all bacterial RNA polymerases. They are responsible for determining the specificity of promoter DNA binding and control how efficiently RNA synthesis (transcription) is initiated. Rho factor is used as transcription termination by an RNA polymerase and is essential for the viability of the cell. = ½ + ½ c) hnRNA is required to undergo splicing because of the presence of introns (the non-coding sequences) in it. These need to be removed and the exons (the coding sequences) have to be joined in a specific sequence for translation to take place.= ½ + ½	2

21	The number of phytoplankton and their biomass is less than the biomass of the organisms who consume it. = 1 + 1 =2 OR The pyramid of energy is upright because when energy flows from a particular trophic level to the next trophic level. Some energy is always lost as heat at each step. =1 Each bar in the energy pyramid indicates the amount of energy present at each trophic level at a given time. =1	2
	SECTION -C	
22	(a) - Initiation by GnRH from hypothalamus which acts on Anterior Pituitary to release FSH & LH (Gonadotropins) = 1 -LH acts on cells of Leydig / Interstitial cells to secrete androgens = ½ -Androgens in turn stimulate the process of spermatogenesis = ½ -FSH acts on Sertoli cells and stimulates the secretions of some factors that stimulate spermiogenesis = 1	3
23	The typical female gametophyte or embryo sac has three cells that are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus, in turn, consists of two synergids and one egg cell. = ½ Three cells are at the chalazal end and are called the antipodals. = ½ The large central cell, has two polar nuclei. =½ Thus, a typical angiosperm embryo sac, at maturity is 8-nucleate is 7-celled. Labels – Antipodals, polar nuclei, egg cell- ½ x3= 1½  Mature Embryo sac of an angiosperm	3
24	 	3

	4 labelling - Continuous synthesis, discontinuous synthesis, template /parental strands, newly synthesized strands = ½ × 4 = 2 (b) 2 strands are antiparallel, DNA polymerase acts only in one direction i.e., 5'--3' ½ + ½ = 1	
25	As the environment changes, the organisms which are better adapted to the charged environment could survive better and reproduce. = ½ When DDT was used initially most of the mosquitoes died but a few survived. These few mosquitoes reproduced and the offspring were also resistant to DDT. =½ Today the population of mosquitoes consists mainly of DDT resistant mosquitoes. The DDT resistant mosquitoes have appeared in a time scale of months or years and not centuries. =1 According to Hugo de Vries evolution occurs due to mutations, that is large differences arising suddenly in a population. According to him large, single step mutation, called saltation, must have been the cause of DDT resistance in mosquitoes. = 1	3
26	i) Viral protein coat= ½ ii) B- reverse transcriptase through which the viral DNA is produced. = ½ X is the viral RNA introduced into human cell and C is viral DNA =½ +½ iii) D- macrophages is the host cell. ½ **iv)** Macrophages and Helper T lymphocytes = ½ OR i) A- Plasmid B- ADA encoded gene = ½ ii) ADA deficiency is caused by mutation in ADA gene that code for Adenosine deaminase enzyme involved in purine metabolism. It affects immune system and causes SCID (severe combined immunodeficiency). = ½ +½ iii) The introduction of functional ADA gene in bone marrow cells of the patient, is done through an engineered retrovirus containing a functional ADA gene. =1 Recipient cells are lymphocytes/bone marrow cells. =½	3

27	a) Escherichia coli (E. coli) =½ b) Ori = ½ c) The coding sequence of B galactosidase is considered as a better selectable marker because it differentiates the recombinants from the non-recombinant on the basis of their ability to produce colour in the presence of chromogenic substrate. =1 The bacteria whose plasmid does not have an insert, produce blue colored colonies, but those with an insert do not produce any colour. =1	3
28	Ans. Co-extinction- When a species becomes extinct, the plant and animal species associated with it in the obligatory way, also becomes extinct = ½ × 3 = 1½ Introduction of alien species - When alien species are introduced, some of them turn invasive (because of not having their predator there), and hence cause decline / extinction of indigenous species = ½ × 3 = 1½	3
	SECTION-D	
29	a) Females can be carriers of colourblindness and not have it =1 b) Colourblindness is a sex linked recessive disorder =1 c) Her mother is a carrier of colourblindness and father is colourblind. She has inherited bothe the recessive alleles from both the parents .So she is colourblind. =1 d) All daughters have received the recessive alleles from father, as father is colourblind. =1	4
30	a) morphine b) cannabinoids = ½ + ½ b) Atropa bellodona and Datura = ½ + ½ **c)** Avoid undue peer pressure, educating and counselling, seeking help from parents and peers, looking for danger signals, seeking professional and medical help. (Any 4) = ½ x4 =2 OR Psychological attachment of certain effects such as euphoria and a temporary feeling of wellbeing associated with drugs and alcohol is called addiction. = 1+1	4

	SECTION-E	
31	a) c, rapid secretion of LH (LH surge) = ½ + ½ b) d, luteal phase =½ + ½ c) At the time of ovulation, the structure ruptures and ova is released from it. After ovulation it is converted into yellow coloured mass of endocrine tissue called corpus luteum. Corpus luteum secretes progesterone which maintains the endometrial wall and pregnancy =1 d) 4 labels = ½ x4=2  **OR** **a)** Diagram – ½ x 4 =2  	5

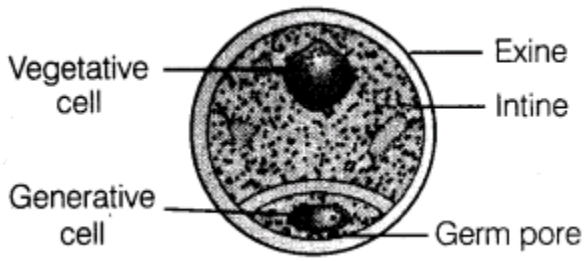


Diagram = ½ x2=1
(b) Functions of layers are:

- Exine provides protection. = ½
- Intine grows out as pollen tube through one of the germ pores on the exine. =½

Functions of two cells

(i) Vegetative cell contain food reserves, i.e., starch, protein, fat. = ½

(ii) Generative cell divides mitotically to produce two male gamete = ½

32 5

a) Semi conservative replication of DNA, = ½
During DNA replication, the two strands of DNA separate and serve as a template and the daughter strand will be a newly formed strand. =1 ½
b) M. Messelson and Franklin Stahl =1
c) E. coli = ½
d) $^{15}NH_4Cl$ = ½
e) By centrifugation in CsCl density gradient = 1

OR

(a) The 'I' gene is the regulatory gene of the operator. 'I'gene codes for the repressor protein of the operon, which is synthesized in constant amounts. = ½ + ½
The repressor binds to the operator and prevents the RNA polymerase from transcribing the structural genes. =1
(b) When repressor binds to the operator, the operon is switched off and transcription is stopped. So, it is called a negative regulation. ½ x2=1
(c) Lactose is an inducer molecule. = ½

-Gene 'z' codes for beta-galactosidase, which is responsible for the hydrolysis of lactose into galactose and glucose = ½ + ½

- 'y' gene codes for permease. It increases the permeability of the cell to lactose. =½

33

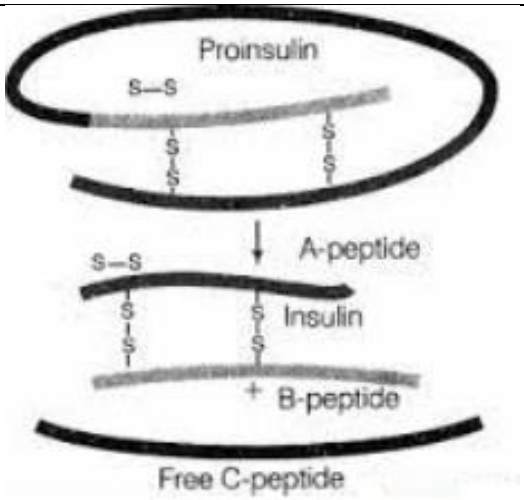


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Diagram – 2 labels = ½ x2=1

a) Eli Lily, prepared two DNA sequences corresponding to chain A and B of human insulin and introduced them in plasmids of E. coli to produce insulin chains. =1

-Chain A and B were produced separately, extracted and combined by creating disulphide bonds to form human insulin called Humulin =1

b) E coli plasmid — Human cell

Restriction enzyme — human insulin gene

Cut plasmid – sticky ends — Restriction enzyme cut insulin gene sticky ends

Annealing by DNA ligase

Recombinant DNA

Introduced into E coli = 1

↓

Clones of engineered bacteria in a fermenter containing medium (same method followed for both Chain A and B)

↓

Extracted Chain A and B

↓

Purified

↓

Connected by disulphide bonds

↓

Recombinant insulin.

b) Insulin from animal source caused some patients to develop allergy or other types of reactions to the foreign protein.
= 1

OR

I) a. Protoxin is produced in an inactive form. = ½

b. This protoxin, in the presence of alkaline pH in the intestine of insects becomes active. The toxin binds to the epithelial cells of the surface of the midgut of the insect that induces pore formation, swelling, and cytolysis, eventually leading to death. =1+1

c. Isolation of specific Bt toxin genes from Bacillus thuringiensis and its integration into several crops such as cotton and corn that are pest-resistant to specific insects. = 1

ii) In this method complementary strands of RNA binds with single strand of mRNA which makes it double stranded RNA, as ds stranded RNA cannot translates so it blocks gene expression. = 1

The parasite cannot survive in a transgenic host that expresses the RNA interference; thus, the tobacco plant is protected from the nematode. = ½

END OF THE PAPER