



General Certificate of Education
Advanced Level Examination
June 2010

General Studies (Specification A)

GENA4/PM

Unit 4 A2 Science and Society

Case Study Source Material

For use with **Section A**

- The material consists of five sources (A, B, C, D and E) on the subject of **Transport and the environment**. These extracts are being given to you in advance of the Unit 4 examination to enable you to study the content and approach of each extract, and to consider issues which they raise, in preparation for the questions based on this material in Section A.
- A further Section A source (F) will be provided in the examination paper.
- Your teachers **are** permitted to discuss the material with you before the examination.
- You may write notes in this copy of the Source Material, but you will **not** be allowed to bring this copy, or any other notes you may have made, into the examination room. You will be provided with a clean copy of the Source Material at the start of the Unit 4 examination.
- You are not required to carry out any further study of the material than is necessary for you to gain an understanding of the detail that it contains and to consider the issues that are raised. It is suggested that three hours' detailed study is required for this purpose.
- In the examination room you are advised to spend approximately one hour and fifteen minutes reading a previously unseen extract and answering a range of Section A questions based on all the source material.

Case Study Source Material on Transport and the environment.

Source A

Figure 1: Climate change and energy

- Transport accounted for about 28% of the UK greenhouse gas emissions in 2005, almost the same as the domestic and industrial sectors on an end-user basis
- Carbon dioxide (CO₂) is the main greenhouse gas accounting for about 84% of the 'basket' of greenhouse gas emissions in 2005
- Road transport is one of the major producers of greenhouse gas (22% of the total UK CO₂ produced in 2005)
- In 2004, the Government set out its transport strategy in *The Future for Transport : a network for 2030* white paper. This made clear that while good transport is central to a prosperous economy, we must balance the increasing demand for travel against our goal of protecting the environment effectively and improving the quality of life for everyone.



The Budget of 2008 announced that the Government will take further steps to promote environmentally efficient business travel and the take up of cleaner cars through measures such as:

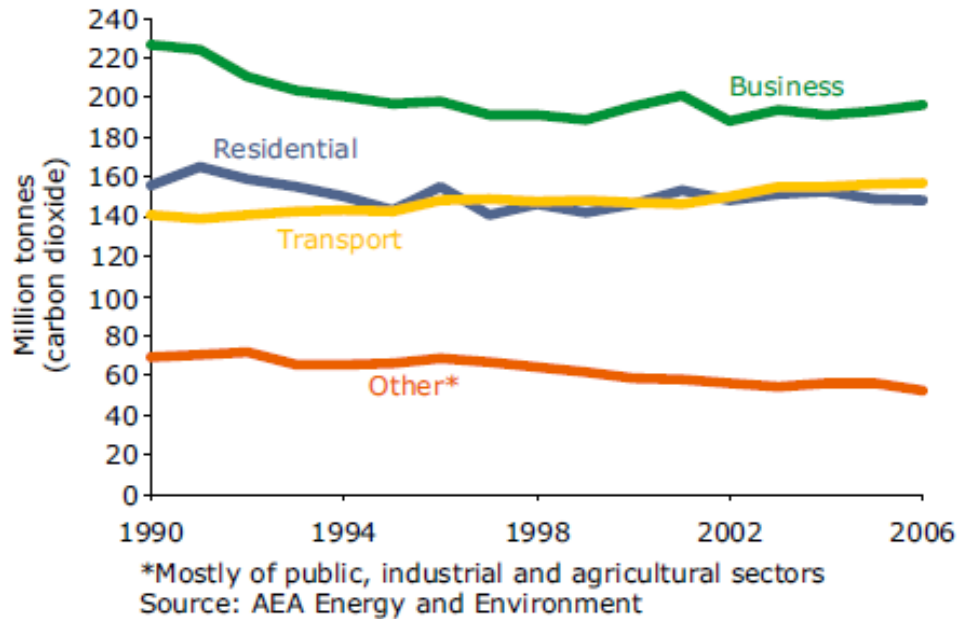
- increasing fuel duty by 2p per litre on 1 October 2008 and 1.84p per litre on 1 April 2009
- reforming the Vehicle Excise Duty with new charging bands based on CO₂ emissions
- increasing company car tax rates on all but the cleanest cars and introducing an emissions-based capital allowance treatment for business cars.

Source: Adapted from www.defra.gov.uk, Department for Environment, Food and Rural Affairs, 2008

Figure 2: Greenhouse gas emissions

Carbon dioxide emissions by end user, 1990 to 2006

United Kingdom



Between 1990 and 2006:

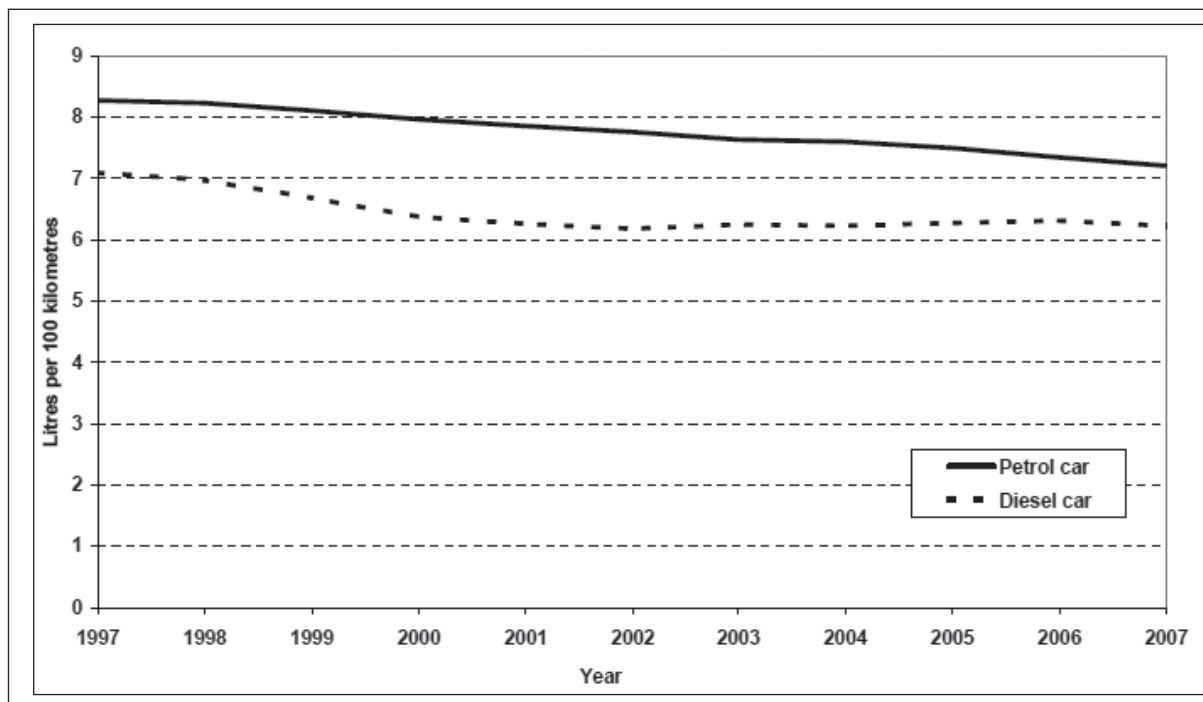
- total CO₂ emissions fell by 6%
- emissions attributable to business declined by 14%
- emissions attributable to residential users declined by 5%, but those attributable to transport rose by 12%.

Source: Adapted from *The environment in your pocket 2008*,
Department for Environment, Food and Rural Affairs, 2008

Figure 3a: UK Energy consumption by transport mode and fuel type: 1997–2007

	Million tonnes of oil equivalent/percentage										
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Road transport petroleum	41.26	41.02	41.40	41.07	41.10	41.94	41.82	42.22	42.39	42.51	42.81
Railways petroleum	0.58	0.61	0.63	0.64	0.66	0.66	0.67	0.70	0.71	0.73	0.70
Water transport petroleum	1.26	1.18	1.07	1.03	0.84	0.70	1.23	1.20	1.37	1.81	1.62
Aviation petroleum	9.32	10.24	11.02	11.98	11.77	11.66	11.94	12.91	13.86	14.00	13.97
All modes electricity	0.72	0.73	0.74	0.74	0.76	0.73	0.71	0.73	0.76	0.71	0.71
All energy used by transport	53.14	53.77	54.85	55.46	55.14	55.68	56.37	57.75	59.08	59.75	59.81
All energy used by final users	154.37	155.92	156.53	159.21	160.93	156.48	158.03	159.82	160.19	157.95	154.87
Energy used by transport as a percentage of all energy used by final users	34	34	35	35	34	36	36	36	37	38	39

Figure 3b: UK Average new car fuel consumption 1997–2007



Source: Adapted from *Transport Statistics GB: 2008 edition*, Department for Transport

Figure 4a: Road Traffic in Great Britain by type of vehicle 1949–2006 (selected years)

Year	Billion vehicle-kilometres						
	Cars and taxis	Motor cycles	Larger buses and coaches	Light vans	Goods vehicles ¹	All motor vehicles	Pedal cycles
1949	20.3	3.1	4.1	6.5	12.5	46.5	23.6
1959	62.2	9.8	4.0	13.7	14.6	104.2	13.6
1969	147.9	4.2	3.8	19.3	17.4	192.5	4.6
1979	201.5	6.4	3.3	25.1	19.6	255.9	4.6
1989	331.3	5.9	4.5	39.7	25.5	406.9	5.2
1999	377.4	4.5	5.3	51.6	28.1	467.0	4.1
2006	402.4	5.2	5.4	64.3	29.1	506.4	4.6

¹ over 3500 kg gross vehicle weight

Figure 4b: Forecasts of road traffic in England and vehicles in Great Britain: 2015 and 2025

	Base Year 2000 = 100	
	2015	2025
Vehicle kilometres: England:		
Cars and taxis	127	133
Goods vehicles	109	114
Light goods vehicles	152	188
Buses and coaches	105	105
All motor traffic (except two wheelers)	129	138
Car ownership: Great Britain:		
Cars per person	122	133
Number of cars	125	140

Source: Adapted from *Transport Statistics for Britain 2007*, Department for Transport, 2008

Turn over ►

Figure 5: Explosion in rail use ‘means growth of the network is urgent’

- The Association of Train Operating Companies (ATOC) has published a vision for the network in 2057 by which time, if the post-privatisation growth trend continues, the number of passengers will have more than trebled.
- Rail passengers clocked up 48.2 billion kilometres in 2007, the greatest distance travelled by train in peacetime and 16 billion more km than a decade ago.
- The annual passenger growth rate is running at 7.8%, with 1.2 billion journeys made in 2007.
- The only years when the railways were busier were during the Second World War, when millions of troops were moved around the country – and the network today is two-thirds the size it was in 1945.



- The association believes that the growth rate will decline slightly, but still forecasts that the network will be carrying 2.4 billion passengers by 2028.
- A forecast by the Office for National Statistics of an 18 million increase in the population during the next 50 years plus environmental constraints on expanding roads and airports mean that demand for rail travel would continue to grow even during an economic downturn.
- The Government published what it claimed was a 30-year rail strategy in July 2007 but the only commitments given were for modest expansion up to 2014.
- According to George Muir of ATOC: “People are increasingly turning to rail; not only is it a faster and more convenient way of travelling, it is greener than travelling on our congested roads and domestic air routes”.

Source: Adapted from BEN WEBSTER, ‘Explosion in rail use ‘means growth of network is urgent’, *The Times*, 11 April 2008

Figure 6: Cars or planes?



- In 2007, the number of passengers at UK airports rose to 315 million compared with 4 million in 1954.
- The number of passenger kilometres flown by UK airlines increased from 80 billion in 1985 to 287 billion in 2005. Around 97% of the 2005 total involved international travel.
- Driving a relatively fuel-efficient car generates fewer greenhouse gas emissions per passenger mile than flying.
- Environmental website Grist.org calculates that driving 300 miles in an average-sized car generates some 105 kg of CO₂. Flying the same distance on a commercial jet would produce 182 kg of CO₂ per passenger.
- Long-haul flights are more efficient than short-haul flights as a high proportion of the energy is required to climb to cruising altitude.
- In addition to CO₂, planes emit other gases that contribute to global warming. Some estimates suggest that this means their overall greenhouse gas emissions are some 2.7 times higher than their CO₂ footprint.

Source: Adapted from ROBIN McKIE, 'Could climate goals survive Heathrow's third runway?'
The Observer, 21 December 2008

Turn over ▶

Source B

Could climate goals survive Heathrow's third runway?

At first glance, British American Tobacco, Friends Provident, Pirelli and the Trades Union Congress seem unlikely allies, straddling a vast political divide. Yet they are connected – along with 100 other UK companies and organisations – over a single cause: the need for a third runway at Heathrow Airport.

The group recently published a statement urging that the government approve the £12 billion project which would see a 2200 metre runway as well as a sixth passenger terminal constructed on Heathrow's perimeter. "Heathrow is vital for business", the group claimed. "It offers the direct connections which make our companies globally successful and which will be all the more important as India and China grow."

The move allies British industry and trade unions with runway supporters that include the prime minister, the construction industry, engineers and aviation experts. All believe Heathrow's expansion is vital for Britain.

However, they are opposed by the entire green movement, more than 100 backbench MPs, cabinet ministers that include energy and climate change secretary Ed Miliband and environment secretary Hilary Benn and a great many scientists and analysts. They say the runway – which would see flights rise from 480 000 to 702 000 a year – would trigger a major expansion of the UK aviation industry and completely undermine Britain's commitment to reduce its greenhouse gas emissions by 80% by 2050.

Emissions from aircraft are our fastest-rising source of carbon dioxide and, by 2050, could account for almost all the nation's permitted carbon output. Cars, homes, factories and power plants would have to become carbon neutral just to accommodate the aviation industry's desire for unbridled expansion. A third runway is incompatible with the fight against climate change, the most pressing issue facing the nation, it is claimed.

But runway supporters claim that lighter materials, changes in aviation control procedures and more powerful jet engines will curtail fuel use and keep emissions in check. Aircraft will soon be carbon efficient and their increased use will be made acceptable. Thus technology will rescue the environment and keep British business in a competitive state.

But will it? The question goes right to the heart of the Heathrow debate. Can aircraft emissions be curtailed significantly over the next few decades and aviation continue to expand? Are our business leaders right to pin complete faith on the ability of innovative technologists to ensure aircraft no longer pollute the skies?

According to Professor William Banks, president of the Institute for Mechanical Engineers, "every take-off and landing slot at Heathrow is precious so planes wait, with their engines running, for long periods to get one. Enormous amounts of fuel are wasted because Heathrow is running at maximum capacity".

Runway supporters point to a new range of carbon-fibre reinforced plastics – very strong and light – which would permit major reductions in the miles per gallon of kerosene of an aircraft and, of course, in its carbon emissions. In addition, planes currently fly in to land on long, low trajectories that consume large amounts of fuel. If they plunged far more steeply, this would cut down on fuel use. A new generation of engines will have greatly improved power-to-weight ratios. Biofuels, if they can be adapted, will be far less damaging than kerosene.

Opponents remain sceptical. "There is no way you can decarbonise the aviation industry," according to Dr Sam Fankhauser, of London's Grantham Research Institute on Climate Change. "Runway supporters assume that all the improvements promised by the aviation industry, but which have yet to be developed and tested, will work as promised. At present, people decide to fly off on holiday if they can afford the cost. Soon they will have to work out if they can afford the carbon as well."

Source: Adapted from ROBIN McKIE, 'Could climate goals survive Heathrow's third runway?'
The Observer, 21 December 2008

Source C

£100 million road to electric motoring... police, post office and politicians step off the gas

A new generation of electric public service vehicles, including postal vans, police vehicles and ministerial limousines is to be introduced as part of a government initiative to speed up the introduction of low-emission technology on Britain's roads. Around £20 million will be available to provide electric and low-carbon vans to public sector organisations including Royal Mail, the Metropolitan police, the Environment Agency and the government Car and Despatch Agency as well as councils around the country.



Gordon Brown looks at the Tesla Roadster, an electric car, outside Downing Street. Photograph: Lewis Whyld/PA

The announcements are part of a £100m proposal by the government to develop the technology and infrastructure needed to make electric and low-carbon cars a practical reality. Motorists will also be able to test-drive demonstration models of the latest electric cars in locations around Britain from 2009. Each car will need to keep within a maximum emission of 50g CO₂/km. Drivers will be able to report back on their experiences as part of the consultation planned by the government.

In addition, around £30m will be used to develop research into electric vehicles. This includes work to make car designs more practical and affordable, as well as developments of more general technologies for vehicles that could deliver big carbon reductions in coming decades. Around 22% of the UK's carbon emissions come from road transport, with 13% of these from private cars.

According to the government's transport secretary, Geoff Hoon: "Electric cars and other low carbon vehicles, like plug-in hybrids, cut fuel costs and reduce harmful emissions. If we can inspire more people to use them, it will help us to make a positive impact on climate change."

Environmental campaigners are equally optimistic. Anita Goldsmith, of Greenpeace, said: "Electrifying our transport network is a vital step in the fight against climate change and will be key to reducing our dependence on foreign oil." Tony Bosworth of Friends of the Earth added: "To be truly green, electric cars should be run on electricity generated through renewable sources of energy. The UK has a pivotal role to play and it must stand firm against the self-interested lobbying of the car industry."

Goldsmith also called for free parking and cheaper road tax for people who go electric as well as a renewed focus on improving public transport. "While £100m sounds a lot it is the same amount as the government spends on widening a mile and a half of motorway. If ministers get this right then Britain's ailing car industry could become a trailblazer in this technology, creating thousands of jobs and exporting zero emission cars to developing countries."

Source: Adapted from: ALOK JHA, '£100m road to electric motoring...police, post office and politicians step off the gas' *The Guardian*, 28 October 2008

Source D**Are electric cars the answer to the growing environmental problems?**

Thanks to film-maker Chris Paine's provocative documentary *Who Killed the Electric Car?* it seems likely that there has been a buzz surrounding these vehicles and their potential to help us lead a much more environmentally-friendly lifestyle.

Back in the late 1990s, the electric car was all the rage. It was touted not only as an environmentally-friendly vehicle, but also as a better overall vehicle than the regular internal combustion engine vehicles that dominated (and still dominate) the roads.

The electric cars essentially worked by running on large batteries that motorists were able to recharge either at home or at a network of specialised recharging stations by simply plugging in the car to an electric socket. Really not that difficult.

Despite the considerable talk surrounding the electric car, it failed due to lack of support from the major car manufacturers and, using an intentional pun, the plug was pulled on the electric vehicle in the early 2000s.

However, thanks to recently-developed vehicles like the Tesla Roadster and the Audi-R-Zero concept car, it certainly seems that the electric car is on its way back.

Here's a list of pros and cons that I was able to pull together from various online resources:

Pros:**Electric cars**

- are zero-emission vehicles;
- provide a quieter ride when compared to more conventional vehicles;
- are much less expensive to maintain than cars powered by an internal combustion engine.

Cons:**Electric cars**

- have a limited driving distance between charges;
- even though the vehicle itself doesn't release any emissions, the electricity used to recharge the car typically comes from a pollution-producing power plant;
- there aren't many specialised charging stations so it has to be used almost exclusively as a commuting vehicle.

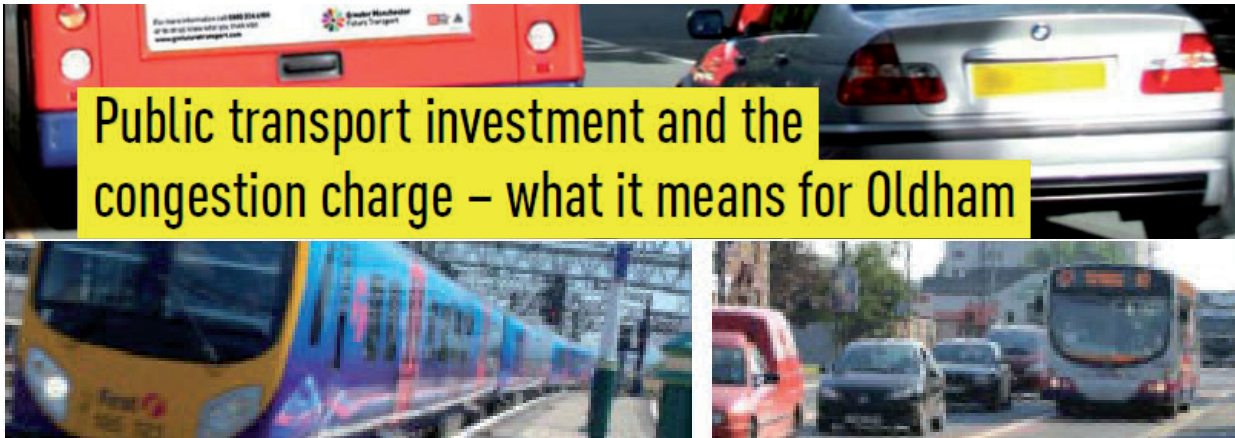
It seems to me that the most compelling argument against electric cars is that they appear merely to transfer the point of pollution. While the car itself is pollution free, pollution-producing power plants have to do work (recharging the cars) that they probably wouldn't do otherwise.

Source: Adapted from: BRIAN CARR, 'Are electric cars the answer to growing environmental problems?' www.dailyfueleconomytip.com, 30 March 2007

Source E



Have your say. Vote by 11 December



Manchester City Council which, along with nine other local councils that make up Greater Manchester, is about to conduct what many see as Britain's first referendum on green taxes. On 11 December 2008, the votes will be counted from a postal ballot in which the people of Manchester will decide on proposals to invest £3 billion on the area's public transport system. But the money from The Treasury comes at a price. To secure it, local people must vote for a £5-per-day congestion charge.

The vote has not just national but international implications. Ministers have warned that if Manchester votes "No" it will postpone plans to roll out congestion charging across the country for at least 10 years. The US President-elect, Barack Obama, is so intrigued by the precedent the scheme could set that he recently sent his transport advisors to the city to see if the scheme could work in the US.

On the face of it, Manchester is being offered a great deal. Vote "Yes" and a £1.5bn grant will come from the Government's Transport Innovation Fund (TIF) with controls on council spending being relaxed. The city's Metrolink tram/rail network and bus services will be trebled. "It's a very clear and stark choice," Manchester City Council leader, Sir Richard Leese, says. "If we vote 'Yes' we get the biggest public transport network ever outside London. If we vote 'No' we get nothing."

A tide has grown against the proposals. A 'No' coalition was developed with a cross-party alliance of seven local MPs and the leaders of three councils which oppose the plans. Some 250 businesses have lined up behind the 'Yes' campaign but a similar number back the 'No' vote.

Perhaps the most prominent opponent of the plan is the man who was leader of Manchester City Council before Richard Leese. Graham Stringer, Labour MP for Manchester Blackley, rejects the idea that this is a green referendum. "It has nothing to do with it being green – there are no concessions for hybrid vehicles or higher charges for SUVs," he says. "It's an income-raising scheme." Yet according to Chris Palmer, a spokesman for the 'Yes' campaign, "Manchester has the slowest peak-time commuting speeds in the UK".

There are further disagreements about the possible health improvements that might result from fewer accidents and cleaner air and also the suggested economic impact of the congestion charge. Leese predicts the creation of 10 000 new jobs while Stringer calls the charge "a tax on the poor".

One of the reasons that the debate is generating more heat than light is that not all the facts on financing are in the public domain. At a public meeting recently, just over 50% present said they would vote 'No', with 46.5% proposing to vote in favour. Just 3% were undecided. The decision, it seems, is still wide open but there is a sting in the tail. If the bid is to get the go-ahead, a majority 'Yes' vote must be achieved in at least 7 of the area's 10 local councils.

Source: Adapted from: PAUL VALLELY, 'Running out of road?', *The Independent*, 24 November 2008
 Graphics from information brochure published in 2008 by GMPTE on behalf of the Association of Greater Manchester Authorities and Greater Manchester Passenger Transport Authority

END OF SOURCES

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