1.   Given a universal set U = {cars}, S = {sports cars}, G = {green sports cars}.

(a)   Draw a Venn diagram to illustrate this information.

(3)

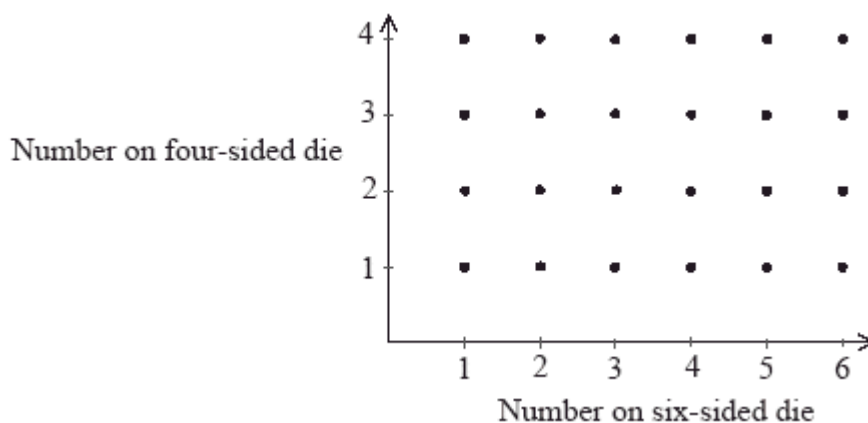(b)   Shade the set $S \cap G'$ on your diagram.

(1)

(c)   Write in words the meaning of $S \cap G'$.

(2)
(Total 6 marks)

2.   A fair six-sided die has the numbers 1, 2, 3, 4, 5, 6 written on its faces. A fair four-sided die has the numbers 1, 2, 3, and 4 written on its faces. The two dice are rolled.

The following diagram shows the possible outcomes.

(a)   Find the probability that the two dice show the same number.

(2)

(b)   Find the probability that the difference between the two numbers shown on the dice is 1.

(2)

(c)   Find the probability that the number shown on the four-sided die is greater than the number shown on the six-sided die, given that the difference between the two numbers is 1.

(2)
(Total 6 marks)

3. In a group of fifteen students, three names begin with the letter B and four begin with a G. The remaining eight names begin with A, C, D, E, F, H, I and J respectively.

The 15 names are placed in a box. The box is shaken and two names are drawn out.

Find the probability that

(a) both names begin with any letter except G or B;

(b) both names begin with the same letter;

(c) both names begin with the letter H.

(Total 6 marks)

4. A **weighted** die has 2 red faces, 3 green faces and 1 black face. When the die is thrown, the black face is three times as likely to appear on top as one of the other five faces. The other five faces have equal probability of appearing on top.

The following table gives the probabilities.

Red 1	Red 2	Green 1	Green 2	Green 3	Black
$\dfrac{1}{8}$	$\dfrac{1}{8}$	$\dfrac{1}{8}$	$\dfrac{m}{8}$	$\dfrac{1}{8}$	$\dfrac{n}{8}$

(a) Find the value of

(i) m;

(ii) n.

(2)

The die is thrown once.

(b) Given that the face on top is not red, find the probability that it is black.

(2)

The die is now thrown twice.

(c) Calculate the probability that black appears on top both times.

(2)
(Total 6 marks)

5. 100 students are asked what they had for breakfast on a particular morning. There were three choices: cereal (*X*), bread (*Y*) and fruit (*Z*). It is found that

> 10 students had all three
> 17 students had bread and fruit only
> 15 students had cereal and fruit only
> 12 students had cereal and bread only
> 13 students had only bread
> 8 students had only cereal
> 9 students had only fruit

(a) Represent this information on a Venn diagram.

(4)

(b) Find the number of students who had none of the three choices for breakfast.

(2)

(c) Write down the percentage of students who had fruit for breakfast.

(2)

(d) Describe in words what the students in the set $X \cap Y'$ had for breakfast.

(2)

(e) Find the probability that a student had **at least** two of the three choices for breakfast.

(2)

(f) Two students are chosen at random. Find the probability that both students had all three choices for breakfast.

(3)
(Total 15 marks)

6. A group of 50 students completed a questionnaire for a Mathematical Studies project. The following data was collected.

> 18 students own a digital camera (D)
> 15 students own an iPod (I)
> 26 students own a cell phone (C)
> 1 student owns all three items
> 5 students own a digital camera and an iPod but not a cell phone
> 2 students own a cell phone and an iPod but not a digital camera
> 3 students own a cell phone and a digital camera but not an iPod

(a) Represent this information on a Venn diagram.

(4)

(b) Calculate the number of students who own none of the items mentioned above.

(2)

(c) If a student is chosen at random, write down the probability that the student owns a digital camera **only**.

(1)

(d) If two students are chosen at random, calculate the probability that they both own a cell phone **only**.

(3)

(e) If a student owns an iPod, write down the probability that the student also owns a digital camera.

(2)
(Total 12 marks)

7. There are 49 mice in a pet shop.
30 mice are white.
27 mice are male.
18 mice have short tails.
8 mice are white and have short tails.
11 mice are male and have short tails.
7 mice are male but neither white nor short-tailed.
5 mice have all three characteristics and
2 have none.

Copy the diagram below to your examination script.
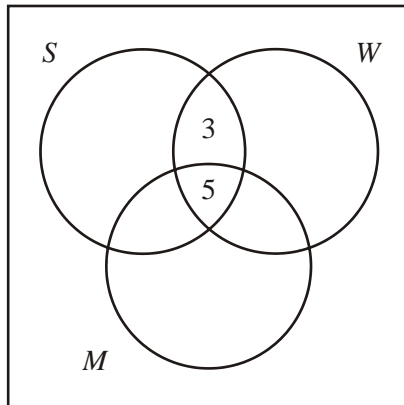
W represents white mice.
M represents male mice.
S represents short-tailed mice.

(a) Complete the diagram, using the information given in the question.

(4)

(b) Find (i) $n(M \cap W)$

(ii) $n(M' \cup S)$

(3)

Two mice are chosen without replacement.

(c) Find P (both mice are short-tailed).

(2)
(Total 9 marks)

8. The data in the table below refers to a sample of 60 randomly chosen plants.

Growth rate ↓	Classification by environment			
	dark	light	shady	total
high	3	8	14	25
low	8	9	18	35
total	11	17	32	60

(a) (i) Find the probability of a plant being in a shady environment.

(ii) Find the probability of a plant having a low growth rate and being in a dark environment.

(iii) Find the probability of a plant not being in a dark environment. **(5)**

(b)   A plant is chosen at random from the above group.

Find the probability that the chosen plant has

(i)   a high growth rate or is in a dark environment, but not both

(ii)   a light environment, given that it has a high growth rate.

(4)

(c)   The 60 plants in the above group were then classified according to leaf type. It was found that 15 of the plants had type A leaves, 37 had type B leaves and 8 had type C leaves.
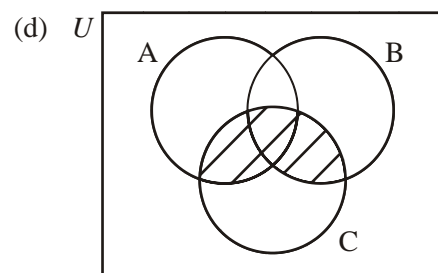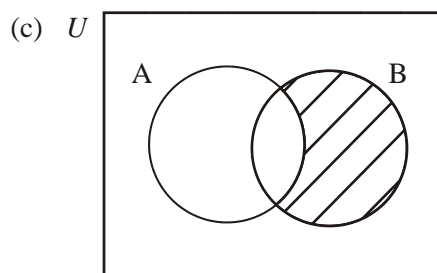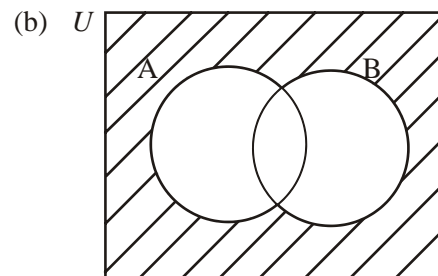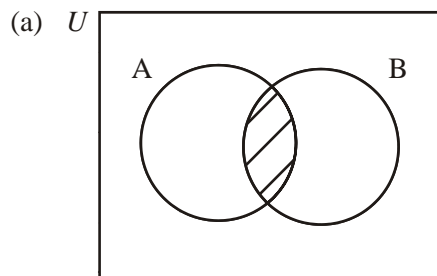
Two plants were randomly selected from this group. Find the probability that

(i)   both plants had type C leaves

(ii)   neither of the plants had type B leaves.

(5)
(Total 14 marks)

9.   Write down an expression to describe the shaded area on the following Venn diagrams:

(Total 8 marks)

10. The Venn diagram below shows the number of students studying Science (*S*), Mathematics (*M*) and History (*H*) out of a group of 20 college students. Some of the students do not study any of these subjects, 8 study Science, 10 study Mathematics and 9 study History.
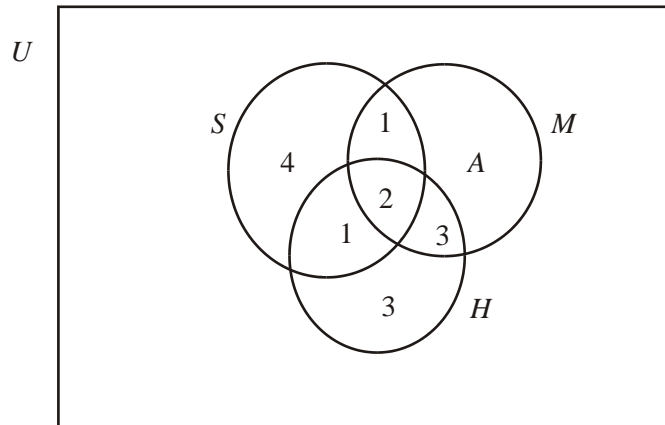
(a) (i) How many students belong to the region labelled *A*?

(ii) Describe in words the region labelled *A*.

(iii) How many students do not study any of the three subjects?

(5)

(b) Draw a sketch of the Venn diagram above and shade the region which represents $S' \cap H$.

(1)

(c) Calculate $n(S \cup H)$.

(2)

This group of students is to compete in an annual quiz evening which tests knowledge of Mathematics, Science and History. The names of the twenty students are written on pieces of paper and then put into a bag.

(d) One name is randomly selected from the bag. Calculate the probability that the student selected studies

(i) all three subjects;

(ii) History or Science.

(2)

(e) A team of two students is to be randomly selected to compete in the quiz evening. The first student selected will be the captain of the team. Calculate the probability that

(i) the captain studies all three subjects and the other team member does not study any of the three subjects;

(ii) one student studies Science only and the other student studies History only;

(iii) the second student selected studies History, given that the captain studies History and Mathematics.

(5)
(Total 15 marks)