PART ONE - WHILE LISTENING

Answer Key- All answers are worth one point with the exception of Question 5 and 9 where each answer =0.5. Total points =16

Click on the links for video explanations

1. What was the definition of DNA given by Dr Roberts in her lecture?
The hereditary material passing on genetic information / the code that passes on our inherited traits

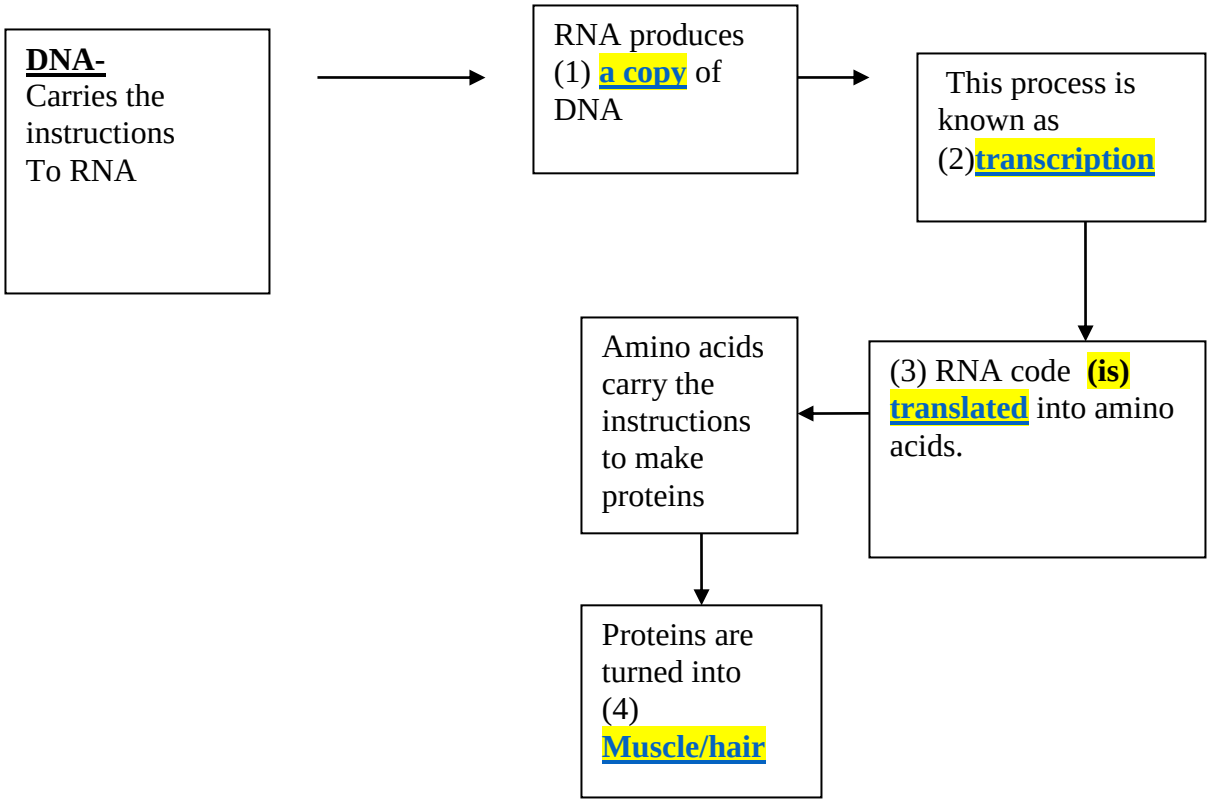
2. Why does Dr Roberts reject the idea that we will be an exact copy of our parents?
Some of these traits are activated/turned on and some of these are not

3. Why was Miescher not interested in DNA at first?
They believed proteins carried the hereditary material.

4. What characteristics of amino acids made people believe that they were the hereditary material?

The number of ways that amino acids could be combined
The number of the combinations of amino acids (explained the variety)

5. Fill in the process:



6. What explanation does the tutor give to the student for the confusion over Frederick Griffith's experiment?

Re-examined by Avery

7. What was the initial aim of Griffith's research?

To develop a vaccine against a bacteria ***(responsible for a serious lung disease)***

8. What is the definition of strain given by Dr Roberts?

an element or part (of the bacteria) which has clear physical characteristics from the other elements(in the bacteria.)
A (kind of) group that shares the same properties or characteristics.

9. Fill in the table with the details of Griffith's experiments:

Experiment	Strain(s) injected	Outcome for mice
1	R	Didn't die
2	S	(a) ***Died***
3	(b) ***heated S***	(c) ***didn't die***
4	(d) ***Heated S + R***	Died

10. What conclusion did Griffith finally reach to explain the reason for the death of the mice in the fourth experiment?

Genetic material passed from (heated) S to R (strains)

11. Give two reasons why Avery's discovery was not recognized as groundbreaking:

(1) ***Experiment used bacteria***
(2) ***Released during World War II***
(3) ***The Atom bomb was more important***

12. Why did Avery never receive the Nobel Prize for his work involving DNA?
Died (before the importance of his work was understood)

Tutor: In this context, our inherited characteristics from our parents or ancestors.

Student: Ok, now I understand.

Tutor: Good. So OK some of these heritable traits in our DNA are turned on and become active while some of them might remain inactive or are never passed on. Just because the information is there in the DNA it doesn't always mean that we will get all the traits that our parents have. Some of these traits are activated and some of them are not.

Student: Oh I see.

Tutor: Now coming back to your comment about how we all could look so different due to DNA, well, if we look at the history of the discovery of DNA scientists also had a real problem believing that this one molecule could be responsible for heredity. Did you find anything about this in your reading?

Student: Just a moment. Let me look at my notes. OK, yes. First of all, I think the substance DNA was discovered by Miescher in 1868.

Tutor: Good. Go on.

Student: He had gradually become interested in studying the chemistry of a cell's nucleus. To understand the chemistry he examined pus, a yellowish liquid found in open wounds and cuts and fish sperm and discovered that there was an acid material called deoxyribonucleic acid, now shortened to DNA, in the nucleus of cells. But neither Miescher or other biochemists paid that much attention to it because at that time they believed that it was proteins that carried the hereditary information. But I don't really understand why?

Tutor: Well, until the end of the 1940s or early 1950s this was a common belief among scientists. Proteins seemed to have the necessary properties to explain inheritance and the variety found in species on earth. Proteins have a combination of 20 different amino acids. Scientists thought that because of the number of ways that amino acids could be combined it seemed to explain inheritance and the variety of species. In other words it seemed logical to scientists that this could explain inheritance due to the variety of the various combinations of amino acids in proteins. Do you see now?

Student: Yes, now I remember they looked at the variety of species around us and the number of the combinations of amino acids seemed to explain this variety.

Tutor: Yes, so scientists could not even imagine that something as basic and simple as DNA could be the genetic material for a process that was so complicated. However now we know that proteins are at the end of the chain of production not the hereditary material. The DNA code carries a set of instructions to build protein. Did you find out how DNA makes protein?

Student: Yes. Turning DNA into protein is known as transcription and translation. Firstly DNA carries the instructions. An exact copy of the DNA is made by RNA. RNA then carries the DNA's message. This part of the process is called transcription. Each code contains groups of three letters. Each of the three letters in the RNA relates to an amino acid. So this code carries the instructions to make the protein. The RNA is then read and translated into an amino acid which in turn correlates to a protein. These proteins then become the muscle in our bodies or our hair and so on.

Tutor: An excellent explanation. Scientists however didn't actually begin to explore the structure of DNA until the 1940s or early 1950s due to their failure to believe that DNA was the genetic material of all living things. This issue was demonstrated in scientists' attitude towards the results of the experiments initially conducted by Frederick Griffith in 1928. Do you have any notes on this?

Student: Yes. But there was something I couldn't understand when researching this. In one text book it says that another researcher named Oswald Avery conducted this experiment in 1944 while in the other text book it says it was Frederick Griffith in 1928.

Tutor: OK. The original experiment was conducted by Griffith in 1928 but it was reexamined by Oswald Avery in 1944. That's why their names are accredited to the same experiment.

Student: Now I understand. OK. So in Griffith's experiment in 1928 he was trying to develop a vaccine against a bacteria, which scientist had discovered was responsible for a serious lung disease. He conducted 4 different experiments involving laboratory mice. Griffith took two different strains of the bacteria. What I want to check here is what *strain* means exactly? Is it a kind of part of the bacteria?

Tutor: Ok. A strain here means an element or part of the bacteria which has clear physical characteristics from the other elements in the bacteria. A kind of group that shares the same properties or characteristics. So in Griffith's experiment he had identified two different strains or two different groups that were physically different in the same bacteria. What did you find out about these?

Student: Well, the first strain was called the R strain. it was harmless to mice. The second strain was called the S strain which was disease causing. Griffith injected both the R and the S strains into the mice in four different experiments. In the first experiment he injected mice with the harmless R strain of the bacteria and of course the mice didn't die because it had no deadly bacteria. In the second experiment he injected mice with the S strain and of course they died as it was disease causing. In the 3rd experiment I believe that he heated the S strain. He did this because heat can kill harmful bacteria. He injected more mice with the heated S strain and this time they did not die because the bacteria's disease causing properties had been killed by the heat. Am I doing ok so far?

Tutor: Yes, go on.

Student: Well finally in the fourth experiment, he took the heated S strain so the deadly bacteria had died and mixed it with the R strain and surprisingly when the mice were injected they died. However, what I don't understand is why this series of four experiments started to indicate that DNA could be the genetic material?

Tutor: Ok well what was going on in the fourth experiment also had Griffith puzzled at first. He formed the first hypothesis that the heat-killed S cells weren't really dead in the fourth experiment. Why couldn't this be the case?

Student: Well if this had been the case the mice would have died in the 3rd experiment.

Tutor: Yes. Instead he came to realize that even though the heat had killed the bacteria it did not destroy the genetic material, in other words, the part of the code that specified how to cause infection. He eventually realized that the genetic material was passed from the heated S strain to the R strain.

Student: So you mean the heated S strain changed the harmless R strains characteristics.

Tutor: Yes, in other words, something was transforming the non-deadly strain into a killer virus. However Griffith didn't quite make the connection to DNA. Do you know who did?

Student: Yes. I read about this. This experiment was revisited by Oswald Avery a bacteriologist working as part of a team at Rockerfellor University in 1944. He and his coworkers found that the factor that was transforming the R strain into a deadly strain was DNA. This finally proved that it was DNA and not proteins that carried the genetic information. But what I didn't really understand is why scientists still couldn't accept this?

Tutor. Well you would imagine that people would be amazed by this discovery but biochemists still couldn't believe that DNA was the genetic material for all living things. Instead because the experiment had been conducted using bacteria they could only concede that maybe DNA was only the genetic material for rare forms of bacteria. But they still believed that it was not responsible for the heredity properties of animals and plants.

Student: yes, and I also read that there was a problem with Avery's report which delayed scientists noticing its importance.

Tutor: yes that's correct. Go on

Student: Unfortunately, his report was released in 1944 during one of the crucial periods of the 2nd world war. His discovery at this point of the war didn't seem that important when so many people were dying. Also at that time the race for the atom bomb was deemed to be far more important.
Tutor: Exactly. However further studies were conducted by other groups of scientists and by about 1952, through these many experiments, researchers gathered strong evidence that DNA and not proteins, served as the molecule of inheritance. Unfortunately for Oswald Avery he was never awarded the Nobel Prize for his discovery as he had died by the time the scientific community had understood the importance of his work. The Nobel Prize is only ever awarded to those who are still alive.
Student: I see.
Tutor: Well I think we have covered everything. Do you have any more questions?
Student: No not at the moment.
Tutor: Ok well we'll end here for today, but if you have any more questions please ask.
Student: Ok, thank you very much.

PART TWO – LECTURE AND NOTE-TAKING – ANSWER KEY
1 point each; 16 points

Click on the links for video explanations

1. What did the earliest map produced in Catalhoyuk show?
(Plan of) an urban area/ (positions of) streets and houses (of a town)

2. The purpose of the ancient maps showing local features was
to guide ancient people in (the activities of) daily life.

3. Maps from ancient Egypt helped Egyptians to __ **restore / reestablish land boundaries** ___ after the annual floods of the Nile.

4. Why weren't the ancient world maps realistic?
Any one of the following

Because the cartographers used their own views and philosophies about the world.

Early cartographer had very little knowledge of the world.

Early cartographers were severely limited by the lack of knowledge of the world.

5. Write TWO things that a cartographer needed to know in order to produce an accurate world map. (0.5 pt each; 1 point)
Any two of the following (0.5 pt. each)

The shape of the Earth

The size of the Earth

(how to calculate) the distance between two points on the Earth's surface

6. In what way did Greek philosophers like Aristotle contribute to produce an accurate world map?
They claimed/ declared that the Earth was round / spherical.

7. Why is Ptolemy's book "*Geographia*" important in the history of cartography?
Any one of the following

It was used as a guidebook (by later cartographers)

Ptolemy's maps / The maps (in the book) became models for later cartographers.

8. What was one flaw of Ptolemy's maps?

Any <u>one</u> of the following

He couldn't calculate the size of the Earth correctly

He couldn't work out how big the Earth was

His world was much smaller (than its actual size.)

9. There wasn't any development in cartography in the Middle Ages because

Any <u>one</u> of the following

Maps were dominated by religious views

Maps were strictly controlled by the church

10. How were later maps in the Middle Ages different from the earlier ones in the same period?

Any <u>one</u> of the following

They were (highly) decorated with religious figures.

There was no empty space on the map because of the decoration with religious figures.

11. In which ways did navigational charts help voyagers? Write <u>TWO</u>. (1 pt each; 2 points)

Any <u>two</u> of the following (1 pt. each; 2 pts)

for deciding the best times for sailing.

for identifying places to stop during their journey.

for determining where to seek refuge from pirates / for determining escape routes from pirate attacks.

12. What was the reason behind the increased interest in scientific and detailed world maps after the Middle Ages?

the discoveries of new lands

13. In the 17th and 18th centuries, world maps and navigational charts helped Eurepean countries to

Any <u>one</u> of the following

colonise / conquer new lands.

To develop strategic or tactical plans (before the ships set off) to conquer / colonise new lands.

14. Why were maps and charts protected so carefully in the past?

Any <u>one</u> of the following

Because they were (potential) sources of information to the enemy

Because they were valuable information to the enemy.

15. The method of lead weighting was a very effective method in destroying the maps and navigational charts because

Maps sank (to the bottom of the sea) very fast.

Lecture and Note-Taking – The History of Cartography

Hello everyone. The focus of today's lecture is the history of cartography, that is, the history of maps and map-making. Cartography is the scientific term for map-making. So in this lecture I will be talking about the development of maps and map-making throughout history. As you can see in your handouts, I will start with the maps in Ancient times. Then I'll continue with the Middle Ages. Before we move onto the Renaissance era, I will give you information about a different type of maps that are called ocean maps or navigational charts. Finally, I will be focusing on the importance attached to maps and the way they were treated. So here we go. Ah, an important note - in this lecture I will be using the term 'cartography' for map-making and 'cartographer' for the person who produces maps.

So. Let's start with the first maps in history, that is the ancient times. Cartography dates back thousands of years. The oldest picture that resembles a map is the one discovered in Catalhoyuk in Anatolia. This map was created in the 7th millennium BCE, which means seven thousand years before the Christian Era, BCE for short. This map was the plan of an early urban area - it showed the positions of the streets and houses of the town.(1) When we look at all other ancient maps, we notice that they have something in common: Yes, we see that they all showed local features. By 'local features' I mean the features of the area belonging to the ancient community. Some examples of local features are settlements, like in the Catalhoyuk map, with streets and houses,(1) crop fields, land borders and hunting grounds. OK. So, why were these maps created? What was their purpose? Well, they were created in order to guide ancient people in the activities of daily life – I mean, with the information provided in these maps, ancient people could carry out their activities in their daily lives easily. (2) For example, some maps in ancient Egypt showed land borders, or land boundaries. These maps were very useful for the ancient Egyptians. You see, the river Nile overflowed its banks every year, and flooded the land on both sides. Of course, this wiped out the boundaries of crop lands. And it was with the help of such maps that ancient Egyptians were able to re-establish the exact boundaries of land properties. So, by using these maps, Egyptians could restore the land boundaries after the annual floods of the Nile. (3) Thus, fights and arguments among land owners were avoided.

So as we've said, the first maps guided ancient people in daily life. (2) Later we see world maps. However, these ancient world maps were not like the ones we know of today. They were far from accurate, or realistic, representations of the Earth. In other words, they were more like a symbolic illustration of the world. This was because cartographers reflected their own views and philosophies about the world onto their work. (4) One example of these is the form of the Earth. Some believed that the earth was flat, some believed it was triangular and some thought it was an oval disk. Of course there is a reason behind why cartographers made use of their own views and philosophies in their maps. And the reason for this is that early people had very little knowledge of the world. And they were severely limited by this lack of knowledge. (4) Therefore, they had no other choice but rely on their own resources.

So in order for the cartographers to create accurate maps of the world, they needed to learn three things: They had to learn about the shape of the Earth most of all, then they had to learn about the size of the Earth, and they also needed how to calculate the distance between two points on the Earth's surface. (5)

Now, at this point it is important to mention ancient Greeks, who played an important role in the development of cartography. In fact, it was the ancient Greeks who put forward theories about the shape of the Earth starting in 500 BCE. Highly influential thinkers, I mean, philosophers – and one of these philosophers was Aristotle – declared that the Earth was spherical, that is, round. (6) Some others took these views further and they started to depict

the Earth as spherical in maps. The first Greek who produced world maps that showed the Earth to be round was Ptolemy – let me spell that for you P-T-O-L-E-M-Y. Ptolemy created many world maps and compiled them in a book called "Geographia." All his maps were curved, which emphasized the spherical shape of the Earth. His book, "Geographia" had a great impact on the cartography. Well, its significance arises from the fact that it was used as a guide book throughout cartographic history. That is, Ptolemy's spherical maps became models for later cartographers. (7)

All right. So.. Ptolemy's influence was great. However, although he created maps that suggested the round shape of the Earth, he made one important mistake- His mistake was that he failed to calculate the size of the Earth correctly. He couldn't work out how big the earth was. So what was the result? Well, this calculation caused Ptolemy's world to appear much smaller than its actual size. (8)

OK. That's enough of ancient times and Ptolemy. Let's move on to the Middle Ages. With the Middle Ages, a new era for cartography starts. This is the era of NO development in cartography. The era which started around the year 300 A.D. lasted for almost a thousand years, until the 14th century A.D. Why was there no development in cartography during the Middle Ages? For one thing, as in everything during the Middle Ages,

the world maps created during this period were dominated by religious views and were strictly controlled by the Church. As you might expect, such strict control by the Church led to maps becoming symbolic, religious representations of the world, rather than scientific maps(9) - just like the ancient world maps. We can say that the science of cartography went back in time, rather than improve. And of course, no need to say, they were inaccurate. The early maps were very simple: Jerusalem, which was the home of Christianity, was put at the center of the Universe, and the continents and oceans were depicted in rectangles with little or no detail. So these maps were generally very plain. However, as time went on, the style of maps changed. Unlike the simple early maps, later maps during the Middle Ages were highly decorated, usually with religious figures. They were often decorated so much so that there wasn't any empty space left on the map at all. (10)

OK. Now. Let's briefly talk about another type of maps – these are ocean maps, or navigational charts. Navigational charts began to appear at the beginning of the 14th century, which is the end of the Middle ages. All right. Navigational charts were created by sailors. And for this reason, they contained information that was useful for sailors and voyagers such as the location of harbours and wind directions. Navigational charts were used during the voyages and helped sailors greatly in reaching their destinations safely. These charts were also used for planning voyages, that is, before the actual voyage started. The people involved in a voyage used these navigational charts for three main reasons: FIRSTLY, they used them for deciding the best times for sailing. This helped them avoid sailing in bad weather conditions. SECONDLY they used them for identifying places to stop during their journey. They might stop at these places for trade, or they might stop for help if the ship needed repairs. AND FINALLY, AND PERHAPS MOST IMPORTANTLY, sailors used these navigational charts for determining where to seek refuge from pirates. You see, this was crucial at the time. Pirates were a real danger to sailors and their ships and it was important to have escape routes from pirate attacks. (11)

OK. That was the Middle Ages. Now let's talk about the time AFTER the Middle Ages, that is, the Renaissance. With this new era, developments in cartography started again. During this era, Ptolemy's book, which as you may remember was called 'Geographia', was rediscovered, and reintroduced to Europe. Remember, "Geographia' included many world maps and cartographers reproduced these maps and improved them. OK so. During the renaissance, there was also an increased interest in scientific, detailed and correct maps. What do you think was the reason for this motivation to improve cartography? Yes, anyone? .. OK. The main reason for this was the discoveries of new lands.(12)

In the 15th century, European explorers such as Columbus and Magellan took cartographers with them on their voyages. They got the cartographers to create navigational charts and maps of the newly found lands. The most common example of a newly found land at this time was the Americas. So with the discovery of the Americas, we see the new world maps that include these newly found lands.

Another reason for the improvement in cartography was the developments in science and technology. As a result of all this, maps became more and more accurate and performed their most important role in the history of this time: During the 17th and 18th centuries, these improved maps AND navigational charts helped the western European countries greatly in colonising the Americas and Africa. So these maps, as they were more accurate, gave Europeans the opportunity to conquer these new lands. (13) How did they help with conquests and colonization of these new lands? Well, these maps enabled European nations to develop strategic or tactical plans long before the ships set off on their voyage. This of course increased their chances of succeeding greatly.

OK. This brings me to the last part of the lecture, which is the importance attached to maps in the past. Maps and navigational charts have been very important documents throughout history. Maps of an empire, or even a city were protected very carefully and treated as national treasures. This is because maps were potential sources of information to the enemy. If enemies were able to obtain the maps, they would gain valuable information. (14) Therefore, only a few people were allowed to access these maps and only a part of maps were copied and given out to related people for specific purposes – such as for military and educational reasons. There are many examples in history of men who were even punished by death as a result of giving away information contained in such maps.

Another piece of evidence that shows the importance of these maps is the fact that in emergencies, they had the priority over everything else – the ship itself, even the lives of the crew. In other words, in case of emergency, maps were the first things to be rescued – or to be destroyed. Yes, you didn't hear me wrong – Remember, I said maps contained valuable information. Therefore, if they couldn't be protected, they had to be destroyed before they fell into enemy hands. A commonly used method by sailors to destroy maps and (navigational) charts was the weighting of these documents with lead. That is, they tied large pieces of lead around the documents. And it was a very effective method too. Let me explain how this method worked: When the maps were thrown into the sea, the heavy weight of this metal sent the maps down to the bottom of the ocean very quickly. In fact, the maps sank to the bottom of the sea so fast that the enemy didn't even realize what was going on. (15) As I mentioned earlier, this was a very effective way of destroying maps so that the enemy couldn't get hold of them. Clever, isn't it?

SKIMMING – ENVIRONMENTAL REQUIREMENTS FOR LIFE

Heading	Prg Number
a) The meteorites and comets as a source of organic molecules.	10
b) The unique conditions on Earth which make life possible.	3
c) The position of a planet in relation to the sun and its ability to support life.	12
d) An evaluation of the three requirements for life.	22
e) The creation of elements when solar systems appear.	7
f) The necessity of the existence of elements in molecules.	9
g) The advantage of water in solid form over the other liquids.	17
h) The necessity of a continuous chemical activity for life.	13
i) The way in which water separates charges in molecules.	18

ELAE Practice Materials Key

DETAILED READING – REVOLUTIONS IN RUSSIA AND IRAN

Task 1

Click on the links for video explanations

1. What was one reason that forced the tsar to create the Duma?
   widespread rebellion in the countryside / paralyzing strikes in the cities / and liberal professionals' demands for civil and religious liberties
2. What was the result of the leaders' incompetence in conducting the war?
   patriotic support disappeared
3. What were the expectations of the lower classes from the Provisional Government?
   an end of the war as well as an end to oppression in the factories and exploitation in the countryside
4. What triggered the lower classes to withdraw their support from the Provisional Government?
   deepening economic crisis
5. Why did the Provisional Government's rule of law fail with the lower classes?
   the "rule of law" offered little to the masses but protected the interests of elites

Task 2

1. What was the problem with Reza Shah's modernization attempts?
   Reza Shah was selective on what forms of modernization and secularization he would adopt
2. What was the main reason why religious groups were against the white revolution?
   Land reforms initiated the breakup of huge areas previously held under charitable trust (*vaqf*) administered by members of the *'ulama'* and formed a considerable portion of that class's revenue
3. Why was the land reform unsuccessful?
   The government was unable to put in place a comprehensive support system and infrastructure that replaced the role of the landowner (who had previously provided tenants with all the basic necessities for farming)
4. Why did the Majles, the Iranian Parliament, fail to offer any real political participation?
   The Majles was dominated by two parties, both of which were obedient to and sponsored by the shah. / Traditional parties such as the National Front had been marginalized, while others, such as the Tudeh Party, were outlawed and forced to operate in secret.
5. How did the new Islamic government control political opposition in Iran after the revolution?
   With the Revolutionary Guards (a religious militia formed by Khomeini, intimidated and repressed political groups not under control of the ruling Revolutionary Council and its sister Islamic Republican Party)

Task 3

1. agriculture
2. parliament
3. political
4. modernization program / reform
5. clerics / ulema
6. dictatorship