1. In guinea pigs, the allele for black fur (*B*) is dominant over the allele for brown (*b*) fur. A black guinea pig is crossed with a brown guinea pig, producing five F1 black guinea pigs and six F1 brown guinea pigs. (10%)

(a). How many copies of the black allele (*B*) will be present in *each* cell from an F1 black guinea pig at the following stages: G1, G2, metaphase of mitosis, metaphase I of meiosis, metaphase II of meiosis, and after the second cytokinesis following meiosis? Assume that no crossing over takes place.

(b). How many copies of the brown allele (*b*) will be present in each cell from an F1 brown guinea pig at the same stages? Assume that no crossing over takes place.

2. In the pearl millet plant, color is determined by three alleles at a single locus: $Rp^1$ (red), $Rp^2$ (purple), and *rp* (green). Red is dominant over purple and green, and purple is dominant over green ($Rp^1 > Rp^2 > rp$). Give the expected phenotypes and ratios of offspring produced by the following crosses: (10%)

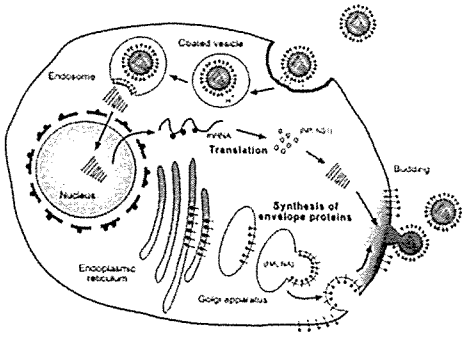
(a). $Rp^1/Rp^2 \times Rp^1/rp$　(b). $Rp^1/rp \times Rp^2/rp$　(c). $Rp^1/Rp^2 \times Rp^1/Rp^2$　(d). $Rp^2/rp \times rp/rp$　(e). $rp/rp \times Rp^2/Rp^2$

3. (a). The subtypes of Influenza virus A are divided on the basis of 2 proteins, hemagglutinin (HA) and neuraminidase (NA), pleases explain the similarity and difference H5N8 and H5N2 according to the most updated news in Taiwan? (3%)

(b). Dose influenza virus belongs to retrovius (according to its life cycle)? Why? (3%)

(c). There are two types of H5N2, the new and old ones. What does that mean? (3%)

(d). In 2009, there was a new strain of H1N1 Influenza (called swine flu) arosed from the reassortment of genetic material from avian (禽), swine (pig), and human viruses. As we know, most humans are not easily infected by avian influenza. How then do DNA sequences from avian influenza become incorporated into human influenza? (5%)




4. The diagram illustrates a step in the process of translation. Sketch the diagram and identify the following elements on it.

(a). 5′ and 3′ ends of the mRNA (1%)

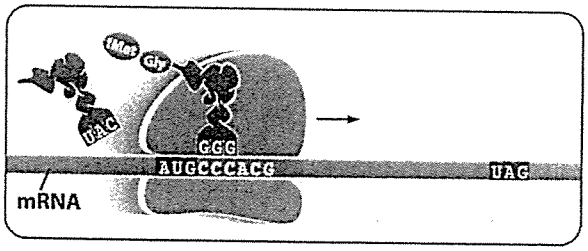
(b). A, P, and E sites (1%)

(c). Start codon (1%)

(d). Stop codon (1%)

(e). Amino and carboxyl ends of the newly synthesized polypeptide chain (1%)

(f). Approximate location of the next peptide bond that will be Formed (1%)




5. Waxy endosperm (wx), shrunken endosperm (sh), and yellow seedling (v) are encoded by three recessive genes in corn that are linked on chromosome 5. A corn plant homozygous for all three recessive alleles is crossed with a plant homozygous for all the dominant alleles. The resulting F1 are then crossed with a plant homozygous for the recessive genes in a three-point testcross. Following are the progeny of the testcross: (10%)

(a). Determine order of these genes on the chromosome.

(b). Calculate the map distances between the genes.

| | | | |
|---|---|---|---|
| *wx* | *sh* | *V* | 87 |
| *Wx* | *Sh* | *v* | 94 |
| *Wx* | *Sh* | *V* | 3479 |
| *wx* | *sh* | *v* | 3478 |
| *Wx* | *sh* | *V* | 1515 |
| *wx* | *Sh* | *v* | 1531 |
| *wx* | *Sh* | *V* | 292 |
| *Wx* | *sh* | *v* | 280 |
| total | | | 10,756 |

6. 何謂 clone？並請說明其遺傳組成與遺傳特性為何？(10%)

7. 請問何為雜種優勢？並請以遺傳學的觀點解釋為何可具有雜種優勢？(10%)

8. 請說明自花授粉、異花授粉與常異花授粉作物的育種特點。(15%)

9. 請說明在何種情況下會使用回交育種法？並請舉例說明其進行方式？(15%)

試題隨卷繳回