

L3 Lead Examiner Report 1901

January 2019

**L3 Qualification in Applied Science
Unit 7: Contemporary Issues in
Science (31629H)**

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A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

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Unit 7: Contemporary Issues in Science

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	8	16	26	36

Introduction to the Overall Performance of the Unit

Overall the performance of learners was slightly improved in comparison to the first sitting of this unit in June 2018. In most cases, learners were able to give full answers to the five questions.

The degree of preparation for the examination remains an important factor in the success of learners. It was evident from some of the responses that learners may not have used the allotted preparatory time prior to the examination to read the articles carefully and then to look at the references given in the articles.

The learners that were the most successful, were able to use information from the three articles appropriately in response to the questions. The best responses showed that there was a good deal of preparatory work done, a clear understanding of the topics raised in the articles and a high level of literacy.

In this examination the articles related to aspects of nanotechnology and their application in general to exploration and then more specifically in the construction of a space elevator. Many learners were able to engage with the articles and draw from them the ideas that were asked for in response to the questions. Weaker responses lacked focus and, in many cases, confused ideas relating to the last article with ideas in general presented in the first article, for example some learners thought that the space elevator, (last two articles), was a device that used the idea of nanosatellites, (first article), to operate.

Many learners were able to give ethical, social, economic and environmental examples to the implications or uses mentioned in the articles for question 1. Weaker learners confused these ideas, for example suggesting that an ethical impact was the issue, when what was being discussed was a social or environmental issue.

Many learners were not confident of the use of key words used in the questions and assessment criteria for this unit. Words and phrases such as 'Ethical Issue', 'Environmental Issue', 'Social Issue' and 'Reliability' were examples among many that were not used correctly in responses and led to a clear view that some learners had not prepared well for this unit. Teachers and Learners should be aware that on page 96 of the specification for this unit there is a list of key terms used and what they mean. Knowing what the terms mean would greatly assist learners in their preparation for this unit.

Individual Questions

Q1 Discuss the implications of the scientific issues identified in the articles, (12 marks)

In this response the learner scored Band 4, 12 marks.

In these 3 articles, there are scientific ~~impacts~~ ~~more~~ impacts that I will discuss. These impacts are: environmental - how ~~the~~ the environment is affected, economical, - how the economy is affected, social - how society is ~~affected~~ affected, and ethical - what is considered to be morally right.

In ~~article~~ article 1 (an article that appeared in 'The Guardian' newspaper written by 'Stuart Clark') ~~an~~ an economical impact is mentioned: "Making things smaller and lighter is, therefore, a natural route to reducing the cost of launching a spacecraft". This would ~~make~~ make an impact ~~because~~ because in the article it is also mentioned that the cost of launching equipment into space costs "\$10,000" and so ~~mean~~ reducing the cost means the money could go to other needs such as healthcare. In article 1 there is a statement from 'Nagaya Nagayapan' - "when nanotechnology is really developed even countries that don't presently think about space will be able to afford space exploration". This is a social impact as all of society will be able to take part in space exploration and there wouldn't be anyone left out which could cause arguments.

In article 23 an ethical impact is mentioned - "The Marine Node is a city on multiple floating platforms in the eastern Pacific Ocean". This could disturb ocean life and if the platform increases in size, then this could largely impact the quality of life for marine life. This also links to an environmental impact as the potential pollution from ~~the~~ 'a city on multiple floating platforms' could result in ocean acidification ~~or~~ or contribution to global warming.

In article 2 ~~there is a social impact~~ it states "Attacks by terrorists or enemies in war are also a major concern" this is a social impact as the ~~there~~ potential for a terrorist attack could endanger a lot of lives if an attack was to happen. This also links to an ethical issue as some people might not agree with putting peoples lives in ~~danger~~ potential danger.

In article 3 it is mentioned "recent progress in thin-film photovoltaics makes the alternative of using solar power quite feasible" this ~~is~~ has an environment ~~no~~ impact as using solar power is much better for the environment than using alternatives such as fossil fuels - which ^{are} ~~are~~ non-renewable and contribute to greenhouse gases.

In article 3 it is mentioned that "Building a space elevator will become more feasible when either a strong enough material becomes available" this is an economical impact ~~is~~ because ~~if~~ if a new material ~~is~~ needs to be developed and ~~has~~ researched, this could cost more money from potentially the government or ~~other~~ big organisations that could go towards other needs e.g. healthcare, housing.

Also in article 3 the space elevator ~~is~~ would have to "pass through the Earth's radiation belts" and "~~may~~ will as a result be exposed to large fluxes of charged particles that pose a radiation hazard to humans" This could implicate further development of the space elevator if potentially the government thought that this could pose a risk to humans. This could be done by the government ~~stop~~ stopping any funding they could be giving for ~~the~~ research and development.

The learner was awarded all the marks as the answer shows comprehensive knowledge and understanding of the articles, using short quotes to exemplify their answer. The learner has identified implications and drawn on all of them in the answer. The learner has drawn links between the implications, balancing some of the environmental and cost implications. The response has a well-developed structure and is logically presented and keeps to the point.

In the next response the learner scored Band 4, 10 marks.

The learner has drawn upon information from all of the articles and has considered implications relevant to the topic. The discussion is considered to be comprehensive in its use of information from the articles. There are some links to the economic, environmental, social implications, but these are not all well developed. The discussion has a well-developed clear structure.

Weaker learners quoted from the articles but did not draw links and treated each article one by one. In addition, weaker learners confused information regarding nanosatellites in article one with space tether development in articles two and three. Some learners had

The three articles need to be considered holistically in order to gain a mark in the highest band.

1 Discuss the implications of the scientific issues identified in the articles.

(12)

While nanotechnology is a fascinating and innovative new technology, the fact that it is new means that we don't know the long term effects of it. It could potentially be harmful to the environment if anything is disposed of incorrectly - animals could ingest it, the technology could pollute ~~water~~ rivers and lakes - we just don't know the long-term effects.

However, as ~~inferred~~ ^{inferred} from Article 3, solar panels could take advantage ^{of} ~~from~~ nanotechnology - making them smaller and ^{and possibly less expensive} lighter. This means that more things could be ~~be~~ powered by the energy collected from the sun, rather than relying on the dwindling supply of ~~for~~ fossil fuels that we use now. This would also mean that less CO₂ emissions (from burning those fuels) would enter the atmosphere, and hopefully even helping with the greenhouse effect and global warming.

Article 2 says that while every government would like to have their own space elevator, cost considerations will likely make that difficult in the near-term. Developing and manufacturing these space elevators will be a very expensive endeavour, so there needs to be a lot of funding supplied. Any companies or organisations giving ~~me~~ money to this project will most likely ~~also~~ be expecting something in return as well, so they need to take this into ~~account~~ ^{account} too.

On the other hand, also in Article 2, it says that the cost may not be an issue, ~~also~~ due to the fact that space elevators could be profitable to a number of companies, such as Google, ~~and~~ DARPA.

and Exxon. These companies pose their own implications for space elevators, however. One of the ~~the~~ things I could see Google using space elevators for would be imaging (for Google Maps, etc), but if this is possible, what is stopping others taking advantage of this and using space elevators for spying and espionage against ~~other~~ other countries?

There also could be concern with ~~DARPA~~ DARPA (agency of the US Department of Defense responsible for the development of emerging technologies for use by the military) using the space elevators - people could speculate as to if they are developing more ~~advanced~~ advanced weapons.

The implications of Exxon using space elevators could actually be positive. ^{Because} ~~Being that~~ they are a multinational oil ~~and~~ and gas corporation, ~~could mean~~ that they may start to look into the possibility of space ~~mining~~ mining and gathering resources from places other than Earth.

Space elevators could potentially improve our already existing communication devices ~~in~~, ~~then~~ for example boosting the internet connection or improving mobile and radio signals.

However, quite a few people think that the money being used to develop these space elevators could be better used elsewhere, such as donating to the poor, starving, or homeless, or even public services such as schools and colleges, the NHS or the police.

In this response the learner scored band 2, 4 marks.

(12)

The implications of nanotechnology as
no one actually knows the long term
issues as it hasn't been fully tested or
even made so they can't say for certain
that it will work. We don't know in the
long run how it will affect our environment.

~~It will be very expensive to put up~~

~~There are no less there~~

Yes the material has to be made put once
they have built it parts will need maintaining
so how will the faulty parts be replaced
as this could also have a big impact on
our environment. The tethers that hold this
elevator have to be released at the same
time to make it work so what happens
if they don't go off at the same time.

How will it effect the flight routes of
airplanes if it's so thin how will pilots
be able to identify that it's there.

The elevators can be scheduled to
take off on any day with any kind of
weather whereas rockets today can only
be scheduled for a clear sunny day the

elevator could send missions into space any day any time. This could really develop the way we research space and how we are able to do this. If it was to break down in use how long would people be stuck in the atmosphere it wouldn't be humanly right.

How will the elevator and its tethers affect the earth's orbit? There isn't any mention but it would be a huge factor to consider.

It could become a threat when wars break out and used as a target for terrorism or even enemies. How will cope under extreme weather conditions. Will it be strong enough to withstand earthquakes, really strong hurricanes, tornados. There isn't enough understanding of what the material is really capable of but it's only figures and drawings. There isn't any evidence to suggest it's going to work.

Going back to flight routes how will affect migration of birds a fish when the move during the seasons.

The learner has shown some limited knowledge and understanding and has made a number of generalised comments. There is an attempt to draw links to environmental and social implications, but these are not developed. There is some structure to the answer. Overall the answer has aspects of a band one response with some from band two. The lack of detail, the limited attempts at draw on the implications and the structure of the answer gave it a mark of 4.

The learner makes some comments that relate to the tether affecting the Earth's orbit. Such comments were ignored, as the paper does not test specific understanding of the underlying Physics, but such comments do indicate a lack of scientific literacy and use of the articles and other texts, as there are is no mention in the texts or in other reputable research material that this would be an issue.

Q2 Identify the different organisations/individuals mentioned in the articles and suggest how they may have an influence on the scientific issue (6 marks)

Learners were able to identify NASA and the ESA and the IAA as major influences on the development of nanotechnology in space exploration. In addition, individuals were identified that had made major contributions to the field. In many cases where there was an identification of an institution or individual, the contribution was not given in any detail. Learners wrote in general terms, such as 'making a big contribution' or 'a major influence' but not saying exactly how. It was evident from some learner answers that there had been a good deal of additional work done in the preparation time to research the background, and qualifications of some of the individuals mentioned. In the best examples the learners went on to use this information to show how they had influenced the issue, in others, there was no more than a biography of the person, with no link to the issue.

In this response the learner scored band 3, 6 marks.

(6)

~~the~~ NASA is a governmental organisation that specialises in space technology and exploration. It is mentioned in article 1 multiple times in reference to space elevators. As NASA is a government organisation, it can influence the scientific issue because it could change the outcome on how nanotechnology is used. In addition to this, although NASA focuses on the USA, it has an influence world-wide because it is a well-known and ~~reputable~~ reputable organisation. ~~In addition~~ Also, NASA is government funded, which would mean that they do not rely on fundraisers or the public money.

The IAA (International Academy of Astronautics) is mentioned in articles 2 and 3, and the author of article 3 is a member of the organisation. It is non-governmental, but has easily established an influence base in many countries because of it as they are not limited to be based in one country. This means ~~the~~ also means that they do not need to consult politicians before doing research, and can focus on more long term projects because they are not affected by change of governments. Although they are reputable and influential in terms of research, it is less likely that the IAA would be able to change the outcome of the issue because they

not involved with the government.

John Knapman is the author of Article 3 and is a member of the IAA. As he has a PhD in artificial intelligence and is a member of the Journal of British Interplanetary Society, he is likely to have an influence on the outcome of what nanotechnology can be used for because he's qualified and part of these study groups and societies - other scientists and researchers will be able to read his work, and build on it with research of their own, which could then lead to more efficient technology such as space elevators being built.

Colin McInnes, a professor of engineering science and a member of the Royal Society of Edinburgh is mentioned in article 1. Like John Knapman, McInnes is able to influence the issue by sharing his research with people at his university or presenting it at the Royal Society, which would enable people to build on it with their own research. In addition to this, as he is part of a university, his research is more likely to be read by students or online through social media.

The learner has demonstrated comprehensive knowledge and understanding of how some key organisations and individuals can influence the scientific issue and have then gone on to explain how these may have influenced the issue and linked it to the articles.

In each example in the answer, there is information regarding the role played by the institution or individual, be it in research and development, funding, or international cooperation. Weaker answers omitted these. It should be noted that learners are not expected to produce an exhaustive list and the parts played to gain a band three mark. The requirement is for the identification to show a comprehensive knowledge.

Some learners produced a list of individuals or organisations, without further comment. This restricted the mark available to band 1.

This response scored band 1, 1 mark.

Organisation such as ~~the~~ NASA, The International Space Agency, The European Space Agency and The International Academy of Astronautics, have been involved with this project and have used their ~~not~~ influence on many people which are interested such as undergraduate students and other scientists. He lead to more employment to gain as much help as possible ~~from~~ for all the scientific issues they have such as the rate of increase in materials, the power source used on the elevator and so on.

The learner has identified some organisations but has not given anything creditworthy in terms of the influence they would have. There is a basic explanation, but in very generalised terms.

Q3 Discuss whether article 3 has made valid judgements. (12 marks)

Learners were expected to focus on the final article to answer this question. The quality of the answer related to the learner's interpretation to the idea of validity. Many learners solely focused on the way the article was written and did not discuss how the article interpreted and analysed the scientific information to support the conclusions being made. There was for some learners a focus on the validity and reliability of the data and in referencing. Some learners' confused reliability and validity, and some offered a critique of the article in terms of the layout of graphs and charts.

This response scored band 4, 12marks.

The article generally lacks reliability because ~~it~~ there isn't a wide range of references ⁽¹⁰⁾ & almost half ⁽⁴⁾ are references to the own authors studies. This suggests the article may be biased*. However, J. Knapman is an international space elevator consortium, which suggests that the article may have some reliability because the author does have the correct knowledge & qualifications. The language used in the article also suggests biased, because it only talks about the positives of experiment instead of conflicting ^{arguments} ~~and~~. There is no quantitative data to back up the study, which also reduces the reliability of the ^{article} ~~data~~.

The remaining 6 references used are from people/organisations (IAA) which suggests the ^{study} ~~article~~ has some credibility if the organisations are saying the same thing.

The article was published 2016 which lowers the validity of the study is slightly out of date, & isn't in this time period. There are four references between 1975-2010 which also lowers the validity of the study because newer findings and technologies has

~~which is backed up by the positive language used in the article, doesn't say the potential problems~~

moved on since then, possible thing such as the ^{affects} ~~teng~~ of weather on the tether may have changed.

However, because of the use of qualitative data it shows the author has done the research through this specific field, gives reliability & validity to the judgments made.

The judgments made in the study isn't backed up by quantitative data which lowers the reliability. ~~the article~~ the supporting in the article, mainly comes from the authors own study and research which reduces the reliability & validity of judgments made. ^{there is vague proof of the} Due to the lack of ^{studies lack} quantitative data the study ^{is unsupported by graph, data} has a low repeatability ^{and figures} which reduces the validity further. However, because the source (IAA) is a well known organisation with a high reputation & influential, there is still some confidence in the study.

Due to very few statistics in the article lowers reliability, the evidence based on conclusion from a small data set should be considered unreliable.

The article section 3.1 suggests that the climber will be approx 20-tonne as well as 14 tonne payload. Whereas article 1, NASA states that the climber would weigh approx 2 - 5 kg carrying seven lots of payloads at one time. Which is conflicting evidence data. The authenticity of the article is mainly high because the information of all three articles say similar things about the study which gives the judgments made high reliability. However, because of the ^{lack of quantitative} ~~year it was written,~~ data and the lack of ~~and the few~~ references decent supporting evidence, the judgments made has low reliability, because ~~it is~~ Some judgments made has some reliability and validity because well known organisations are referenced, however some references are not ~~reliable~~ as such due to biased.

To conclude the article made some reliable & valid judgments because it came from a trusted source & is backed up by other articles (1, 2). However, the judgments lack reliability & validity because the era of the article and some of its references (1975-2010) the articles general feel is biased which also reduces validity & reliability.

The learner has focused on some of the scientific information in article three. The validity and reliability of the data has been considered, together with consideration of references. Towards the end of the answer the learner considers how the article has interpreted and analysed the scientific information presented. There is a well-developed structure to the answer that is able to be followed easily. The learner concludes the answer by summarising some of the evidence and using it to make a judgement on the validity and reliability of the article. It should be noted that not every aspect of the scientific information in the article needs to be considered to access the top band marks.

To support the conclusions/judgements being made ~~the~~ to the scientific information the article has ~~interpreted~~ interpreted and analysed ~~the scientific data~~ ^{some facts such} as ^{wiki} cost, the height and even some problems ~~with~~ the elevator but it was mostly pros compared to cons. The Article also has some reliable information from ~~a~~ other scientist and valid data.

The Article is more valid than it is reliable. This is because cause most of the information is from ~~the~~ the author him self this make the authors work ~~that~~ ~~that~~ one-sided and does not explore the down sides of the space elevator.

In this article there are not enough references to other sources of information. There are ~~10~~ ten references in the article four ~~being~~ ^{being} the authors. it is clear to say that the author is pushing the idea to become ~~a~~ reality.

23

Q4 Suggest any potential areas for further development and/or research of the scientific issues from the three articles. (5 marks)

Learners were expected to use all three articles to suggest further research or development of the ideas presented. Some learners considered widening the range of uses of materials for the development of SMART clothing or for further development of sensors. Other learners considered developments in tether design or means of powering the elevators.

Some learners drifted off the point and moved onto considering the reasons for or against developing space elevators.

This response scored band 3, 4 marks.

One of the main areas of further research needed is stated in article 3 which says that the material strength of the tethers needs to be developed further and the develop more materials to even further enhance the strength of the tether. This will be required to have high strength and a long length. The size of the capsule and launched items is due to change ~~due to~~ because of research showing the ~~of~~ suggested size would be too large and would too ~~slow~~ ~~slow~~. Whilst a smaller would create less weight and a faster climb speed. The material used needs to be made stronger that would be resistant to freezing temperatures and high winds, this is too increase the safety of the occupants. Most of

most of the statistics ~~a~~ shown are regarding during the construction and/or immediately after the construction of the space elevator. Therefore it doesn't regard maintenance or changes that might need to be done in the future. This is another area for research.

The learner has suggested some areas for further development and has gone some way to provide evidence from the articles to do this, but not used all the articles as required for full marks but has addressed issues in two of the three. The learner has used knowledge from some of the articles to support the ideas presented. There was just sufficient here to support a mark in band three.

This response scored band 1, 1 mark.

The idea is all very new and alot more research is needed before anything should be aloud to happen. more research needs to be done on the materials as ~~to~~ it is alot of money and if it breaks how are they going to fix it how are they going to insure that it's not going to have a faictal effect on many. Where are the techers going to be how is it going to effect the seas and the creatures living in them Lots of people may argue that it will invade their habitats. Once / if this is made able to happen the human population will want to know what it's all about and want to understand why and how this will help the Planet. Will ~~the~~ this be a benefit to all the countries in the world or will only the richer few benefit from all the incomes of the elevator.

This response does not address specific issues. There are some areas of further development identified, but these are vague and there is limited use of the articles. This is more of a general set of concerns about the space elevator project than a consideration of areas of development.

Q5 You are a research assistant for the UK Space agency. Write a report on the advantages and disadvantages of participating in an international project to build a space elevator. Your report will be sent to a UK House of Commons Committee who are not scientists.

The most able learners were able to take the scenario and use the information from the articles to produce a well-structured coherent document that addressed the brief of the question. Some learners were aware of the audience and wrote accordingly, selecting aspects such as economic advantage and disadvantage, social improvement, job creation, international co-operation, environmental and defence considerations, all of which would be concerns for the target audience. Some responses were limited to considering the design of the elevator in some detail, rather than the major advantages and disadvantages in terms of economic and social interest, national security and national prestige. Some learners looked at the appropriate information and considered the main advantages and disadvantages but presented the information in a way that was inappropriate to the target audience. A tabloid, spectacular scoop approach was not appropriate in the scenario given.

This response scored band 4, 15 marks.

The feasibility and probability of a space elevator

A space elevator is a structure designed to significantly reduce the cost of transporting objects into outer space. Once built the cost of transport will decrease from £14,000 per kilogram to only around £600. This reduction in cost will allow the UK to increase the amount of space research without increasing the funding required per year.

This cost reduction is only after the structure is built, the estimated total funding required for the structure is 600 billion pounds although this won't all be provided by the UK but other countries such as the USA and Japan. This is a major investment required over the time to build such a vast structure is certainly a factor that needs to be discussed once built the pay back time requires the structure to last about a decade even if the structure was used every day.

Using current technology the space elevator in its current design isn't possible as there are two major problems that should be overcome before starting the development process. The first major hurdle in developing a material strong enough to be able to support its self, the estimated tensile strength required is 50 GPa meaning that it would be a material stronger than currently being used in engineering. Although research is being done on a material called single crystal graphene that could theoretically have a maximum tensile strength of 1TPa, over 20 times the current requirement.

The other major engineering requirement is to have the material to be about 22,500 miles long, this means that not only does the material have to be strong it has to be able to be manufactured at such a major rate. This means the example of single crystal graphene although technically strong enough it cannot be long enough as connecting the crystals together is both time consuming and expensive. The current connecting process also significantly reduces the tensile strength of the material by about half.

If the structure was possibly built it would have to survive for such a long period of time without being damaged. There are approximately 600,000 pieces of space debris in low orbit space meaning that even a small piece could cause major damage to the structure mainly due to the speed that debris can travel, up to a speed of 17,500 mph, this has caused damage to conventional space rockets because they have been hit.

One of the major benefits of working as a part of the project is the ability to co-operate with a variety of different countries to achieve the same goal. The sheer size alone makes the space elevator the biggest science and engineering task ever attempted meaning that co-operation is key to the success of the manufacturing project and will allow the British astronaut program to develop under the guidance of major organisations such as NASA.

However, due to the vast amount of co-operation required to both fund and build the space elevator social and political problems will occur. One of the major problems is location of the structure, no country will be allowed to build it in any owned territory as political opposition won't want other countries to have main control, this means that it will have to be in the ocean. The current proposed location is around the Galapagos island due to its lack of earthquakes and hurricanes however that is very far away from the UK.

Another problem with the location is the disruption to the local ecology, parts would have to be transported by ships that use fossil fuels and contribute to the majority of CO₂ emissions as well as sulphur dioxide pollution. This transport to this remote undisturbed location will cause major problems for fish and other animals.

The high value of the space elevator will also cause disruption to planes as it would have to have the world's largest no-fly zone to stop the likely terrorism attacks.

*

Overall, the major advantages and disadvantages should be fully discussed; Is it ethically correct to heavily invest in a project that many believe will fail especially when problems such as poverty and obesity are still major problems in UK society today. Does the decrease in cost of transporting objects to space outweigh the large social and environmental problems caused.

*

The possibility of creating such a structure would increase public interest into science and engineering. This will increase the number of science, technology, engineering and mathematics ^{students} to increase resulting in a more educated UK and open up more opportunities for alternative research projects to tackle some of the other issues modern day is currently facing such as a rise in pollutants in the air, new sources of energy etc.

The learner has briefly identified what a space elevator is, which to a non-specialist audience is an important start.

The learner then goes on to consider cost, research and development opportunities, international co-operation, and environmental issues. There is a conclusion that suggests that the funding needed for this could be best spent elsewhere.

The learner has used the information in the articles and given advantages and disadvantages using material from the articles to support the report. The tone and presentation are fit for the purpose intended in the question and the answer has a well-developed structure and is logical.

This response scored band 3, 12 marks.

Space elevators are a relatively new idea that has come around, and while the benefits of developing one could possibly be immense, there are a lot of issues and problems with it too.

One of those problems is the amount of time it will take to manufacture a working space elevator. A new study says that a space elevator could be built by 2035, over 15 years from now.

Another issue is that of funding. Although major companies/organisations like Google, DARPA and Faxon are likely to provide some, the project will likely be relying on government funding, and a lot of it, due to the fact that the material for the tethers ~~the paper and well easy things~~ hasn't yet been developed at the ~~necess~~ necessary values for strength and flexibility yet.

The 'Marine Node' where the tether will be in contact with Earth will also need to be protected, and this is likely going to be by the armed forces of every government who are getting involved. This 'Marine Node' will also potentially be a new target for terrorism or war attacks as well.

An advantage of participating in this international project could potentially be improved relations with other countries, and the use ~~th~~ of the space elevator as well. Also, once one space elevator has been made and works

how it is meant to work, making others will be a lot faster and cheaper.

The uses of a space ~~to~~ elevator could include the possibility of space mining, and gathering materials and elements from ~~the~~ somewhere other than Earth, improved communication, as in internet connection and mobile/radio signals, an easier way to send ~~a~~ satellites into orbit, an easier way to send spacecraft into ~~the~~ space and ~~the~~ the potential for many more uses.

The manufacture and development of space elevators will make use of nanotechnology. This nanotechnology also has uses elsewhere, like making self-repairing spacesuits, or nanosats to ~~the~~ monitor a much larger area of the Earth's surface than our already existing 'Cluster' of four spacecraft used to measure the Earth's magnetic field and gauge its response to solar storms.

Nanotechnology can be used in a number of other things too, not just space, like making lighter and more efficient solar panels to cut down ~~the~~ on the use of fossil fuels, and other such things.

~~Be while there is~~

While there are numerous ~~the~~ advantages to participating in the international project to build a space elevator, there are also some disadvantages.

One such disadvantage would be that the funding going to this project wouldn't be going to another cause, ~~the~~ like funding the NHS, schools, or ~~the~~ public services, and the general public could protest this choice because of it.

The learner has considered advantages and disadvantages and has looked at the key aspects of cost, defence, environmental and social impacts. The learner does not identify all of these directly but does look at the issues in the answer. The learner has not formed a conclusion which would help advice the committee and

this limits the mark to band three, in addition some of the points made are not well supported from evidence in the articles.

This response scored band 2, 6 marks.

The European ~~for~~ Space Agency and NASA have all been researching the possibilities of using nanotechnology to built a Space Elevator. The idea of the ~~Elev~~ Elevator is save time and money researching space, and At the moment rockets can only be launched on a clear day where as the Space Elevator could ~~be~~ be launched ~~best~~ whatever the weather. It would be ~~to~~ tethered to the earth and would go up through the atmosphere. The tethers are designed to have a low mass but able to hold large weights. There are no clear details on ~~the~~ how the material will be made and tested.

The Elevator won't be run on fossil fuels that will pollute the atmosphere it will be ~~produce~~ run on solar power. The power should be supplied by solar panels rather than lasers as safety and technical considerations, climber ascends effective weight diminishes because of reduced gravity. Consequently the power needed higher up is reduced.

It could be tethered in the sea by a marine node. This could provide a ~~safe~~ tether terminus which could enable safe and routine operations. This could make stabilising, moving the tether easier also some where to unload cargo and local operation support.

The marine node is a city on multiple floating platforms. The main elements the floating operations platform where air craft can deliver items, can give a strong ~~tether~~ ~~terminus~~ a strong base to anchor the tether with stability. The marine node can have ~~a~~ somewhere for living quarters so workers can stay.

The elevator could however bring danger as it become a target during ~~times~~ potential wars or tensions for enemies. It could be a

threat as it could be targeted by terrorists.
so it would need alot of Security and
constantly be supervised by the will become
the most aggressively defended no-fly zones.
This could save alot of money if it
works making going into space alot cheaper
as it would make all equipment lighter and
cheaper. ~~There was~~ It would need alot of
funding and is a huge investment and if
it fails it billions of pounds lost. ~~3~~
This could benefit the whole world greatly
it just needs alot more research and
testing - we need to help the agencies
research this to help move it forward.

This answer is a description of the workings of the space elevator, and where it would be sited and the issues surrounding research and development of the materials to be used. To a large extent it does not answer the question set and are going to be irrelevant to the committee making a decision of supporting this. There are towards the end of the answer some points made about cost, and security and other relevant aspects. Overall these are some main points summarised with some advantages and disadvantages and some idea of the audience. Learners should look carefully at the scenario given and write an answer for that scenario. There were good points made in this answer, but not the question set.

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