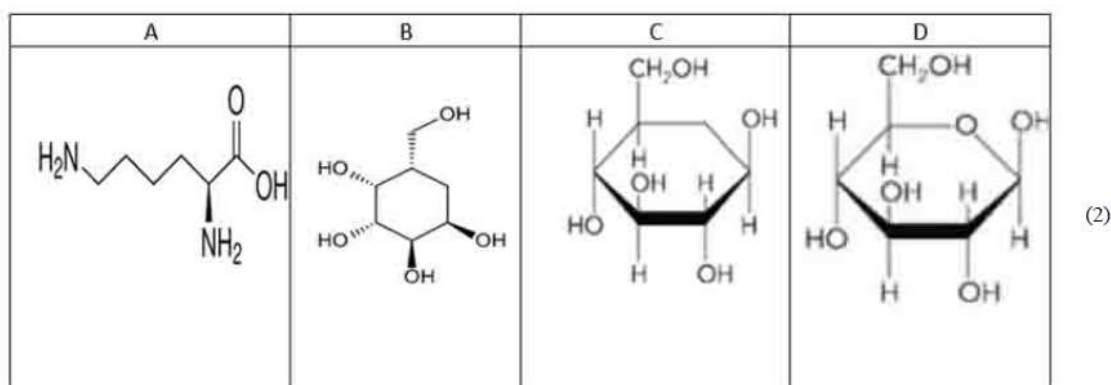11) You are in a start up company facilitating long stay on moon. The company is considering the following four molecules that can be used to synthesize a polymer for human/animal consumption to produce energy on digestion.

A	B	C	D

(2)

According to you which monomer is best? Why? (1 mark)
Construct the structure of the polymer in the form of an illustration using the monomer of your choice clearly illustrating the linkage (1 marks)

(A) **Monomer D** is suitable as it can form **glycosidic linkages /** Monomer D is **glucose molecule** which can form glycosidic linkages. Glycosidic linkage on breaking by enzymes **can provide energy** 1 mark
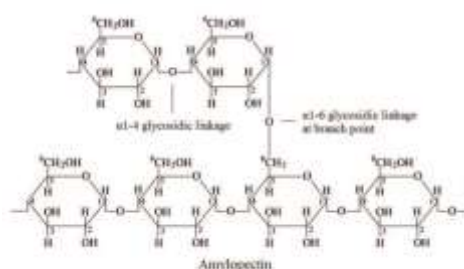
(B)
(Student is expected to illustrate the linkage as shown here) 0.5 +0.5 = 1 mark

12) In Mendel's pea plant Yellow seed colour (Y) and Spherical seed shape (R) are dominant. The recessive characters are green seed colour and wrinkled seed shape. When a Yellow and Spherical seed bearing plant upon selfing always produced the following two seed phenotypes. The photograph is given below.

(3)

A. Represent the cross in the form of a Punnett square clearly mentioning genotypes and phenotypes (2 marks)

B. Find the test cross phenotypic ratio of Yellow and Spherical seed bearing plant. Show your calculation (1 mark)

(A) Yellow Spherical : Selfing = YyRR X YyRR
(1 mark for correct Punnett square, 1 mark for mentioning genotypes and phenotypes correctly)

	YR	YR	yR	yR
YR	YYRR Yellow Spherical	YYRR Yellow Spherical	YyRR Yellow Spherical	YyRR Yellow Spherical
YR	YYRR Yellow Spherical	YYRR Yellow Spherical	YyRR Yellow Spherical	YyRR Yellow Spherical
yR	YyRR Yellow Spherical	YyRR Yellow Spherical	yyRR Green Spherical	yyRR Green Spherical
yR	YyRR Yellow Spherical	YyRR Yellow Round	yyRR Green Spherical	yyRR Green Spherical

Phenotypic ratio = Yellow spherical: Green spherical = 3:1

(B) Yellow Spherical can be YYRR or YyRR.
The test cross is:
YYRR x yyrr = YyRr (All yellow Spherical, in this case heterozygous)
YyRR X yyrr = YyRR:yyRr = Yellow spherical:green spherical 1:1

(1 mark)

13) "Vikram Lander exceeded its mission objectives. It successfully underwent a hop experiment. On command, it fired the engines, elevated itself by about 40 cm as expected and landed safely at a distance of 30-40 cm away," ISRO said in a statement. This will faclitate in designing our future take off from any alien planet. Now let us assume that Mangalyaan comes back with a rough and smooth strains of bacteria whichis found on Mars and the Manipal student project team was asked to do an "Avery experiment". The results are follows
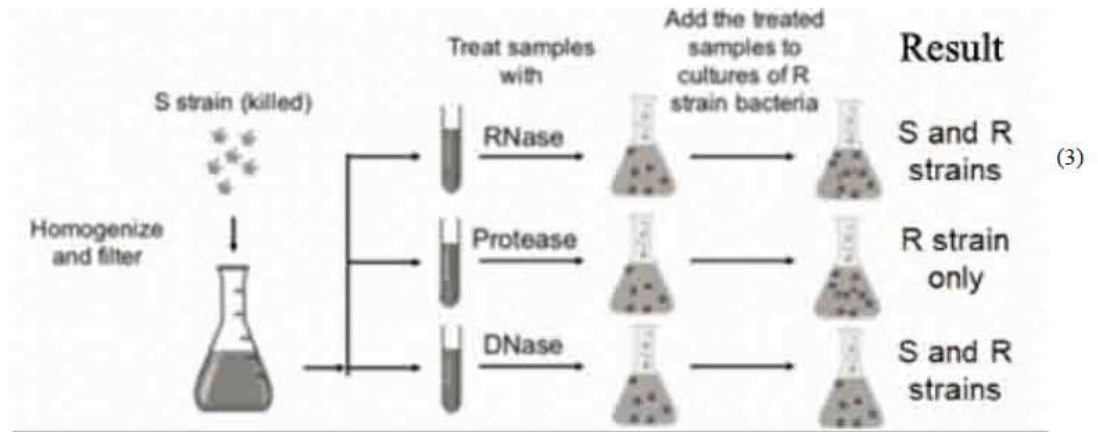

(1) Based on the results, what can be the maritan genetic material? Justify (2 marks)

(2) Why you cant execute avery experiment using the model virus infecting bacteria? (1 mark)

(1) **The Transformation is not occurring when the protease is treated. This means that in this case the information stored for transformation from R to S is damaged.** Means Protein is coding information in these life forms = Maritan genetic material (2 marks) **(Just for citing protein without valid justification = 0.**5 marks only)

(2) When DNAse is used, it can't penetrate the outer protein coat of virus and hence is not useful. When protease is used outer coat is damaged leading to exposure of virus DNA that can lead to damage. Hence this model is not useful (1 mark)
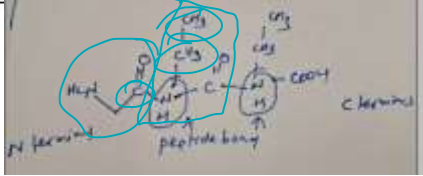
14) # Building blocks of life found in soil taken from asteroid Ryugu

A total of 23 types of amino acids were found in asteroid samples brought back by Japan's Hayabusa2 space probe, according to new studies published in the journal Science. The samples which were recovered in late 2020 were analysed and have been a source of curiosity for researchers across the plane

Given below are three such amino acids
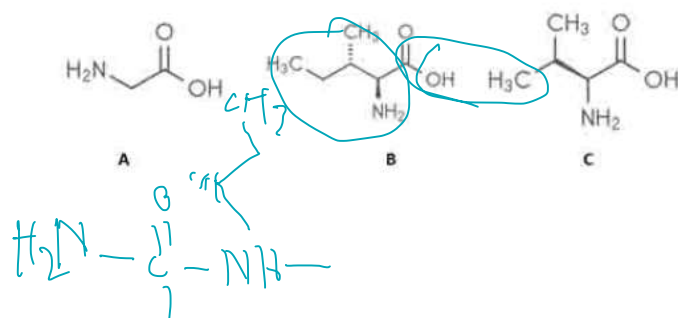
(3)

Question	Response
Based on the above information can you predict the major element for life on Ryugu? Why?	The amino acids are carbon based, hence carbon
The above amino acids has been found to be clustering together. What can be the most probable mode of interaction here? Why?	All these amino acids are non polar. Hence Hydrophobic interaction
Construct a model for the polymer using above compounds?	

(In the model, we are expecting a proper peptide bond between N and C terminus, show a free N end and C end. 1 mark)

15) Ms. Shreya visited Morgan's lab and photographed the fruit fly which is as follows (Character of interest: Eye colour that is X-linked)

Male   Female

(3)

A What can be the genotypes of these fly ? 1 mark
B Predict the outcome of the cross. Give the genotype and phenotypes 1 mark
C What will be the outcome if both male and female are white eyed? Justify 1 mark

A: Male = X^rY Female = X^RX^R or X^RX^r

B: X^rY X X^RX^R = X^RY (males, Red eye); X^RX^r (Females, Red eye) (If the student is giving a heterozygous genotype, ie X^rY X X^RX^r = Males can be X^RY or X^rY; females can be X^RX^r or X^rX^r)

C: ie X^rX^r X X^rY = Both males (X^rY) and females (X^rX^r) are white eyed

16)   Based on Hershey and Chase experiment, answer the following:
(1) What question Hershey and Chase was trying to answer? 1 mark
(2) What is the logic of selecting a virus? 1 mark
(3) Where the radioactivity will appear if the carbon alone is radioactive? Justify 1 mark

(3)

(1) Acidic component (DNA) or protein component is the transforming principle
(2) Virus consists of only protein and nucleic acid. Hence by radiolabelling it is able to predict

(3) Carbon is present both in proteins and nucleic acid. Hence radioactivity will be observed inside the bacteria and outer surface (everywhere).

17) Mr Soham was trying to copy the lecture on Autosomal dominant pedigree chart when the teacher was explaining on the black board. After returning to hostel, he understands that he forgot to shade the affected individuals. However he still remembers that third generation no one is affected. His chart is given below
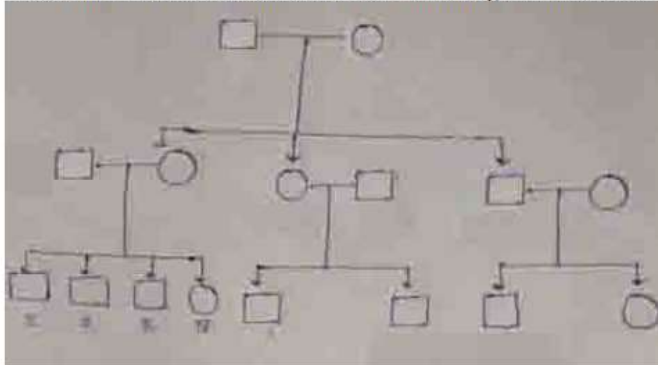
(1) Make it a perfect Autosomal dominant inheritance by shading the appropriate individuals which are expressing the character (2 marks)
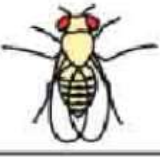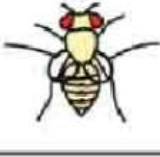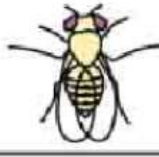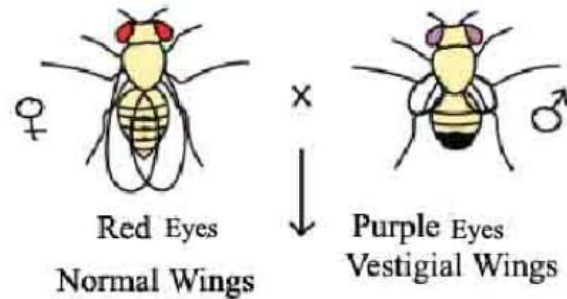(2) Answer the following questions inthe given formatt (2 marks)

(4)
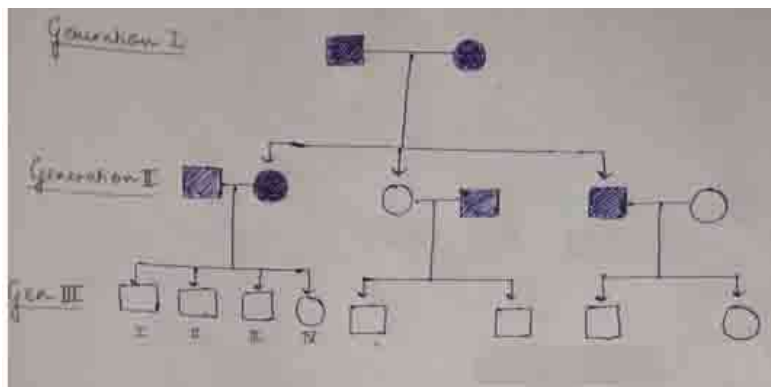
(2) Answer the following questions inthe given formatt (2 marks)

Question	Reasoning
How did you ruled out Autosomal recessive mode in your chart?	Affected parents have unaffected child
How did you ruled out X linked dominant mode in your chart?	Affected male is not transfering the trait to daughter
Genotype of elder couples in the family	Male: Aa Female: Aa

(The student is expected to rule out autosomal recessive and X linked dominant in the pedigree chart as above. Please not that the younger generation all are unaffected. Hence this is the only way. Consider any other alternate charts provided the other forms of inheritance are ruled out)

18) An experimental cross to calcualte recombination frequency is given below. Factors are on autosomes

♀ Red Eyes Normal Wings   ×   ↓   ♂ Purple Eyes Vestigial Wings

(4)

| 1339 | 1195 | 151 | 154 |

(1) Calculate recombination frequency between the factors for eye colour and wing character. 1 mark
Find the distance between factors 1 mark
(2) Let as assume that the factors are not linked. How the results will appear? 1 mark
(3) What is the reason that Mendel didn't observed linkage in the seven characters studied? 1 mark

(1) 151+154/(1339+1195+151+154) = 305/2839 % = 10.74% = 10.7 centimorgans (Also consider if the student mentions as 0.107)
(2) If the factors are not linked, typical Mendelian model will apply. Hence all the offsprings will be of dominant characters in F1 ie Red eyed and Normal wings
(3) Pea is having seven chromosomes, the factors for the seven characters he studied are located on seven different chromosomes. Hence he did not observed linakge