Sample Mendelian Genetics questions

_____ 1. An woman is heterozygous for an X-linked recessive allele that causes albinism. If she marries a non-albino male, what proportions of her *female* & *male* offspring will inherit the albinism allele?
A) all, none B) all, half C) half, half D) half, all E) none, all

_____ 2. President Clinton was once accused of fathering a woman's child. Clinton was blood type O, the mother was blood type AB, and the child was blood type O. The blood test shows
A) Clinton is definitely the father B) Clinton is definitely not the father
C) Clinton is probably the father D) Clinton is probably not the father

_____ 3. At the Noddy locus, *hangashore* (**H**) is recessive to *good-for-nothin* (**G**) and dominant to *sleeveen* (**S**). Uncle Sol (a hangashore) marries Mary Mack (a good for nothin) and their first child is a sleeveen. What are the genotypes of Sol and Mary?
A) both homozygous B) Sol homozygous, Mary heterozygous
C) Sol heterozygous, Mary homozygous D) both heterozygous

_____ 4. Of the progeny of a **GS** x **HS** cross, what fraction will be ***good-for-nothin***?
A) 0 B) 1/4 C) 1/3 D) 1/ 2 E) 2/3 F) 3/4 G) 1

_____ 5. In cats, coat colour is determined by an **X-linked** locus with two *co-dominant* alleles, "**O**" for orange and "**B**" for black fur. **OB** cats are bi-coloured calico. I have two cats: Jennet is an orange female, Puszek is an black male. Can Jennet be Puszek's mother? Can Jennet and Puszek be sister and brother?
A) no, no B) no, yes C) yes, no D) yes, yes

_____ 7. Loci **A** & **B** are linked. Two **AaBb** heterozygotes are crossed, one with both alleles in *trans* and one with both alleles in *cis*. If there are no crossovers between **A** & **B**, what is the expected genotype ratio?
A) 1:1 B) 3:1 C)1:2:1 D) 9:3:3:1 E) 1:1:1:1

_____ 8. Two individuals heterozygous for two semi-dominant alleles at each of four unlinked loci are crossed: how many F_2 phenotype classes are expected?
A) 4 B) 9 C) 16 D) 27 E) 32 F) 64 G) 81

_____ 9. When yogiberrys (**2n=10**) are crossed with boobooberrys (**2n=14**), low-fertility F_1 hybrids are formed. Eventually, a fertile allopolyploid species is formed. How many chromosomes are found in the *F_1 hybrid* and the *allopolyploid*, respectively?
A) 10 & 14 B) 14 & 10 C) 12 & 12 D) 24 & 24 E) 24 & 12 F) 12 & 24

_____ 10. The karyotype of blue boobies comprises a pair of sex chromosomes (one metacentric and one acrocentric), one pair of metacentric autosomes, and two pairs of telocentric autosomes. How many ***arms*** are present in females? How many ***chromosomes*** are present in male gametes?
A) 12, 8 B) 12, 4 C) 15,8 D) 15,4 D) 16, 8 E) 16, 4

_____ 12. In the cross of **MmQq** x **MmQq**, the phenotypes of the **mmqq** and **M-qq** offspring are identical. This indicates which of the following phenomena:
A) **M** is dominant to **Q** B) **M** is dominantly epistatic to **Q** C) **M** is recessively epistatic to **Q**
D) **Q** is dominant to **M** E) **Q** is dominantly epistatic to **M** F) **Q** is recessively epistatic to **M**

_____ 13. Alleles "1" and "2" at loci **E** and **F** contribute 1 and 2 units of pigment to the colour phenotype. From the cross $\mathbf{E_1E_2F_1F_2}$ x $\mathbf{E_1E_2F_1F_2}$, a **5:6:5** ratio of *white : grey : black* phenotypes is observed. What is the *maximum* number of pigment units that produces an un-pigmented phenotype?
A) 1 B) 2 C) 3 D) 4 E) 5 F) 6 G) 7 H) 8

1) $X^AX^a \times X^AY$

	X^A	Y
X^A	AA	AY
X^a	Aa	aY

1/2 ♀ 1/2 ♂

2) $OO \times AB \Rightarrow OO?$

	A	B
O	AO	BO
O	AO	BO

OO not possible

3) $G > H > S$

$H\_ \times G\_ \Rightarrow S\_$ [ss]

$\Rightarrow Hs \times Gs \Rightarrow ss$

4) $GS \times HS$ $[G > H > S]$

	H	S
G	GH	GS
S	HS	SS

"G" = 1/2

5) $X^oX^o \times X^BY$

X^B Y

X^o oB oY

X^o oB oY

BY not possible

$X^oX^B \times X^oY$

$\downarrow$

X^oX^o, X^BY possible

7) $Ab//aB \times AB//ab$

	AB	ab
Ab	AABb	Aabb
aB	AaBB	aaBb

AB Ab

AB aB

1:2:1

8) $("A":"a")^4 = 2^4 = 16$

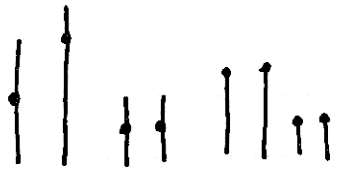
9) $2n=10 \times 2n=14$

$n=5 \times n=7$

$5+7$ (12)

$2\times(5+7)$ (24)

10)



12 arms in ♀♀

8 chromosomes in ♂♂

12) $MmQq \times MmQq$

$\downarrow\downarrow$

$mmqq \equiv M\_qq$

$\Rightarrow$ qq masks expression of "M" locus

"Q" is recessively epistatic to "M"

13)

	11	12	21	22
11	4	5	5	6
12	5	6	6	7
21	5	6	6	7
22	6	7	7	8

ratio 5 : 6 : 5

units 4,5 : 6 : 7,8

↑ produces white

(5)