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TEACHERS WITHOUT BORDERS PROGRAMME

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In Bill Gates words, at the Mandela Day 'Living Together' address: "Maintaining the quality of this country's higher education system while expanding access to more students will not be easy. But it's critical to South Africa's future" – working together, we can help achieve this."

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Clifton School	Milnerton High	Rustenburg Girls' High	St Peter's
Durban Girls'	Northwood High	St Anne's DC	St Stithians
Fairmont High	Roedean	St John's DSG	Wynberg Boys' High
Herzlia High	Rondebosch Boys'	St Mary's DSG Kloof	Wynberg Secondary

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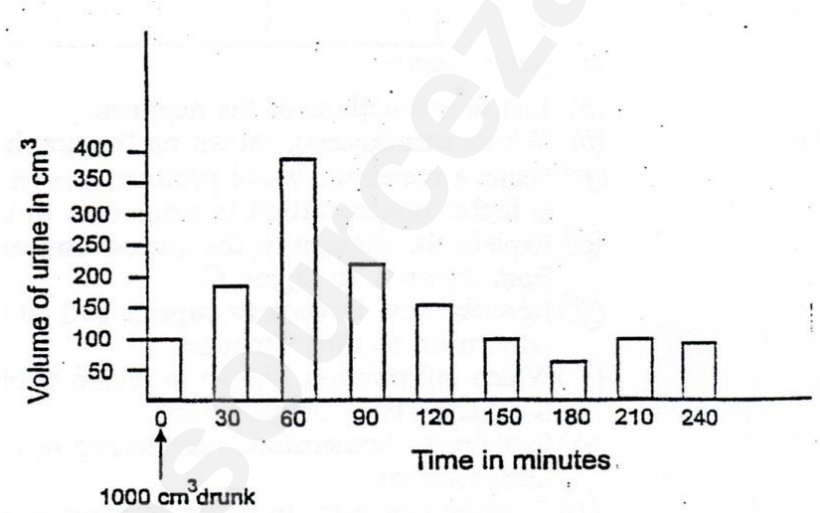
QUESTION 1

1.1 Multiple choice questions are given below. Choose the most correct alternative in each question and write ONLY the letter of the correct answer in the space provided in the table.

Question	1.1.1	1.1.2	1.1.3	1.1.4	1.1.5	1.1.6	1.1.7	1.1.8	1.1.9	1.1.10
Answer										

[10]

1.1.1 The graph below shows the volume of urine that was produced by a person who was given 1 000 cm^3 of water to drink. The person's urine was collected immediately before drinking the water and then at half hour intervals for the next four hours.



How long did it take for the volume of urine to return to normal for that person?

A 1 hour
B 3.5 hours
C 2.5 hours
D 4 hours

1.1.2 Which of the following does not normally form part of the glomerular filtrate?

A large plasma proteins
B glucose
C amino acids
D urea

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1.1.3 The function of arteries is to:

A bring blood to the heart

B take blood away from the heart

C come into close contact with tissue cells and allow exchange of substances to take place

D take deoxygenated blood to the lungs

1.1.4 The immediate environment around most of the cells in the human body is:

A blood

B water

C tissue fluid

D plasma

1.1.5 Which of the following is (are) characteristics of arteries?

i) Always carry blood away from the heart.

ii) Carry blood to and from the heart.

iii) Always carry oxygenated blood.

iv) May carry either oxygenated blood or deoxygenated blood.

A. i only.

B. ii and iii only.

C. i and iv only.

D. i and iii only.

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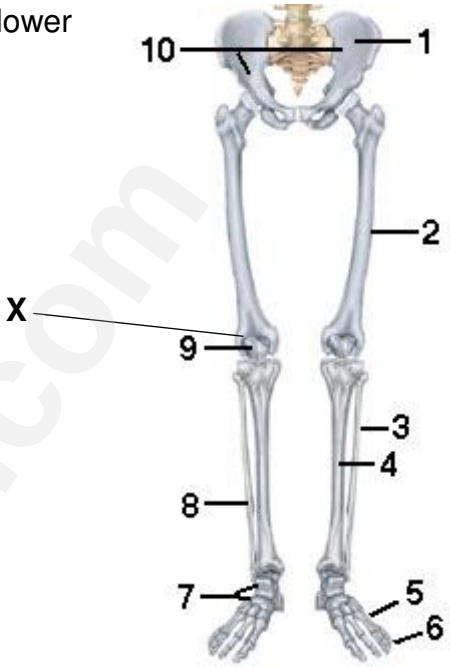
Questions 1.1.6 and 1.1.7 refer to a diagram of part of a human skeleton shown below.



1.1.6 The bone **numbered 4** alongside, articulates at its lower end with the:

A tarsals
B metatarsals
C calcaneum/heel bone
D phalanges

1.1.7 The type of joint found at **X**, is a/an:

A immovable joint
B gliding joint
C fibrous joint
D synovial joint

1.1.8 A gliding joint can be found:

A between the atlas and the axis
B between the fibula and the carpals
C between the femur and the pelvic girdle
D in none of the above situations

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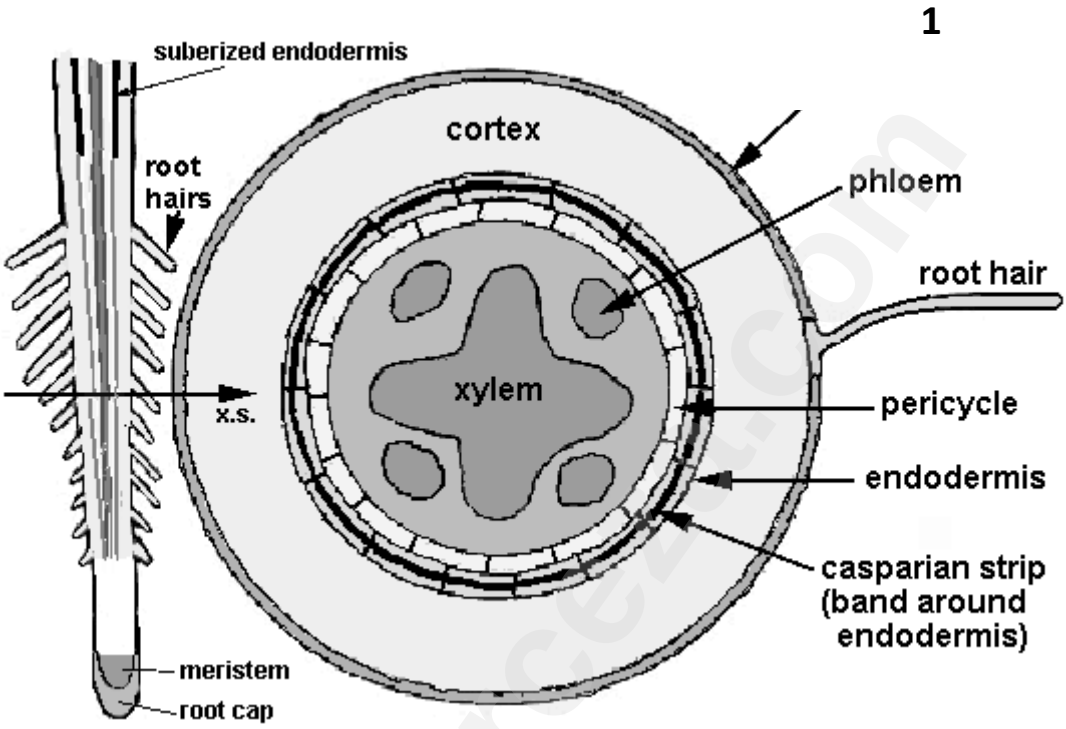
1.1.9 The diagram below shows a cross section of a dicotyledon root. Which label number indicates the pericycle layer?



A 1

B 3

C 4

D 5

1.1.10 Of which tissue is the pericycle composed?

A parenchyma

B meristematic

C phloem

D sclerenchyma

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1.2 Select the term in **Column B** that best matches the description in **Column A**. Write the letter of the term in the corresponding space provided between to the left of **Column A**. Each letter may only be used once. **[10]**

	Column A	**Column B**
	The main artery that conducts oxygenated blood from the heart to the rest of the body.	**A** Superior vena cava
	The membrane surrounding and protecting the heart.	**B** Sino-atrial node
	The muscle layer that separates the heart into left and right halves.	**C** Atherosclerosis
	The blood vessel collecting deoxygenated blood from the upper part of the body and returning it to the heart.	**D** Atria
	The heart chambers that collect blood from the body and the lungs.	**E** Diastole
	A nerve centre in the heart known as the 'pacemaker' which allows the upper heart chambers to contract together.	**F** Aorta
	A cardiovascular condition that may cause a heart attack in which fatty deposits accumulate and block the coronary arteries.	**G** Pericardium
	The vessels which return tissue fluid and blood proteins to the circulatory system.	**H** Systole
	The phase in the cardiac cycle when the heart is relaxed allowing blood to flow into the chambers.	**I** Inferior vena cava
	The circulation of the blood from the heart to all the body tissues except the lungs.	**J** Lymphatic ducts
		K Septum
		L Systemic

1.3 Study the diagram below which shows a potometer used to measure the effect

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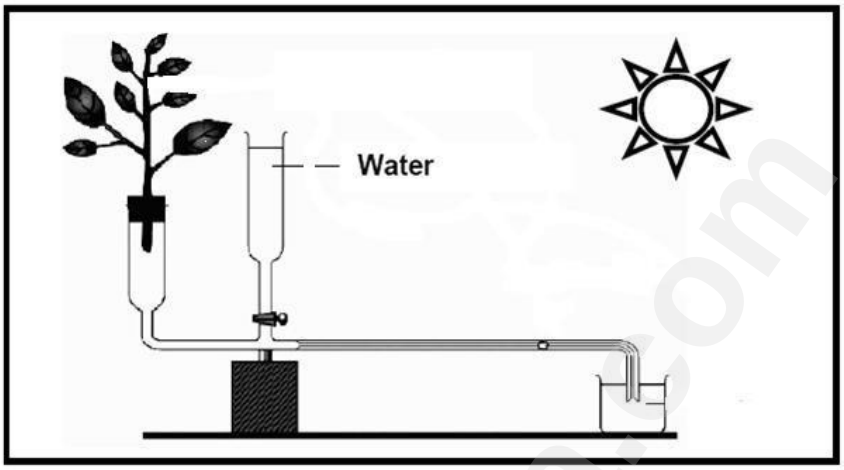
of temperature on the rate of transpiration and then answer the questions that follow.



1.3.1 State TWO precautions you would take when setting up the apparatus.

_____

_____

_____ (2)

1.3.2 Formulate a hypothesis for this investigation.

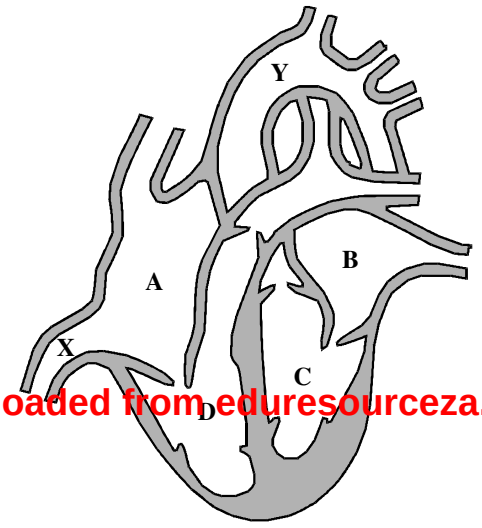
_____

_____ (2)

1.3.3 State the independent variable for this investigation.

_____(1)**[5]**

1.4 The diagram below shows a section through a human heart.



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1.4.1 Supply labels for A, C and Y.

A_____C_____

Y_____ (3)

1.4.2 Complete the table below to show whether the valves are open or closed when the **pressure** in chamber C is at its **highest.**

Location of valve	Valve open or closed
between chamber C and chamber B	
between chamber D and chamber A	
between chamber C and blood vessel Y	

(3)**[6]**

1.5 The following diagrams show a cross section through the proximal convoluted tubule (A) and a single epithelial cell (B) of the same tubule in a human nephron.

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1.5.1 Identify the blood vessel numbered 1._____ (1)

1.5.2 Identify the organelle numbered 3._____(1)

1.5.3 Identify the type of epithelial cell labelled 2 (shown enlarged in diagram B) and explain ONE way in which it is adapted to its function.

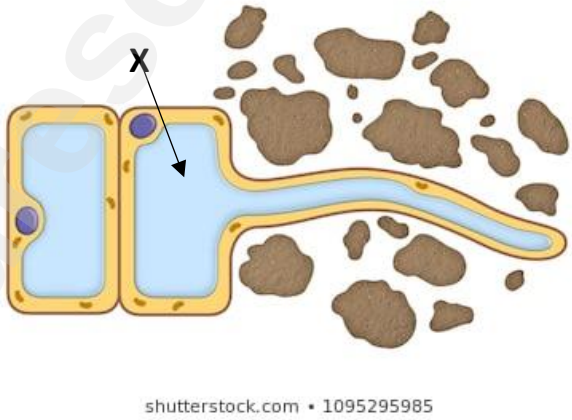
_____

_____

_____(3)**[5]**

(Adapted from Study & Master Grade 11, 2014)

1.6 Study the following cross-section of part of a plant organ, then answer the following questions.



1.6.1 Give a suitable heading for the cross section.

_____(1)

1.6.2 Explain how the part labelled **X** is modified to perform its function.

_____

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_____(2)

1.6.3 There are THREE routes by which water moves across the cortex of a root and into the xylem vessels. Only one route makes use of the process of osmosis. Name this route.

_____(1)**[4]**

(Adapted from The Answer Series Grade 11 2014)

TOTAL QUESTION 1: {40}

ANSWER THE FOLLOWING QUESTIONS ON THE FOLIO PAPER PROVIDED

QUESTION 2

2.1 Water for crops is very scarce in many parts of the world. Scientists are therefore very interested in the rate at which different crop plants lose water to the

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Loss in mass from the start of the experiment (g)

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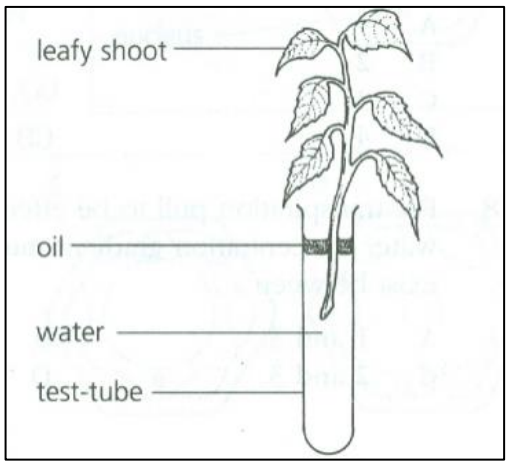
atmosphere. The apparatus below was left outside in the sun and was used to measure this rate.



Time (hours)	Apparatus in the open	Apparatus in a plastic bag
1	0,2	0,1
2	0,4	0,2
3	0,5	0,3
4	0,8	0,3
5	1,0	0,3

The whole apparatus was weighed every hour for five hours. It was then put into a large transparent plastic bag and again weighed every hour for five hours. In both investigations, the loss in mass from the start of the experiment was recorded. The results of the experiment are shown in the table above.

2.1.1 From the above investigation name the independent variable. (1)

2.1.2 Explain why it is better to use the same leafy shoot in different conditions rather than to use two different shoots at the same time. (2)

2.1.3 What is the purpose of putting oil on the surface of the water in the test-tube? (2)

2.1.4 From the results of the experiment, suggest how a farmer growing salad vegetables, in a hot dry area could conserve water. (2)**[7]**

2.2 The figure shown below is part of a section through a leaf showing the path of water from the xylem to the atmosphere.

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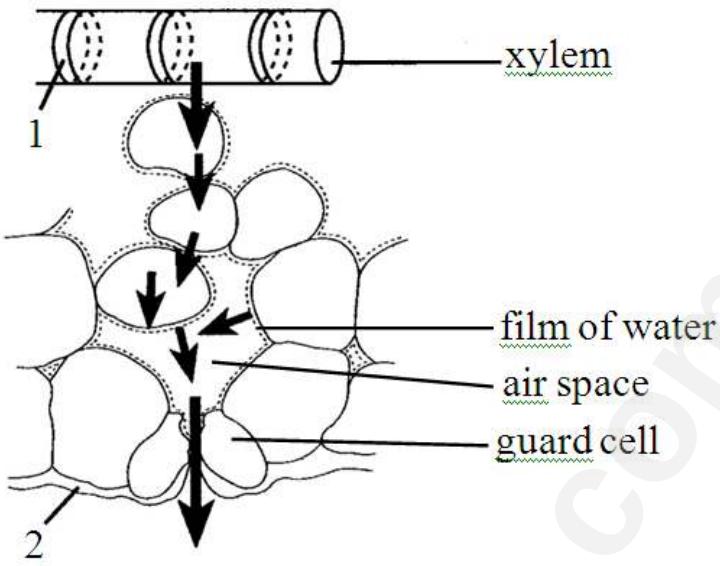
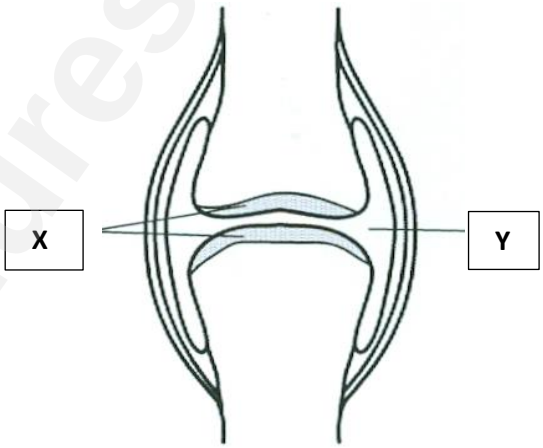


2.2.1 Refer to the different processes shown by the arrows in the diagram, and explain how a plant loses water from its leaves. (6)

2.2.2 Give ONE function of each of the structures labelled 1 and 2 in the diagram. (2)

2.2.3 Name THREE environmental factors, other than temperature, which could directly influence the rate of transpiration from the leaves of the plant. (3)**[11]**

2.3 Study the diagram below of a synovial joint.



2.3.1 Give ONE example where a synovial joint can be found in the human body. (2)

2.3.2 Using the letters and names of the TWO labelled structures in the synovial joint

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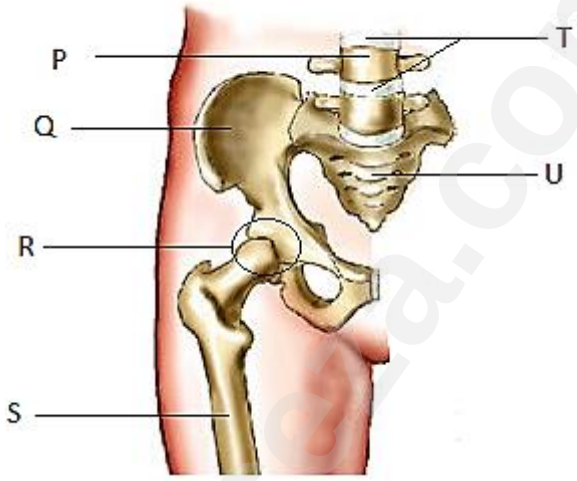
shown on page 11, explain clearly how arthritis would affect the functioning of this joint. (4)**[6]**

2.4 The diagram below shows part of the human skeleton. Use it and your own knowledge to answer the questions which follow.



2.4.1 Name the bones labelled **P**; **Q**; and **S**. (3)

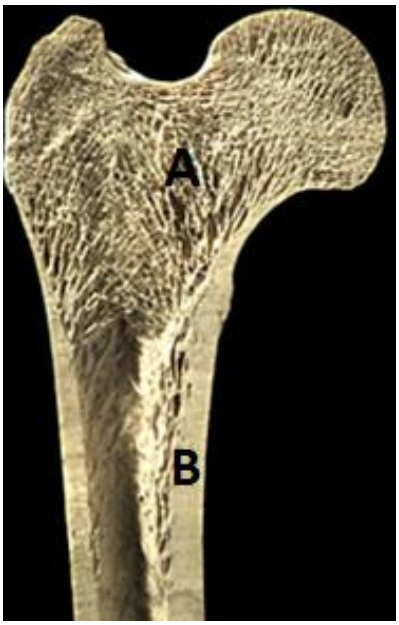
2.4.2 Why does the bone labelled **Q** have such a large surface area? (1)

2.4.3 The internal structure of a section of the long bone labelled **S** is shown alongside:

a) What type of bone can be found at **A** in the image alongside? (1)

b) What characteristic of this type of bone makes it suitable for the location in which it is shown in the diagram? (1)

[6]{30}



QUESTION 3

3.1 The graph below shows how changes in the concentration of ADH in the blood affect

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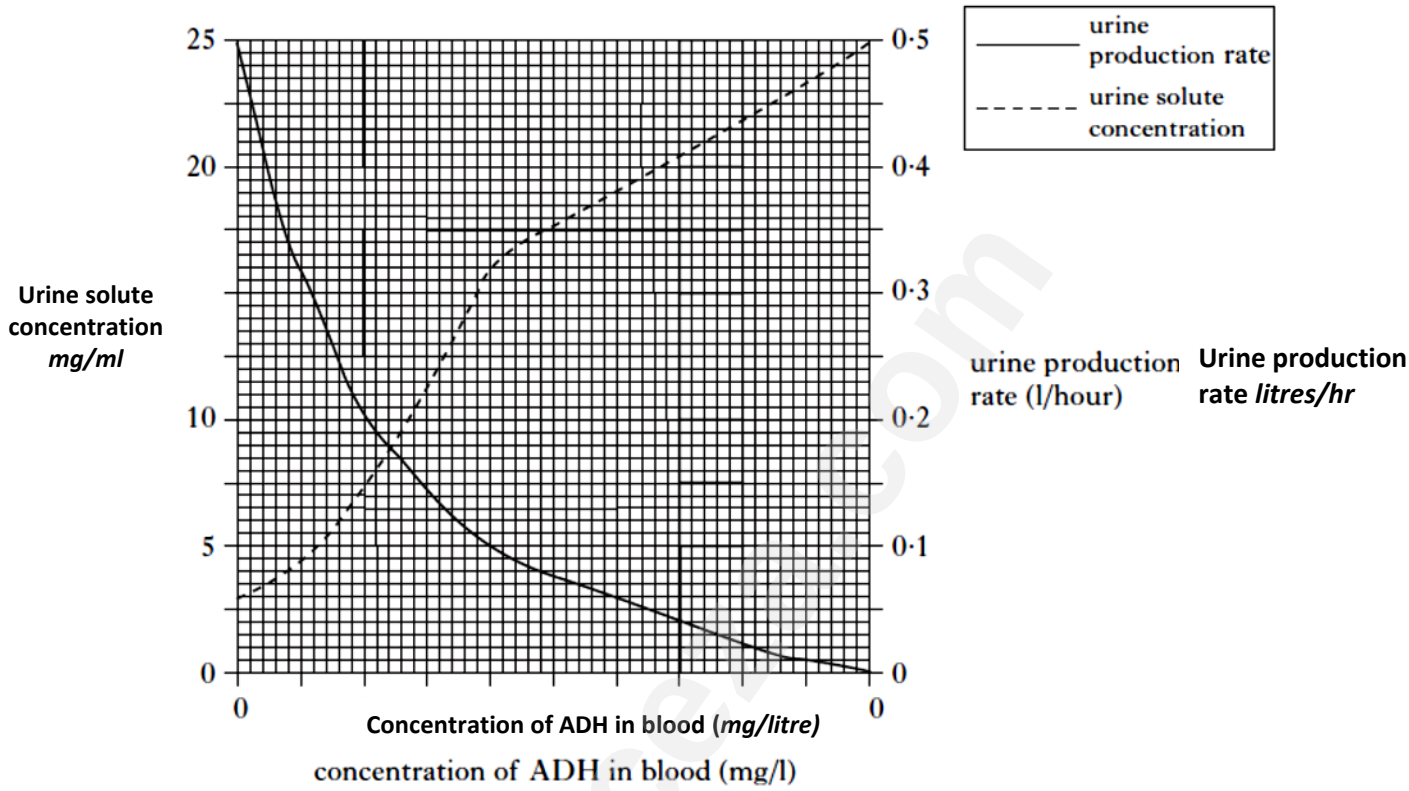
the production rate and solute concentration of urine.



3.1.1 Use the graph to determine TWO effects of increasing the concentration of ADH in the blood. (2)

3.1.2 From the graph determine the following:

a) The urine solute concentration when the ADH concentration in the blood is 6mg/l. (1)

b) The urine production rate when the ADH concentration in the blood is 4mg/l. (1)

3.1.3 If the ADH concentration in the blood remains constant at 4mg/l, calculate the total amount of solute excreted in the urine in one hour.
Show all working. (2) **[6]**

3.2 Study the diagram and table below and then answer the questions which follow.

F

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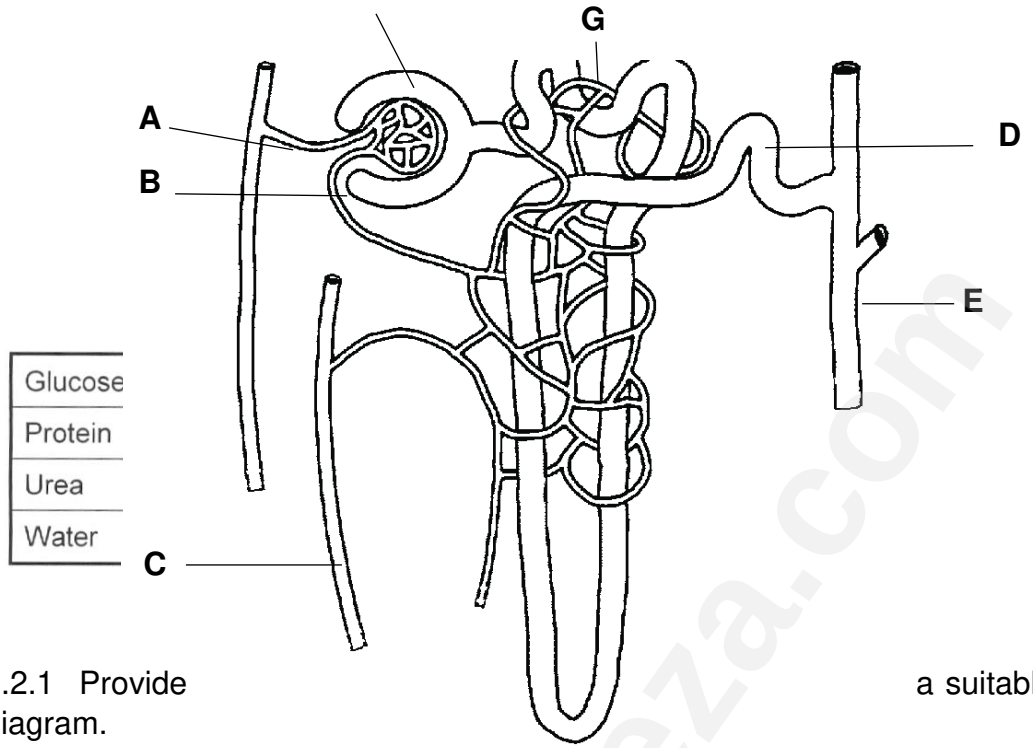

Glucose
Protein
Urea
Water

3.2.1 Provide a suitable heading for the diagram. (2)

3.2.2 Label structures A to D. (4)

3.2.3 Using the letters in the diagram indicate where the following substances from the table would be found:

a) Substance X

b) Substance Y

c) Substance Z (3)

3.2.4 List TWO ways in which the composition of the blood in A will differ from the blood composition in C. (2)

[11]

3.3 Consider being faced with the following scenario:

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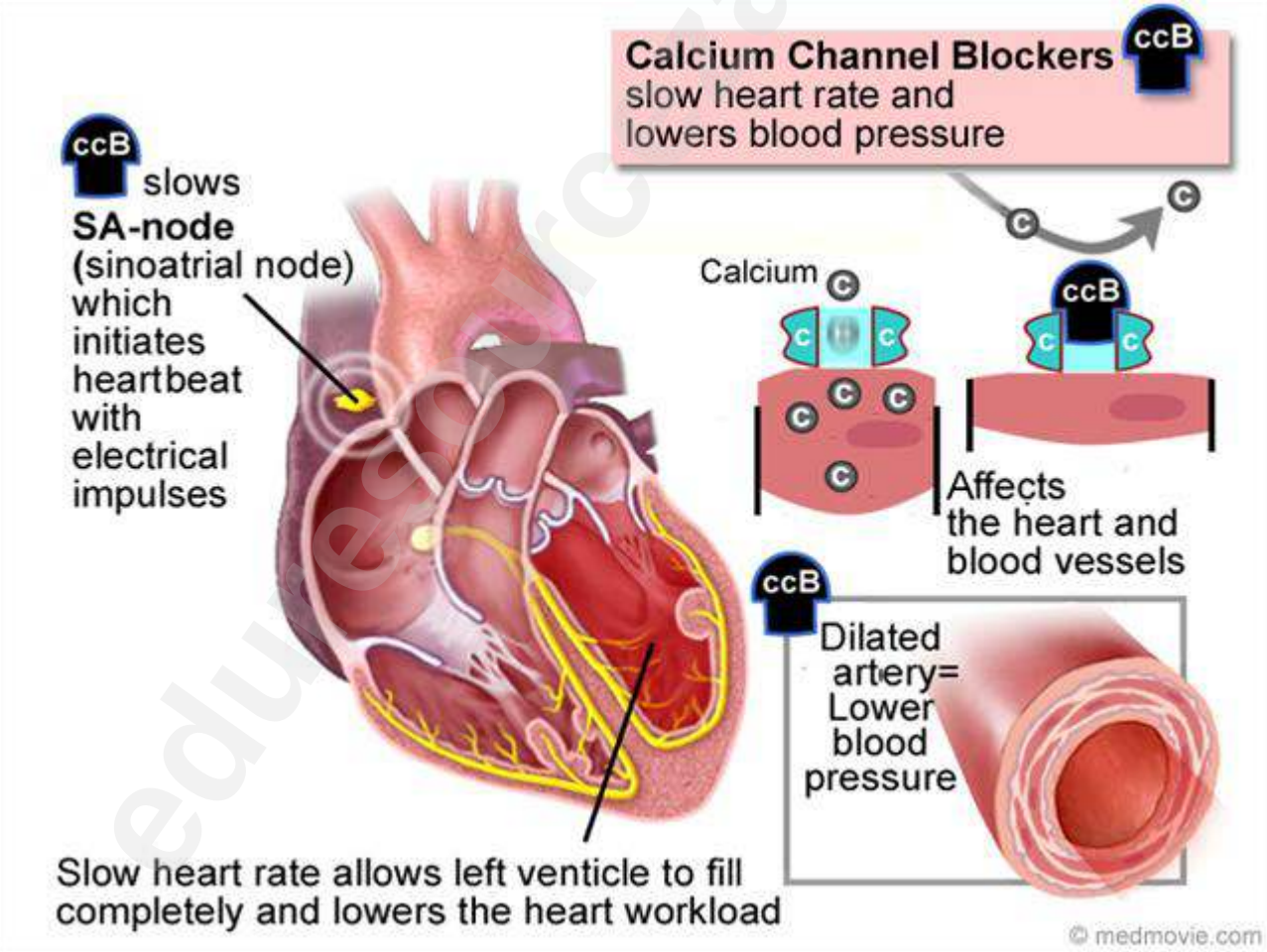
You are the parent of a 10-year-old child who has been seriously injured in an accident and you are told that the paramedics were unable to keep your child alive. The surgeon informs you that they have your child on life-support so that they can find out if you will donate your child's organs to people in serious need of healthy organs. These patients are on standby, desperately in need of organ transplants.

3.3.1 Would you agree to have your child's organs transplanted? Give TWO reasons to support your decision. **[3]**

3.4 Study the diagram and information given below on drugs (ccB) which are designed to deal with high blood pressure.



https://medmovie.com/library_id/3255/topic/ahaw_0247i/

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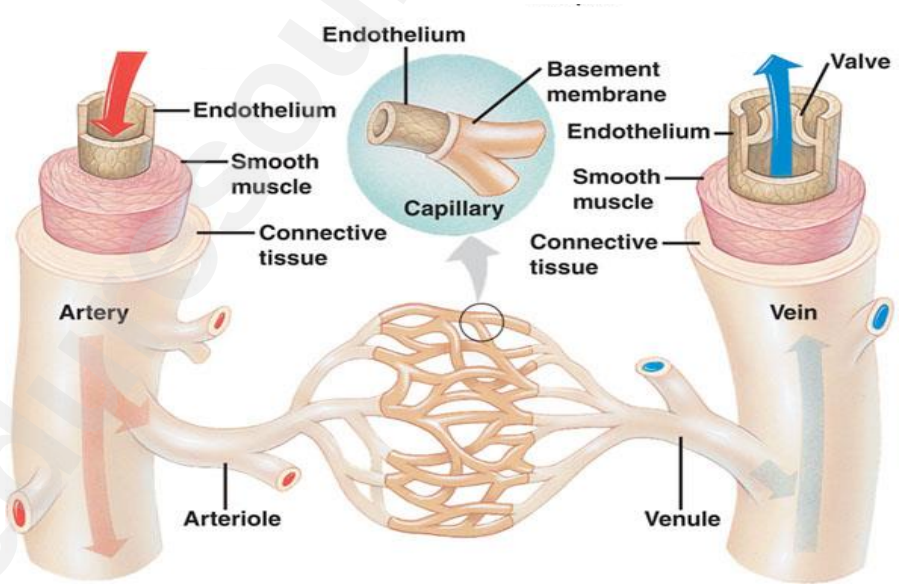
Beta Blockers (also known as calcium channel blockers) are drugs that slow the heart rate, decrease cardiac output, lessen the force with which the heart muscle contracts and reduce blood vessel contraction. They do this by blocking beta-adrenergic receptors in various parts of the body. This prevents adrenaline from stimulating these receptors. They may be used to treat abnormal heart rhythms (arrhythmias) and prevent abnormally fast heart rate (tachycardia) or irregular rhythms such as premature ventricular beats. Since they reduce the demand of the heart muscle for oxygen, they may be useful in treating angina (chest pain), which occurs when the oxygen demand of the heart exceeds the supply. They have become an important drug in improving survival rates after a person has had a heart attack. Beta-blockers are also used to treat high blood pressure and other heart conditions.

3.4.1 Give the medical term for high blood pressure. (2)

3.4.2 Using the text and diagram to assist you, describe TWO ways in which beta-blockers can be used to treat high blood pressure. (4)**[6]**

3.5 Study the diagram below which illustrates different types of blood vessels.



3.5.1 From the information seen in the diagram above, tabulate THREE differences between arteries, capillaries and veins. (7)

3.5.2 Describe in your own words what is represented by the diagram above. (2)

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3.5.3 Choose **ONE** of the following (i, ii OR iii) and write a short paragraph describing what is meant by the condition, procedure or disorder (cause, symptoms, outcome etc).

i) A burst aneurysm

ii) Using a stent to unblock an artery

iii) By-pass surgery on a coronary artery (5)**[14]{40}**

Is the Rufiji Hydro-electric scheme the only viable means of providing more electricity to over 53 million people living in Tanzania?

QUESTION 4

Using the source material (Source A-J) provided, as well as your own knowledge, write a debated argument in the form of a 2½–3 page essay based on your opinion of the question above. **{40}**

To answer this question, you are expected to:

- Read the source material carefully and present a debated argument to illustrate your point of view.
- Select relevant information from sources A to J
- It is important to integrate your own relevant biological knowledge.
- Take a definite stand on the question and arrange the information to best develop your argument.
- Write in a way that is scientifically appropriate and communicates your point of view clearly.
- **Provide** a clear **plan** of your essay before you start writing. Note that the plan will be marked as part of the assessment of this question.

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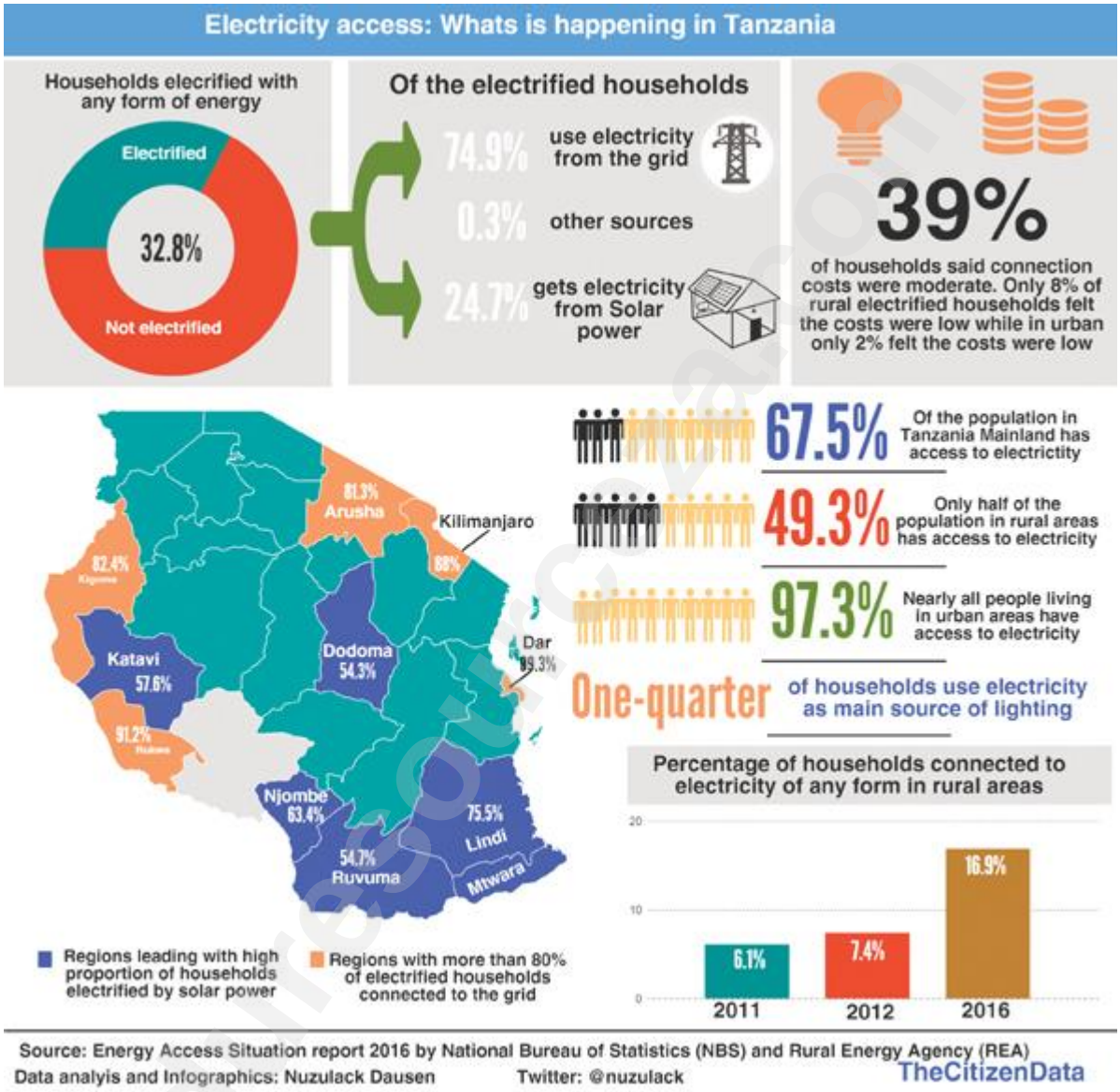
SOURCE A THE CURRENT ELECTRICTY SITUATION IN TANZANIA



By Citizen Reporter @TheCitizenTz news@tz.nationmedia.com

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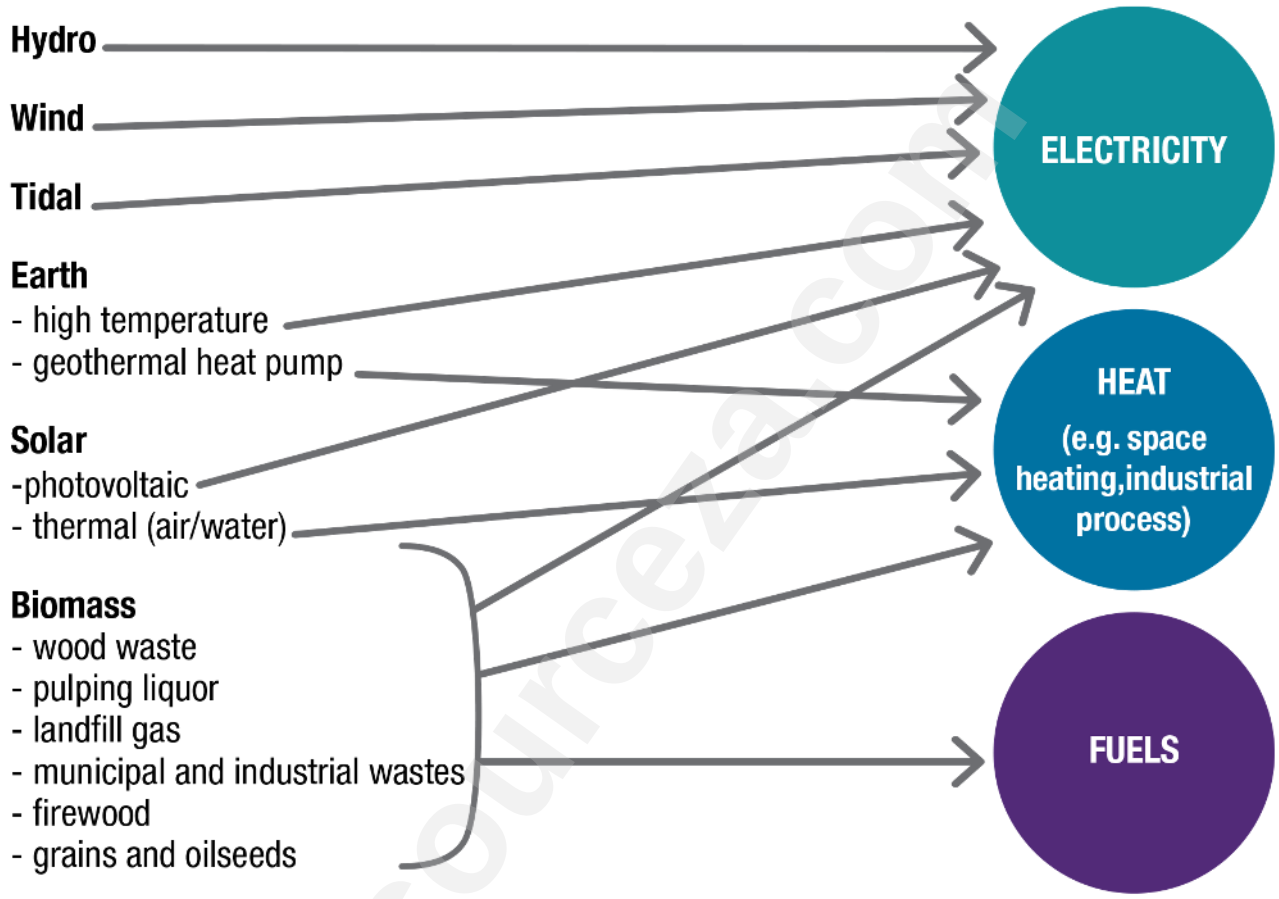
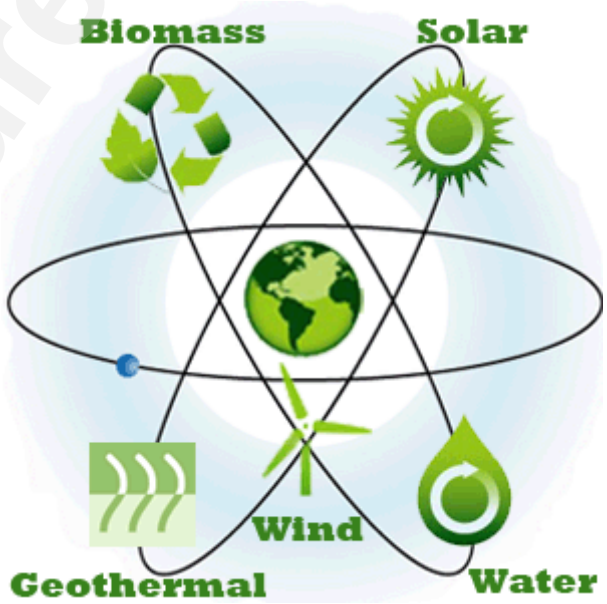
SOURCE B DIFFERENT SOURCES OF RENEWABLE ENERGY



https://www.nrcan.gc.ca/energy/facts/renewable-energy/20069



http://www.nrdc.org/energy/renewables/

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SOURCE C HYDROPOWER DRIES UP WITH CLIMATE CHANGE

Water powers around 70 percent of the world's renewable electricity, and more than 15 percent of the world's total power supply. It's cheap, and unlike solar and wind, can produce electricity on demand. But building hydroelectric dams also reshapes ecological systems, inundates landscapes, and has forced millions of people to abandon their homes. And now, water power faces an added complication: Climate change means some countries are experiencing severe droughts and reservoirs are drying up.

Malawi relies on hydropower for 98 percent of its electricity supply. Last year, it suffered prolonged blackouts. According to the World Bank, less than 10 percent of Malawians have access to a power supply anyway, but key public infrastructure, such as hospitals, was badly hit. Yet, despite uncertainty about future climate, reservoirs are still being built around the world. Greenpeace proposes a combination of wind, solar and biomass, which it says will, in the long term, be cheaper and more efficient, as well as far less destructive.

UK researchers say that if all plans currently on the table for new hydropower plants in Eastern and Southern Africa were fulfilled, the risk of power shortages could increase, since most rely on the same scarce rainfall and would suffer a drop in power generation at the same time. Hydropower should not be seen as an alternative to other renewables, but as a compliment to them, making the entire energy system more efficient and the power supply more secure.

https://www.dw.com/en/hydropower-supply-dries-up-with-climate-change/a-42472070

SOURCE D STIEGLER'S GORGE CAN BENEFIT EVERYONE

DECEMBER 14 2018

The signing of the $6.5 trillion contract between the government and Egyptian firms for the construction of the Stiegler's Gorge hydropower station had been much-awaited. Those who opposed the project argued that the building of 2,113-megawatt station in the Rufiji Basin would disturb the ecosystem of the Sealous Game Reserve, one of the world's largest animal sanctuaries and a UNESCO World Heritage Site. There have also been concerns over the impact of the project on the livelihoods of some 200,000 people - including farmers and fishermen - living downstream from the proposed 1,200 sq km reservoir. But President Magufuli has, on several occasions, allayed fears expressed by the environmentalists and lobbyists. And, considering that only one-third of the country's population currently has access to electricity, it's important that the dream to double power supply through the Stiegler's Gorge be realised. Some experts from the International Renewable Energy Agency (IRENA), agree that Africa still has a lot of hydropower potential, and with such high demand for renewable energy, it cannot be ignored.

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https://www.thecitizen.co.tz/oped/EDITORIAL--Stiegler-s-Gorge-project-can-benefit-everyone/1840568-4895146-ytx6maz/index.html

SOURCE E **The Economics of Alternative Energy**

September 21, 2018

The need to implement alternate sources of electricity will continue to increase as the price of fossil fuels continues to rise and the availability of these resources decreases. Hydro-Electric dams offer a reasonable cost in terms of initial start-up capital ($1.58 million / Mw) and operating costs (.85 cents / KwH). These low costs can be attributed to the lack of fuel needed to operate Hydro-Electric plants and the high power output of these plants, which are capable of generating up to 9,800 Megawatts of power. The use of hydro-electric plants can also be controlled and scheduled to meet the power requirements of any grid. The only negative aspect to hydro-electric power is its reliance on rivers and reservoirs, which makes mass implementation difficult. Wind Turbine generators offer the lowest capital cost per generating capacity ($1.5 million / Mw). Wind power's operating costs ($.015 / KwH) are the third lowest of the options. Wind Farms can be used in almost any location as long as the average wind speed is between 10 to 50 mph. The only problem with wind power is that wind is unpredictable and cannot be scheduled on a power grid. Currently, solar power is the least attractive of alternate power sources. This energy source features the second highest capital costs ($4.16 million / Mw) and the highest operating costs ($.13 / KwH). To make matters even worse, these estimates of solar power's operating costs include government subsidies ($.23 / KwH without subsidization). Solar is unpredictable, and therefore difficult to schedule on a power grid. Moreover, solar uses land inefficiently — it takes 400 acres of collectors to generate 75 Mw of capacity.

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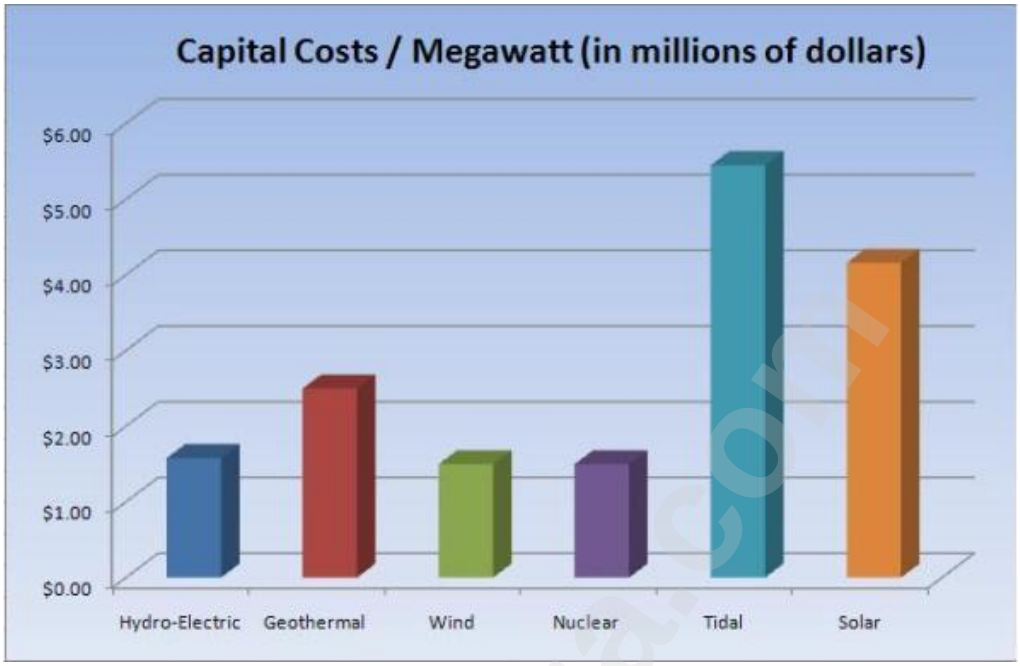

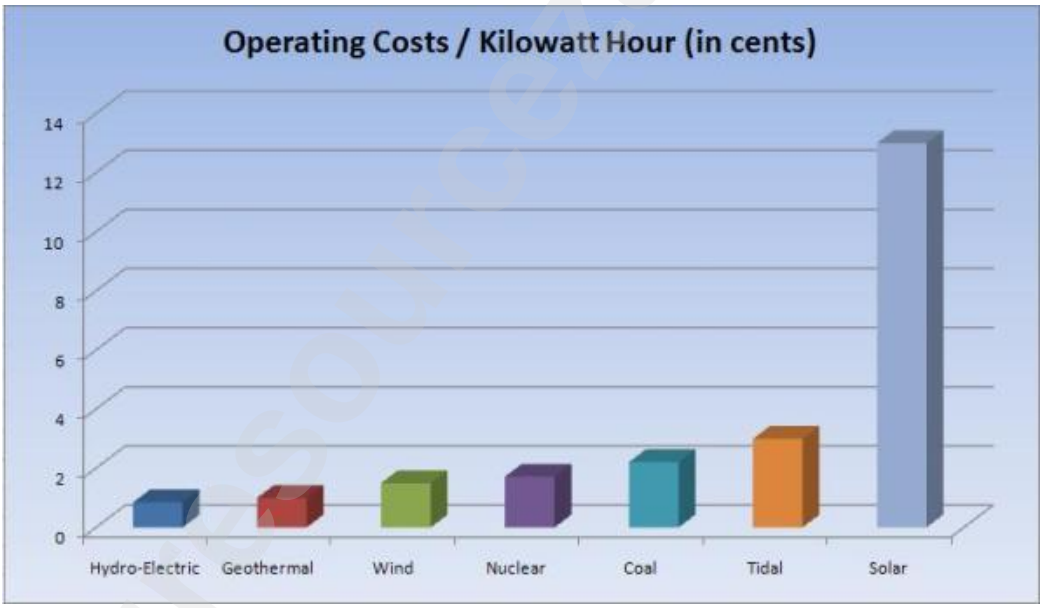

https://financial-market-commentary.com/2018/09/21/the-economics-of-alternative-energy/

SOURCE F Tanzania: 2,100-MW Stiegler's Gorge hydropower project gains further support

01/08/2019

Tanzania's National Environmental Management Council (NEMC) has approved the construction of the planned 2,100-MW hydroelectric project at Stiegler's Gorge, assuring that it will have no adverse impact on the local ecology. The NEMC states that implementation of the Rufiji hydroelectric power project will comply

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with all the relevant environmental protection measures at all levels. The Stiegler's Gorge hydroelectric project is vital in building a strong industrial economy, hence the need to develop it without affecting all the sources of the Rufiji River. The NEMC will continue to uphold all laws and regulations dealing with environmental protection. The NEMC commended the various measures being taken by President John Magufuli's administration in the endeavour to build an industrial economy.

People will benefit not only from electricity but also from secured water supply, irrigation for food production and flood control. Also, societal benefits would appear, such as increased recreational opportunities, improved navigation, the development of fisheries, cottage industries, etc. This is not the case for any other source of energy. Further research and development in the field of other renewable options such as solar and wind power for a country like Tanzania should not be separated but rather go hand in hand. An integrated approach is vital which includes joint ventures between the public and the private sector in hydropower development. There is also a need for technical assistance in planning, development and implementation of the projects.

http://www.diva-portal.org/smash/get/diva2:650272/FULLTEXT01.pdf

SOURCE G ADVANTAGES AND DISADVANTAGES OF WIND, SOLAR AND HYDRO POWER

Disadvantages of Wind Power

- Unreliable
  - wind comes and goes at its own rate
  - Sometimes the wind can be too weak in certain regions
- Produces a lot less

Advantages / Disadvantages

- Advantages
  - Long lasting
  - Can be used anywhere
  - Silent and non polluting
  - Solar cells can be added

Advantages and disadvantages of Solar Power

energy generated everyday
- Solar power production is growing rapidly
- It is a secure type of energy
- Disadvantages
  - High initial cost
  - Takes a lot of solar panels to be efficient initially
  - Can only generate during the day

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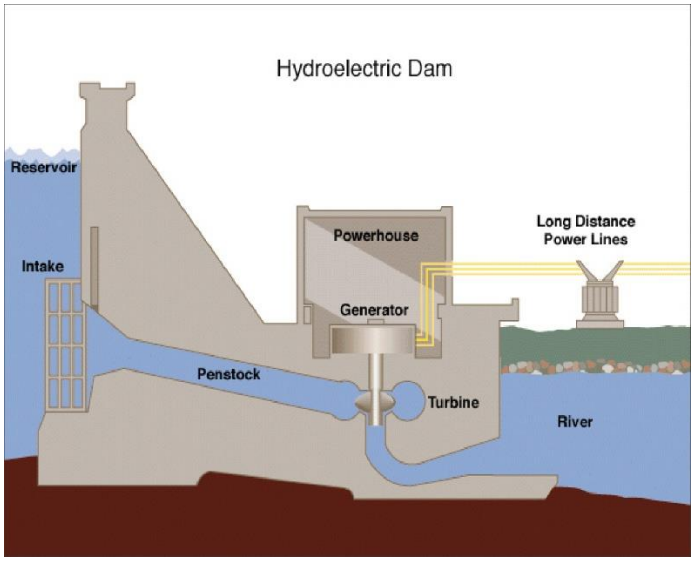
Advantages of hydro-power:

- Electricity can be produced at a constant rate
- If electricity is not needed, the gates can be shut, stopping electrical generation
- The water can be saved for another time when electricity demand is high
- Designed to last decades
- The dam formed behind the wall can be used for recreation
- The dam's water can be used for irrigation
- When in use, electricity produced by dam systems do not produce greenhouse gases



https://www.slideshare.net/kkublbeck/solar-energy-presentation-3401666

SOURCE H Big-dam craze threatens developing world, researchers warn

7 November 2018 | By Rod Sweet

Large dams seem to be everything that one should not try to build if one cares about sustainability. Big dams disrupt river ecology and cause deforestation, damaging aquatic and terrestrial biodiversity and release greenhouse gases as flooded areas rot. They also displace thousands of people and destroy food sources and livelihoods. Consultants hired by dam builders "routinely" inflate benefits and minimise costs, and do not make their data public until long after the dam is built. Governments should explore less damaging

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alternative renewable power sources such as solar and wind, and less intrusive hydropower technologies such as “instream turbines” systems where, instead of damming a river, turbines of various designs can be dipped into faster flowing water, supported by lighter infrastructure. This can be less disruptive of natural sediment and wildlife flows.

The hydropower industry dangles the purported benefits of big dams in front of governments who are keen to develop, but such schemes regularly go far over budget and rarely produce the expected return on investment. Governments should learn from what is happening in America, where dams built in the heyday of hydropower (1930-50) are now past their 50-year lifespan, and are facing material degradation and higher-than-expected rates of sedimentation, leading to disruptive failures and failure scares, such as at California’s Oroville Dam in February last year, when 180,000 people were ordered to run for their lives. Too frequently, energy and water planning are secretively guarded by governments (sometimes in collusion with dam builders), is closed to the participation of civil society, and does not follow the World Commission on Dams guidelines.

http://www.globalconstructionreview.com/perspectives/big-dam-craze-threatens-developing-world-researche/

SOURCE I Social and environmental costs of hydropower are underestimated

JANUARY 11, 2019

The first dams were built in North America and Europe to supply power to rural areas and provide water for irrigation systems. These projects had a social purpose. In contrast, the dams now under construction are mostly designed to supply power to, for example, steel manufacturers, without directly benefiting local communities.

The people affected by these projects reap no benefits, such as access to electricity or a cheaper power supply. The transmission line passes over the heads of the people affected and takes the electricity generated straight to the major cities and urban industries.

https://phys.org/news/2019-01-social-environmental-hydropower-underestimated.html

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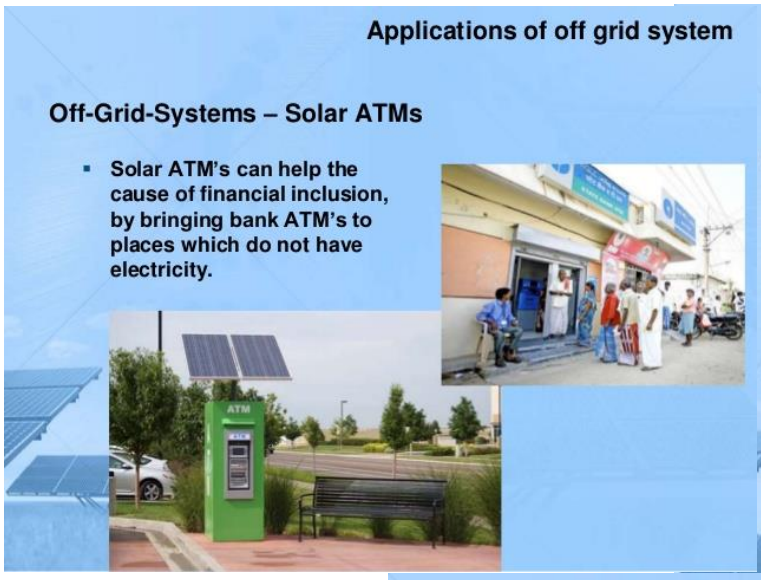
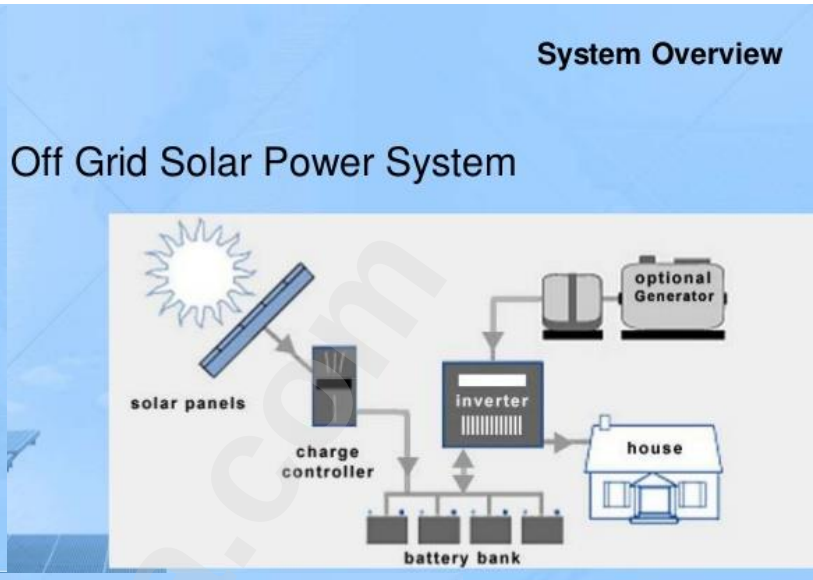
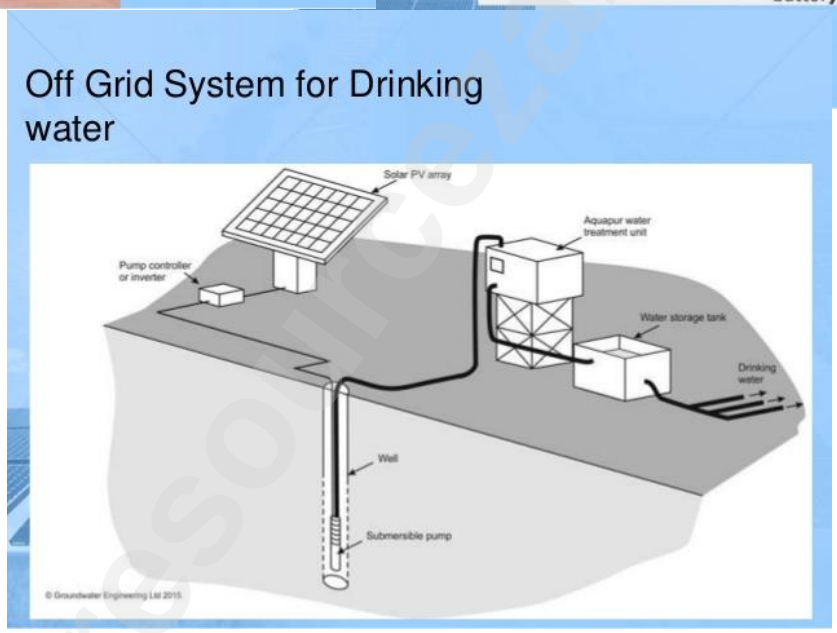
SOURCE J OFF-GRID ENERGY





SYSTEMS

https://www.slideshare.net/ShoebKhan34/introduction-to-off-grid-solar-power-system



Research uncovers mini-grids potential of where more in Tanzania, population than 70% of electricity lack 21

January 2019

A South African-based energy news outlet says the solution to Tanzania's lack of electricity in rural areas may be found in 'mini-grids'. The report has found that Tanzania now has 109 mini-grids, serving over 180,000 people. The country's mini-grids' 157.7MW of installed capacity consists of; hydro, biomass, hybrid, fossil fuel and solar systems. By comparison, Tanzania's central grid has an installed generation capacity of approximately 1,500MW, with mostly hydro and natural gas, serving around 9 million people. Commenting about the report, Deputy Minister for energy and minerals, said: "Given the challenges of insufficient electricity and difficulties for the national grid to reach all areas in the country, it is essential to develop mini-grids, micro-grids and stand-alone electrification." According to the study, by 2040, an estimated 140 million rural Africans will get electricity from mini-grids, requiring more than 100,000 mini-grids to be built.

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Rufiji Hydro-electric scheme

Area covered by the mini-grids project. Credit:World Resources Institute.

Area covered by the mini-grid project. Credit: World Resources Institute.https://www.researchgate.net/figure/Renewable-sources-of-energy_fig1_292208537

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