2015 H1 Preliminary Examination II (Question 3)

a) Explain why the price mechanism fails to allocate resources efficiently in the free market. [10]
b) It is generally recognised that the emission of harmful gases by industries generates negative externalities.
Discuss the view that a policy of tradable permits is the best that is available to tackle this problem in an economy such as Singapore. [15]

a) Explain why the price mechanism fails to allocate resources efficiently in the free market. [10]

The free market fails to achieve allocative efficiency in the presence of externalities or in the case of public goods.

In the case of externalities, there are positive and negative externalities. Positive externalities refer to beneficial side effects of production or consumption on persons other than the consumers and the producers themselves and the third parties do not make payment to enjoy this external benefit. Negative externalities are harmful side effects of production or consumption on persons other than the consumers and the producers themselves and the third parties are not compensated for the external costs incurred.

Consider the situation whereby the production/consumption of a good/service gives rise to negative externalities, for example, in the course of producing goods in factories, smoke and harmful gases are emitted. These factories are only concerned with their private costs, which is the cost of raw materials that they incur from the production of goods but are not concerned with external costs like additional healthcare costs incurred by third parties.

As marginal social cost (MSC) is equals to the summation of marginal private cost (MPC) and marginal external cost (MEC), the presence of negative externalities (i.e. MEC > 0) implies that MSC is greater than MPC. Assuming there are no positive externalities, i.e. marginal social benefit (MSB) is equals to marginal private benefit (MPB), the market for this good could be represented in the diagram below.

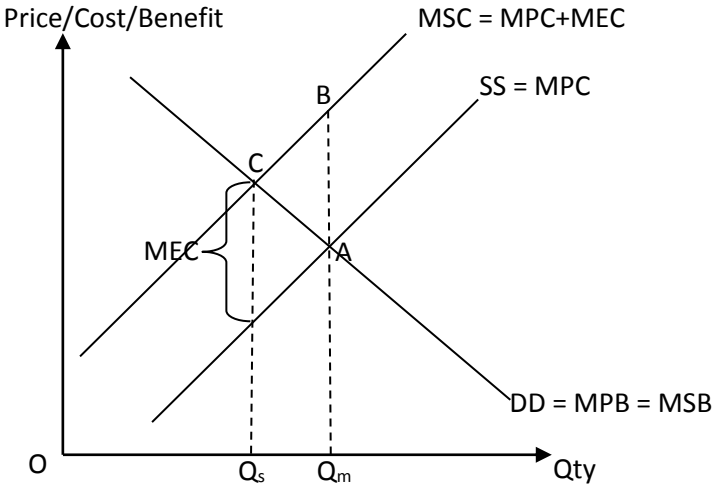

Figure 1: Over-consumption/production due to negative externalities

With reference to Figure 1, the production/consumption of the good occurs at Qm, where demand intersects supply or MPB=MPC if left to the free market. When producers/consumers decide how much to produce/consume, they do not take into account the external costs imposed on third parties (MEC). However, the socially optimal level of output is Qs, given by the intersection of MSB and MSC, since society's welfare is maximised when MSB=MSC. Since Qm > Qs, there is over-consumption/production of the good if left to the free market, which means that resources are not efficiently allocated as too much resources are being allocated to the production of the good. The welfare loss to society (i.e. deadweight loss) is shown by area ABC.

Another scenario whereby the free market fails to achieve allocative efficiency is the case of public goods. A public good is a good/service that has the characteristics of non-excludability and non-rivalry in consumption. Non-excludability means it is impossible or prohibitively expensive to exclude any non-payers from using the good/service. Non-rivalry means the consumption of the good by one does not diminish the amount available for consumption by others.

One example of a public good is national defence. It is non-excludable, since when the army protects the country, all the residents in the country enjoy the benefits of being protected. It is impossible to exclude anyone who does not pay for national defence from enjoying the safety in the country. It is also non-rival, since having one more resident in the country who enjoys the safety does not diminish the amount of safety enjoyed by other residents.

Due to the non-excludable nature of a public good, people who do not pay for the good also get to enjoy it. This gives rise to the problem of free-ridership, where no one is willing to pay for the good since non-payers can also consume the good. And since no profit-seeking producer will be willing to produce a good that nobody is willing to pay for, the free market will not produce the good, though consumers want the good.

On the other hand, due to the non-rival nature of a public good, the marginal cost of serving an additional user is zero. With zero marginal cost, the principle of optimal resource allocation calls for provision of public goods to anyone who wants them at no charge. Any non-zero price would discourage some users from consuming the good, thereby causing a reduction in society's total welfare.

As seen above, the price mechanism totally failed to allocate resources in the case of public goods due to its characteristics.

Knowledge, Application, Understanding and Analysis		
L3	Developed explanation of why the price mechanism fails to allocate resources efficiently in the free market in the presence of externalities and in the case of public goods.	8 – 10
L2	Undeveloped explanation of why the price mechanism fails to allocate resources efficiently in the free market in the presence of externalities and in the case of public goods.	4 – 7
L1	Smattering of valid points	1 – 3

b) It is generally recognised that the emission of harmful gases by industries generates negative externalities.
Discuss the view that a policy of tradable permits is the best that is available to tackle this problem in an economy such as Singapore. [15]

As mentioned in part a, the existence of negative externalities (or external costs) generated by industries causes the divergence between social costs and private costs, since social costs is the sum of private costs and external costs. As the market level of output is more than the socially optimum level of output, resources are not efficiently allocated and this explains the need for government intervention.

A range of policy tools are available to correct this market failure, including tradable permits, indirect taxes, legislations, etc, each having its advantages and limitations. Whether a policy of tradable permits is the best to tackle negative externalities generated by industries in an economy such as Singapore depends on its advantages and disadvantages compared with other policies and the characteristics of Singapore.

One policy that can be used to correct the market failure resulting from pollution generated in the process of industrial production is tradable permits. The government can set a cap on the total amount of a pollutant that can be emitted by all firms by considering the level of output to produce, for example at where Qs is in Figure 1 so that the socially optimum level of output is achieved. This limit on pollutants is then allocated to the firms in the form of emissions permits. Firms are allowed to trade their emission permits. Firms that need to increase their emission permits (due to high emission volumes) must buy permits from those who require fewer permits. A firm will sell a permit if the price of the permit is more than the private cost involved in reducing the firm's emission volume. On the other hand, a firm will buy a permit if the price of the permit is less than the private cost involved in reducing the firm's emission volume. As a result, firms that end up selling their tradable permits (and reducing emissions) are those that can cut emissions most cheaply. In other words, tradable permits would encourage pollution reduction at the lowest cost to society, which is the greatest advantage of tradable permits. In Singapore's context, this scheme can be applied to the oil refineries and factories in the industrial hubs.

However, the scheme has its limitations. First of all, it is usually difficult for the government to determine the optimal cap on total pollution, or the 'correct' number of permits to be issued as government do not know exactly where the socially optimum level of output is. Too much or too little would not bring about allocative efficiency. In the case of under issuance, the permits could become overpriced, which will unnecessarily undermine the cost competitiveness of the industry. Also, volatility in permit price may discourage investment in green technology, as firms cannot know for certain whether or not the future payoff from the sale of permits justifies the adoption of emissions-reducing technologies. Furthermore, high costs could be incurred in administering and enforcing the scheme.

As mentioned earlier, besides using tradable permits, indirect taxation could also be implemented to internalize the external costs of production caused by industries. Indirect taxes increase the costs of production of firms, thereby making it more expensive for them to produce the same amount of goods than before. When the amount of tax imposed is equal to MEC at the socially optimum level of output, MPC increases (shifts upwards) to coincide with MSC as shown in Figure 1. This moves Qm to Qs, i.e. over-production is corrected and social optimum restored. When this is achieved, we say that the external cost is being internalized and the firm is effectively paying for the use of clean air. Because of the pigovian tax, the firm now faces MPC that is the same as MSC. One advantage of imposing indirect tax is that the tax revenue collected could be used to pay for the external damages from the production of this good. In addition, the tax might serve as an impetus for firms to use pollution-reducing devices and to conduct R&D on more environmentally-friendly production methods.

However, indirect taxation is not without its shortcomings. First of all, administrative cost is incurred in collecting the taxes. Despite the government's efforts in setting the correct tax amount, the true MEC is hard to estimate. Any under- or over-estimation of MEC would still result in allocative inefficiency. This is especially so given that pollution is hard to detect/quantify. In reality, different firms produce different levels of pollution too, which means that it would be very difficult and costly to charge each offending firm its own particular tax rate.

Another policy which the government can implement to tackle negative externalities generated by industries is to pass a legislation to curb/reduce activities that give rise to external costs. For example, the government can legislate the maximum level of pollution that a factory can emit. Potential polluters can also be forced to comply with proper disposal of wastes. All these will help to reduce the MEC inflicted on third parties. If the pollution is very serious, then an extreme form of legislation will be the banning of the product. A ban is likely to be imposed in the case where MSC is higher than MSB for all output levels.

Legislation has its shortcomings too. The cost of intervention can be high because of the administration costs incurred in monitoring and enforcing compliance with the legislation. In addition, legislation does not provide incentives for firms to further reduce their external costs. For example, if a firm is required by law to reduce pollution to a certain level, there would be no incentive for the firm to reduce it below the stated level. Unlike cap-and-trade, this method does not allow reduction in pollution to be achieved at minimum cost since different firms might have different costs of reducing the same amount of pollution. Thus to design good rules and legislation, government regulators need to know the details about the specific industries and the alternative technologies that these industries could adopt, but this is difficult to do in practice. Whilst market outcome in the presence of negative externalities results in welfare loss, banning a product that gives rise to external costs and not producing the product at all may lead to even greater welfare loss and thus, thorough consideration has to be put in place before a ban is implemented.

Taking into account of the advantages and disadvantages of each policy above, imposing indirect taxation might be a better policy than tradable permits to tackle the emissions of harmful gases by industries in Singapore, given the efficient tax system that is already in place.

Knowledge, Application, Understanding and Analysis		
L3	Developed explanation on how tradable permits tackle the problem of emission of harmful gases by industries and its limitations AND developed explanation of another 2 policies to tackle this problem.	9 – 11
L2	Developed explanation on how tradable permits tackle the problem of emission of harmful gases by industries and its limitations AND undeveloped explanation of another 2 policies to tackle this problem. Undeveloped explanation on how tradable permits tackle the problem of emission of harmful gases by industries and its limitations AND developed explanation of another 2 policies to tackle this problem.	5 - 8
L1	Smattering of valid points	1 – 4

Evaluation		
E2	An evaluative assessment of the best policy, taking into account of the characteristics of Singapore.	3 – 4
E1	Unexplained judgement, or one that is not supported by economic analysis.	1 – 2