MODULE 1
Class Title: Muslim Scientists- part 1 (of a 2 lesson series)
Aim of the lesson: To understand the role of Muslims scientists in the development of modern science and to understand the reasons behind their success.
Lesson Format: Power point presentation with discussion

Greeting to students*) Assalam alaikum wa Rahmatullahi wa Barakatuh*
(Taooz) Aoodhubillahi min AsShaytanir Rajeem
(Tasmiyah) Bismillahir Rahmanir Raheem
(Du'a) Rabbish rahli sadri wa yassirli amri wahlul uqdatum millisani yafqahu qawli
(Surah At Ta-Ha 20: Verse 25-28)

Slide 1:

Today we will be discussing Muslim scientists and their inventions. Who comes to your mind when I mention Muslim scientists?

Student: Al-Biruni and Jabir bin Hayyan. I don't remember what Al-Biruni did but Jabir bin Hayyan discovered that light travels in a straight line.

Student: Ibn Sina; he provided cures for many illnesses.

Student: Dr. Abdul Qadeer Khan; he empowered us with the atomic bomb.

Teacher: Very good, *mashaAllah.*

Slides 2 and 3:

Let's discuss a little bit of history. Islamic science was developed between the 7th and 16th centuries; about 1400 years ago. That era was also known as the Islamic golden age because many Muslim scholars and scientists made great advances in many fields such as science, maths, medicine, engineering, and perfumery. Today we will discuss their achievements.

Slide 4:

According to a famous writer, Robert Briffault, "Islamic science is the foundation of modern science".

Present day science is built on the foundations provided by the Islamic science of the golden era.

Slide 5:

In that era, Arabic was the 'in' language and enjoyed the same respect, the same prestige and the same importance that English and some other languages have today. This was because most of the written text and information was in Arabic! So whoever wanted to learn had to know Arabic.

Slides 6 and 7:

Islam spread far and wide to many areas, from Persia to China and with that, knowledge and skills were inherited. At that time, Muslims were not restricted to the Arab region. The Islamic Empire was pretty big. The knowledge that they inherited from conquering other empires like Persia and China, was utilized in beneficial ways and they invented a lot of things.

Slides 8 and 9:

Some of the most important institutions were developed by Muslims. They laid the foundations of the first hospitals, libraries and even the academic degree granting universities. In fact, the Guinness book of world records recognizes the university in Morocco as being the world's oldest university. So, the first university was also built by Muslims

Slide 10:

But where do we go for our higher studies these days?

Student: Western universities like Oxford, Harvard, and Yale.

Slide 11:

Then the Muslims also laid down the foundations of the first research institutes, observatories and *waqfs* {trusts}.

Slide 12:

Where are the world's best equipped hospitals situated today?

Student: London, America and Canada?

Teacher: John Hopkins is a famous hospital because of its research about cancer and another hospital is being constructed in Stockholm which is supposed to be very sophisticated and high tech. This is the design for that hospital.

Slide 13:

This is a design for one of the rooms in the hospital's children's ward.

Slides14 and 15:

The concept of hospitals was developed by Muslims. One of the earliest hospitals was the mobile dispensary which was started by the Prophet (pbuh); this dispensary used to follow Muslim armies wherever they went to treat their wounds and injuries.

Slide 16:

Later, the Caliphs laid the foundations for some hospitals. This is the Al-Nuri hospital, which is one of the oldest known hospitals.
Slide 17:

But where was Europe in that era?

Student: Europe was going through the dark ages.

Slide 18:

Teacher: Quite true. In the dark ages, there was a lot of barbarity and wars going on and loot and plunder was the law. Nothing useful was being done. Torture was considered to be the way of getting testimonies out of people and there were countless torture chambers.

Slide 19:

Those who were insane were termed witches and sorcerers and were burnt alive.

Slides 20 and 21:

Conversely, the Muslims had special wards for the mentally ill and every major Muslim city had a special insane asylum where the mentally sick were well cared for and well fed. It is also known that some of the hospitals used to not only treat people but also give them some allowance when they were discharged so that they could fulfil their medical needs.

Slide 26:

Let's watch a video clip. (Play video clip 1)

Interesting, right?

While Europe was undergoing the dark ages, at the other end of the world, Islam was at its golden age, laying the foundation for all the advancements that Europe has made now.

Slides 27 and 28:

Ibn-al-Haytham was the first known scientist. As we just saw in the video clip, he invented the first camera which is named from the word *qamara*, meaning a dark room. That is where the film of a camera is developed: in a dark room. He wrote a notable book –Book of optics. He is regarded as the father of modern optics. He is known as Alhazen or Alhazeni.

Slide 29:

According to Oliver Lodge, "....for more than a thousand years there was not a scientific man of note except in Arabia."

Not only the men but even the women were highly knowledgeable and qualified.
Muslim scientists placed a greater emphasis on experimentation due to…

1- The emphasis on observation found in the Qur'an and Sunnah,
2-The rigorous historical methods established in the science of Hadith.

Muslim scientists thus combined:

1. Precise observation,
2. Controlled experiment
3. Careful records

…which led to the development of the Scientific Method.

Slides 30 and 31:

One of you said a while ago that they have heard the name of Al-Biruni but don't really know what he did. Initially, it was thought that the world is flat, but Al Biruni discovered that the earth was round and he also calculated the radius of earth using various techniques that were available in those times.

The lesson we need to learn is that the Muslims of those times used to ponder on what Allah (swt) is saying in the Holy *Qur'an*, the ultimate Book of Knowledge.

For example, Allah (swt) tells us that all the heavenly bodies are moving in a *falak*, "And He (Allah) it is Who created the night and the day, the sun and the moon. They float, each in a *falak*." (Surah Al-Anbiya' 21: Verse 33)

The word '*falak'* means 'that which is round', which actually means a round sphere in circular motion. So, Al Biruni pondered over this information and realized that, since Allah (swt) had said this in the *Qur'an*, the Earth cannot be flat and he tried to discover the truth.

Slide 32:

These Muslim scientists were known as polymaths which means that they were 'universal geniuses'. '*Hakeem*' is another term used for these pioneers; this word is derived from the word '*hikmat*' which means wisdom.

A polymath is basically someone who is a master of many fields of knowledge rather than just one. For example, if a person was good at chemistry, he was also good at physics, and he was also a master of maths, engineering and various other fields. Polymath scholars were so common during the Islamic Golden Age that it was rare to find a scholar who specialized in only a single field at the time.

Slide 29:

Some of the scientist's names have been distorted over time. Ibn Al-Haytham is now known as Alhacen, Jabar ibn-e-Hayyan is known is Gerbar and Al-Kindi is called Alkindus. Ibn Sina is commonly known as Avicenna, Abu Al-Qasim is known as Abulcasis and Ibn Al-Razi is known as Rhazes. So, if I remove these Muslim names and just call them Alhacen, Gerber, Alkindus, and Avicenna, would you be able to tell that I am talking about Muslims? No, right? This is how our thoughts and our ideologies have been distorted.

Allama Iqbal once wrote that "... the Arabs were responsible for the rapid advancement of science." Again, the word Arab is used here because Islam started from Arabia and later spread all over the world.

Slide 31:

Have you heard of the most famous Muslim Physician – Ar Razi? [1] He was really interesting because instead of giving prescribing medicines, he used to tell people to follow moderate life styles, eat fruits, and exercise, etc.

I call him the meat guy, although he is not famous as the meat guy. In Baghdad he put pieces of meat in different areas of the city. He made it a point to check daily to see how quickly these pieces of meat rotted, and the area where the meat rotted the least was where he set up his hospital. Isn't that smart?

Ibn Al-Razi was the first person to research into small pox and measles.

I will skim over what most of the scientists did quickly so that you get an idea of the various fields they covered.

Slide 32:

Averroes, or Ibn Rushd, founded the Averroism school of philosophy.

Slide 34:.

Ibn Zuhr, known as Avenzoar, was the pioneer of medical surgery.

He performed the first dissections and postmortem autopsies on humans and animals.

What is taught in schools: The first surgery performed under inhalation anesthesia was conducted by C.W. Long, an American, in 1845.

What should be taught: Six hundred years prior to Long, Islamic Spain's Az-Zahrawi and Ibn Zuhri, performed hundreds of surgeries under inhalation anesthesia with the use of narcotic-soaked sponges which were placed over the face.

[1] *Abū Bakr Muhammad ibn Zakarīya Rāzi (Rhazes)* (226-313 H/841-926 CE)

Slide35:

Ala-Al-Din Abu Al-Hassan Ali Ibn Abi Al-Hazm Al-Qarshi Al-Dimashqi, known as Ibn Al-Nafis (1213 – 1288 CE), discovered blood circulation in human bodies i.e. how the heart pumps blood in the body. He was the first to determine that blood is pumped throughout the body via the action of the heart and the venous valves. He is regarded as the founder of human physiology.

We have been taught that William Harvey discovered the circulatory system in the 17th century, but Ibn Nafis discovered it 300 years before William Harvey.

Slide36:

Ammar ibn Ali al-Mawsili was an Iraqi surgeon who invented the first medical syringe. His syringe was a hollow glass tube topped with a needle, which he used for extracting cataracts from the eyes of his patients. Imagine that – 1100 years ago in 9th century Iraq and this technique is still used.

History usually credits the Scottish doctor Alexander Wood with the invention of this device in 1853.

Slide 37:

This is very interesting: in the field of mathematics, Al-Khwarizmi wrote Kitab-al-Jabr. Doesn't his name sound similar to the word 'algorithm'? And doesn't Al-Jabr sound like the word 'algebra'? This is because he was the pioneer of algebra and algorithms. These words are based on the names of the Muslim scientist and his book.

Al-Khwarizmi (780-850) was born in Iran/Baghdad. He introduced what is now known as Arabic numerals.

What is taught: The first man to utilize algebraic symbols was the French mathematician, Francois Vieta. In 1591, he wrote an algebra book describing equations with letters such as the now familiar x and y's.

What should be taught: Muslim mathematicians, the inventors of algebra, introduced the concept of using letters for unknown variables in equations as early as the 9th century CE.

Slide 38:

This is Jamshed al-Kashi, who introduced the decimal point. One of the best mathematicians in the Islamic world. Born in 1380, in Kashan, Iran. His most impressive mathematical work was, "The Key to Arithmetic" completed on 2 March 1427.

Slide 39:

Do any of you like perfumes? Yeah. Well, here is the inventor.

Jabir ibn Hayyan known as Geber - was the pioneer of chemistry and perfumery. He invented the distillation equipment used for extracting perfume from flowers. He gave the world intense rosewater and other perfumes.

What is taught: Robert Boyle, in the 17th century, originated the science of chemistry.

What should be taught: A variety of Muslim chemists, including ar-Razi, Jabir ibn Hayyan, al-Biruni and al-Kindi, performed scientific experiments in chemistry some 700 years prior to Boyle.

Slide 40:

Similarly, Al-Kindi (801–873 CE), known as Alkindus, laid the foundation of the perfume industry. The first to describe the production of pure distilled alcohol from the distillation of wine.

He invented many different scents, combining different plants and other materials.
His book "**kitaab kimiya' al-'itar"** (book of the chemistry of perfume) contains recipes for fragrant oils, salves and aromatic perfume water

What is taught: Purified alcohol, made through distillation, was first produced by Arnau de Villanova, a Spanish alchemist, in 1300 CE.

What should be taught: Numerous Muslim chemists produced medicinal-grade alcohol through distillation as early as the 10th century and manufactured the first distillation devices. They used alcohol as a solvent and antiseptic.

Slide 41:

The law of refraction is known as Snell's law but it should be called 'Sahl's law' because Abu Sa'd al-Ala' ibn Sahl (940-1000) is the one who discovered it.

A Muslim mathematician, physicist and optics engineer of the Islamic Golden Age associated with the Abbasid court of Baghdad. Ibn Sahl is credited with first discovering the law of refraction, usually called **Snell's law.**

Slide 44:

Ibn Sina, wrote two books, called The Cannon of Medicine and The Book of Healing which were being used as standard text books till the seventeenth century in medical universities all over Europe. They are kept in European libraries and are used as reference books even today.

Let's see what Ibn Sina's life was like. He memorized the *Qur'an* when he was ten years old and at fourteen he had overtaken his teachers because he had learned everything that the teachers had to teach him and it is said that there was nothing that he had not learnt by the age of eighteen but, even though he was so knowledgeable, he was not arrogant at all. He used to treat patients free of cost due to his vast medical knowledge.

When stuck with a problem, he would run to the mosque, do *wudu* {ablution} and start praying, and would continue till light broke. This could mean that he continued praying throughout the night or that he continued till he found an answer. Then he would spend more time thanking Allah (swt).

It is said that he read a book on metaphysics forty times and the words were imprinted in his mind but they still made no sense to him. One day, he stumbled upon a booklet, in which he found answers to his questions. He was overjoyed and immediately rushed to the mosque to give thanks to Allah (swt) and alms to the poor.

When we achieve high scores in tests and do well in our studies, we tend to become arrogant but we need to train ourselves to not do so. We can learn from the examples of our ancestors who were selfless and not self centred. They were humble and gave credit to Allah (swt) for their achievements.

Slide 45:

We have learnt that when these Muslim scientists had a problem, they turned to Allah (swt). Whom do we turn to for help? I am not saying that you should just sit on a prayer mat and expect Allah (swt) to give you the answers to all your problems. All I am saying is that you need to ask Him for guidance when faced with a problem and then work hard. Praying to Him for help should not be the last thing on your to-do list during exams; rather it should be the first. Just putting your faith in hard work and studying is not enough for a believer. Our faith should be in Allah (swt).

Another thing to be noted is that, even though they were masters of many fields, they were humble and they did not break their connection with their Lord. Some of them even memorized the *Qur'an* but do you think scientists these days have the time to study the *Qur'an*? Rarely, right?

Also, when faced with a problem, they did not give up easily. They were not pessimistic or negative in their attitudes. They didn't give up. If we can't understand a question, do we do it forty times? We just do it a few times and then give up and leave it for our teacher to explain. Hard work has not killed anyone so far and we need to adopt the virtuous qualities that these early Muslim scholars showed.

Slide 46:

Allah (swt) says in the *Qur'an*, "Alif laam raa. This is a book we have sent down to you so that you can bring mankind from the darkness to the light by the permission of their Lord to the path of the Almighty, the Praiseworthy." (Surah Ibrahim 14: Verse 1)

So the *Qur'an* is meant to take people from darkness to light, from ignorance to knowledge. Who studies the *Qur'an* these days?

The general public feels that they are too busy in their educational pursuits and plan to devote time to the *Qur'an* only when they are nearing their death bed.

You don't just have to read the *Qur'an,* you have to understand what it says. Just like Ibn Sina tried to find more information about the subject matter of the metaphysics

book in order to understand it, we have to try our best to understand the *Qur'an*. Reading without knowing what it means is not enough.

While reading a story book, we are curious about what happens in the end. We keep on reading page after page until we reach the end. However, when it comes to the *Qur'an*, we don't give it that much attention even though Allah (swt) has told us that this is the book which will give us light and will give us success.

We will continue this topic in the next class.

Du'a for end of a gathering) *Subhana Rabbika Rabbul Izzati 'amma yasifun wa salamun 'alal mursaleen, walhamdulillahi Rabbil 'alameen*

(Parting salutation to students) *Assalam alaikum wa rahmatullahi wa Barakatuh*

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