



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

StemUp Model Solution

Forename(s)

Candidate signature

I declare this is my own work.

AS ECONOMICS

Paper 1 The Operation of Markets and Market Failure

Monday 15 May 2023

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- the Insert
- a calculator.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section A**.
- Answer **either** Context 1 **or** Context 2 in **Section B**.
- You will need to refer to the Insert provided to answer **Section B**.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- No deductions will be made for wrong answers.

For Examiner's Use	
Section	Mark
A	
B	
TOTAL	



J U N 2 3 7 1 3 5 1 0 1

Section A

Answer **all** questions in this section.Only **one** answer per question is allowed.

For each question completely fill in the circle alongside the appropriate answer.

CORRECT METHOD



WRONG METHODS



If you want to change your answer you must cross out your original answer as shown.

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown.

0 1

Which one of the following gives rise to opportunity cost?

[1 mark]**A** Alternative uses for resources**B** Market failures for many goods**C** The methodology of positive economics**D** The presence of externalities**0 2**

A bakery decides to increase the price of the bread that it sells.

Which one of the following price elasticities of demand for bread will result in the largest increase in the bakery's total revenue?

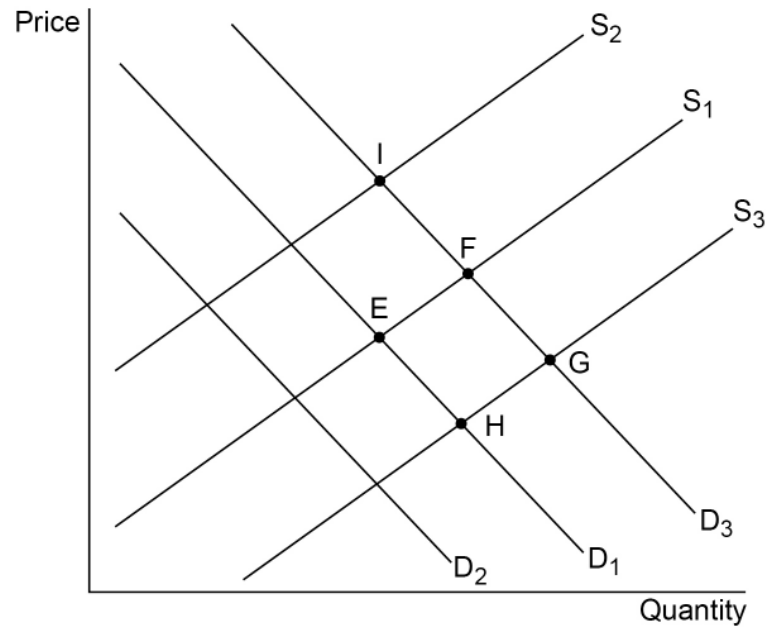
[1 mark]**A** -0.4 **B** -0.8 **C** -1.0 **D** -2.0 

0 3

Figure 1 shows the demand (**D**) and supply (**S**) curves for scooters.

Market equilibrium is initially at **E**, the intersection of **D₁** and **S₁**.

Figure 1



The government announces a cut in the indirect tax on scooters and an increase in the indirect tax on bicycles, a substitute for scooters.

Which one of the following is most likely to be the new equilibrium in the market for scooters?

[1 mark]

A F

☐

B G

☒

C H

☐

D I

☐

Turn over ►



0 4

A soap manufacturer experiences a fall in long-run average costs. This is most likely to be the result of

[1 mark]

- A** fewer external economies of scale.
- B** lower labour productivity.
- C** opportunities for internal economies of scale.
- D** total costs increasing by more than output.

☐☐☒☐**0 5**

A government decides that visitor centres in nature reserves are merit goods and therefore increases their provision.

It can be concluded that this decision

[1 mark]

- A** avoided government failure.
- B** did not have an opportunity cost.
- C** ensured provision of a public good.
- D** involved a normative judgement.

☐☐☐☒**0 6**

The median income is higher in country W than in country Z.

It can be concluded that

[1 mark]

- A** incomes are more equitably distributed in country W than in country Z.
- B** incomes are more unequally distributed in country Z than in country W.
- C** the mean income may be higher or lower in country Z compared with country W.
- D** the ratio of the highest to lowest income is greater in country W than in country Z.

☐☐☒☐

0 7

Which one of the following is a source of monopoly power?

[1 mark]

A A firm's objective of maximising profits

☐

B Advertising to establish a brand

☒

C High cross elasticity of demand

☐

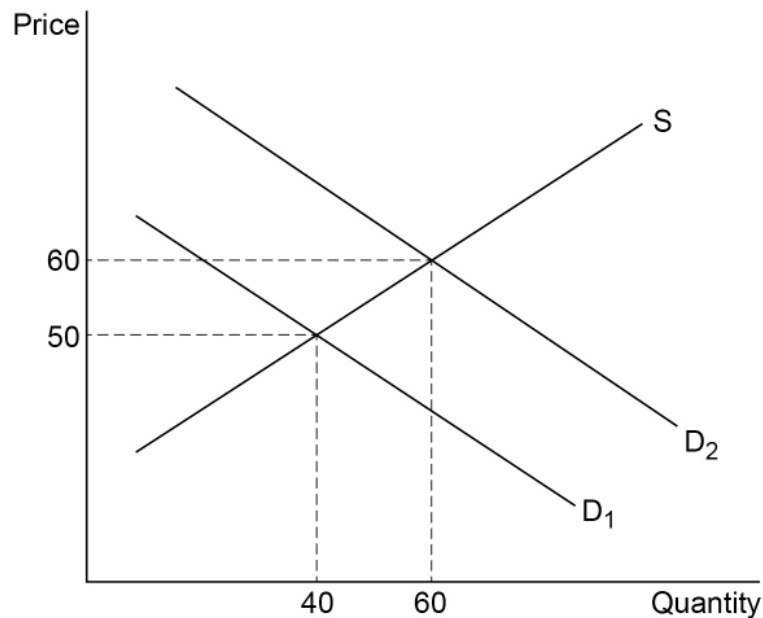
D High prices and low output

☐

0 8

Figure 2 shows the demand (**D**) and supply (**S**) curves for diamonds. An increase in demand shifts the demand curve from **D₁** to **D₂**.

Figure 2



Using **Figure 2**, which one of the following is the price elasticity of supply for diamonds?

[1 mark]

A 0.4

☐

B 0.5

☐

C 2.0

☐

D 2.5

☒

Turn over ►



0 9

One week, a business has to pay £80 interest for its loan, £95 for raw materials and £210 on rent. If the business has no other costs, what are its fixed costs for that week?

[1 mark]**A** £210☐**B** £290☒**C** £305☐**D** £385☐**1 0**

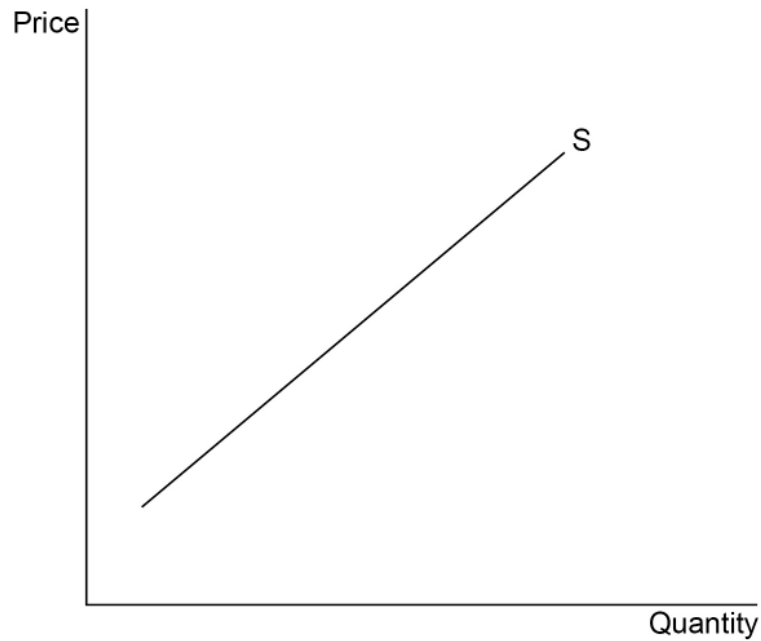
A good is in joint demand when it is

[1 mark]**A** an alternative to buying another good.☐**B** consumed by more than one person.☐**C** consumed together with another good.☒**D** demanded for two or more distinct uses.☐

1 1

Figure 3 shows a supply curve (**S**) for an industry.

Figure 3



All other things being equal, which one of the following causes the upward slope of the supply curve?

[1 mark]

- A** An increase in monopoly power at higher levels of output
- B** Firms achieving economies of scale as output increases
- C** Higher prices causing firms to improve productive efficiency
- D** Higher profits providing an incentive to increase output

☐
☐
☐
☒

Turn over for the next question

Turn over ►



1 2**Table 1** shows the market shares of supermarkets in an economy in 2020.**Table 1**

Company	% share of market
Fresh Co	35
Food Co	28
Value Co	16
Other companies	21

In 2021, **Value Co** fails to make any profits and decides to leave the market.

The most likely result is that the

[1 mark]

- A** market becomes more competitive.
- B** monopoly power of Fresh Co increases.
- C** other companies' market share rises to 37%.
- D** two-firm concentration ratio becomes 63%.

☐☒☐☐**1 3**

Hedges around fields encourage wildlife and bring widespread benefits but many farmers choose to have wire fences instead.

Which one of the following best describes the resulting failure in the market for hedges?

[1 mark]

- A** The social optimum output is greater than the free market output because the private benefit is greater than the social benefit.
- B** The social optimum output is greater than the free market output because the private benefit is less than the social benefit.
- C** The social optimum output is less than the free market output because the private benefit is greater than the social benefit.
- D** The social optimum output is less than the free market output because the private benefit is less than the social benefit.

☐☒☐☐

1 4

Which one of the following is the most likely outcome of greater division of labour in a tractor factory?

[1 mark]

- A** A reduction in labour costs
- B** Higher job satisfaction
- C** Less use of machinery
- D** More skills acquired by workers

☒☐☐☐**1 5**

A government sets a maximum price for fruit below the market price to try to encourage healthier eating.

All other things being equal, which one of the following will result in the lowest amount of excess demand for fruit at the maximum price?

[1 mark]

- A** Demand is income elastic and supply is price elastic.
- B** Demand is income inelastic and supply is price inelastic.
- C** Demand is price elastic and supply is price elastic.
- D** Demand is price inelastic and supply is price inelastic.

☐☐☐☒**1 6**

Healthcare in the UK is provided by the public sector and by private firms. Public sector provision ensures that healthcare is free at the point of consumption for individuals without private health insurance and for those unable to pay for healthcare.

Which one of the following can be concluded about healthcare in the UK?

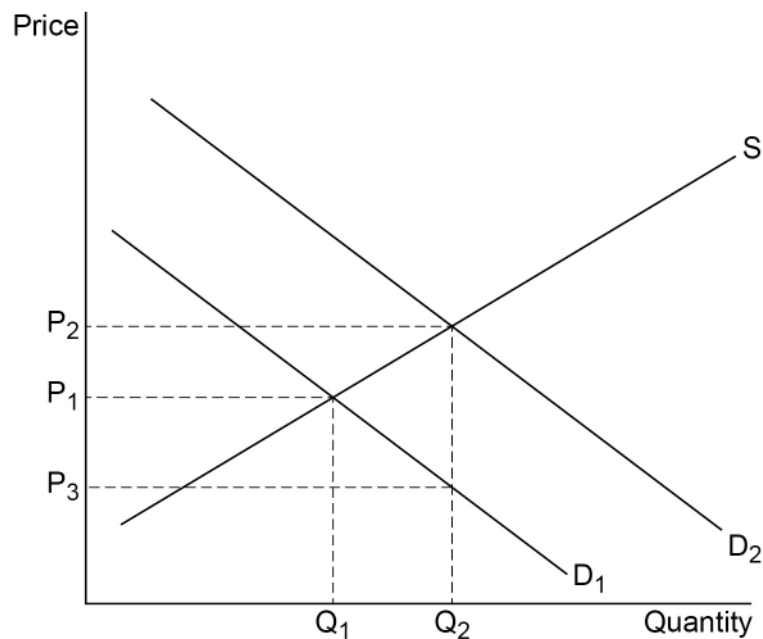
[1 mark]

- A** Healthcare has the characteristics of a private and public good.
- B** Production of healthcare addresses the basic economic questions of 'how' and 'for whom'.
- C** Provision of healthcare is equitable.
- D** The supply of healthcare achieves productive efficiency.

☐☒☐☐**Turn over ►**

1 7

Figure 4 shows the free market demand (D_1) and supply (S) curves for a merit good. D_2 is the demand curve if all the benefits from consuming the good are taken into account.

Figure 4

Which one of the following government policies would be most likely to achieve the socially optimal level of consumption?

[1 mark]

- A** A maximum price of P_3
- B** A minimum price of P_2
- C** A subsidy of P_1 minus P_3 per unit
- D** A subsidy of P_2 minus P_3 per unit

☐☐☐☒

1 8

The income elasticity of demand for cheese sandwiches is -1.2 .

This means that cheese sandwiches

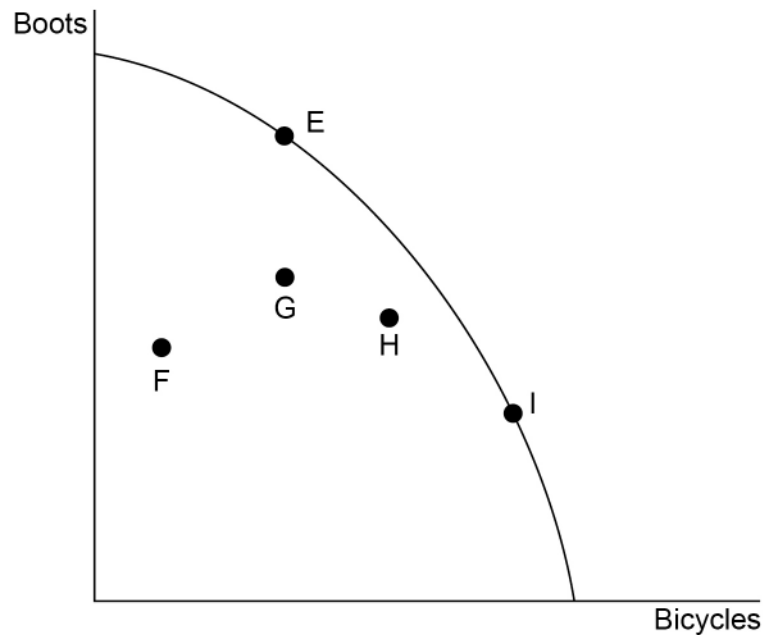
[1 mark]

- A** are a normal good.
- B** are an inferior good.
- C** have an income inelastic demand.
- D** have many substitutes.

☐☒☐☐

1 9

Figure 5 shows the production possibility curve for an economy producing boots and bicycles. The initial combination of boots and bicycles produced is shown by point **E**.

Figure 5

A change in consumer preferences causes the boot industry to contract and the bicycle industry to expand.

If labour is not fully mobile between the two industries, then the new combination of boots and bicycles produced is most likely to be at

[1 mark]**A** point F.☐**B** point G.☐**C** point H.☒**D** point I.☐**2 0**

Which one of the following characteristics of firms can be used to distinguish between market structures?

[1 mark]**A** Firms' productivity and total costs☐**B** The amount that firms choose to produce☐**C** The extent to which firms differentiate their products☒**D** The type of technology used by firms☐**20****END OF SECTION A****Turn over ►**

Section B

Look at the Insert and choose to answer **EITHER** Context 1 **OR** Context 2.

Answer **EITHER** Questions 21 to 26 in the spaces below

OR

Questions 27 to 32 on pages 23 to 32 of this answer booklet.

There is a total of 50 marks for either context.

Shade the circle below to indicate which context you have answered.

Context **0 1** ☐

Context **0 2** ☐

CORRECT METHOD ☒

WRONG METHODS

**EITHER****Context 1**

Total for this context: 50 marks

OIL

Use the Insert provided to study **Questions 21 to 26** and **Extracts A, B and C**, and then answer the questions in the spaces which follow.

2 1 Define 'price elasticity of demand' **Extract B** (lines 5–6).

[3 marks]

Price elasticity of demand is a measure of the responsiveness of the quantity demanded of a good to a change in its own price, ceteris paribus. It is calculated as the percentage change in quantity demanded divided by the percentage change in price. Oil demand is fairly inelastic, so its PED lies between 0 and -1.



2 2

Extract B (lines 4–5) states: ‘the average monthly price of Brent crude (one of two key oil prices) has varied from \$116.52 in February 2013 to \$23.34 in April 2020’.

Calculate the oil price index for April 2020, if February 2013 is taken to be the starting point (base year) of the oil price index. Give your answer to the **nearest whole number**.

[4 marks]

$$\text{Price index} = (\text{price in given period} \div \text{price in base period}) \times 100$$

$$\text{Feb 2013 (base)} = 100$$

$$\text{April 2020 index} = (\$23.34 \div \$116.52) \times 100$$

$$= 0.20031 \times 100 = 20.03$$

$$\text{Oil price index for April 2020} = 20 \text{ (to the nearest whole number)}$$

Turn over for the next question

Turn over ►



2 3

Use **Extract A (i)** to identify **two** significant features of the price of Brent crude oil over the period shown.

[4 marks]

Feature 1 *The price of Brent crude was lower at the end of the period than the start: it was highest in 2013 at about \$109 per barrel and lowest in 2020 at about \$42 per barrel, a fall of about \$67 per barrel (about 61%).*

Extra space

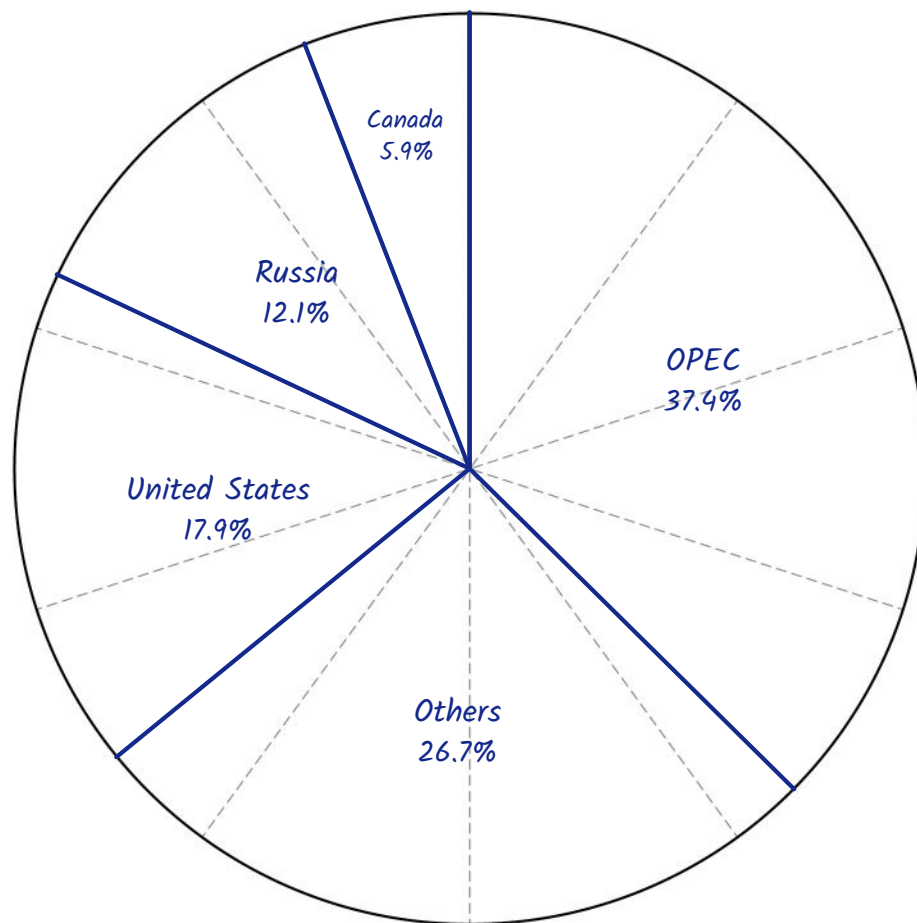
Feature 2 *The only rise in price was between 2016 and 2018, when the price increased from about \$44 per barrel to about \$71 per barrel, a rise of about \$27 per barrel (about 61%). In every other year the price fell.*

Extra space



2 4

Use the data in **Extract A (ii)** to complete the pie chart to show the market shares of each of the following oil producers in 2019: Canada, OPEC, Russia, the United States and Others.

[4 marks]

As a guide, each sector of the pie chart above represents 10% of the total market share. Use of a protractor is not required.

Turn over for the next question

Turn over ►



2 5

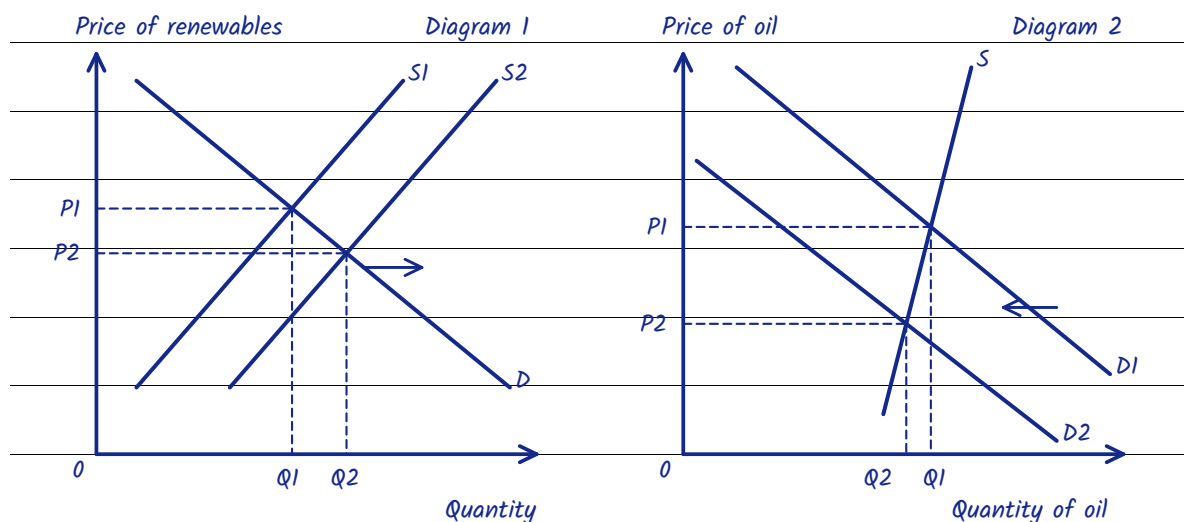
Extract C (lines 13–14) states: ‘Concerns about the impact of oil on the environment have led to the encouragement of renewable energy, such as solar, wind and tidal power’.

Explain how the development of renewable sources of energy is likely to affect the market for oil.

[10 marks]

The market for oil is where buyers and sellers of oil interact to determine its price and the quantity traded. Renewable energy, such as solar, wind and tidal power, is a substitute for oil in some uses, especially generating electricity and, through electric cars, transport, so the cross elasticity of demand between them is positive.

Subsidies and technical progress have cut the cost of renewable energy. In diagram 1 this shifts the supply of renewables to the right from S_1 to S_2 ,



so their price falls from P_1 to P_2 and the quantity rises from Q_1 to Q_2 .

Renewables become more competitive and in 2019 their share of global electricity production rose to 10.4%.

Because renewables are a substitute, a fall in their relative price reduces the demand for oil, shifting it to the left from D_1 to D_2 in diagram 2. The price of oil falls from P_1 to P_2 and the quantity traded falls from Q_1 to Q_2 .

Extract B states that the supply of oil is inelastic, so the fall in demand causes a large fall in price but only a small fall in quantity, as producers



Extra space *cannot easily cut output. Lower prices reduce the revenue and profits of oil companies and oil-exporting countries and, as Extract C notes, lead to the postponement of exploration projects, reducing supply in the long run.*

The size of the effect depends on the use of oil. In electricity generation the cross elasticity of demand with renewables is relatively high, so demand for oil falls significantly. However, some uses, such as fuel for planes, fertiliser and plastics, still lack viable substitutes, so the cross elasticity is close to zero and these markets are barely affected. Demand for oil is also price and income inelastic, and rising incomes in industrialising countries keep increasing demand, so the fall in demand may be gradual.

There is also a feedback effect: when the price of oil falls, renewables become less competitive again (Extract C), which slows the switch away from oil. In the long run, however, as renewables and electric cars become cheaper, demand for oil is likely to become more price elastic, because consumers have closer substitutes, and the market for oil is likely to shrink.

Turn over ►



2 6

Extract C (lines 20–21) states: ‘Unstable prices, monopoly power, environmental concerns and a vital resource – should governments intervene more in the oil industry?’

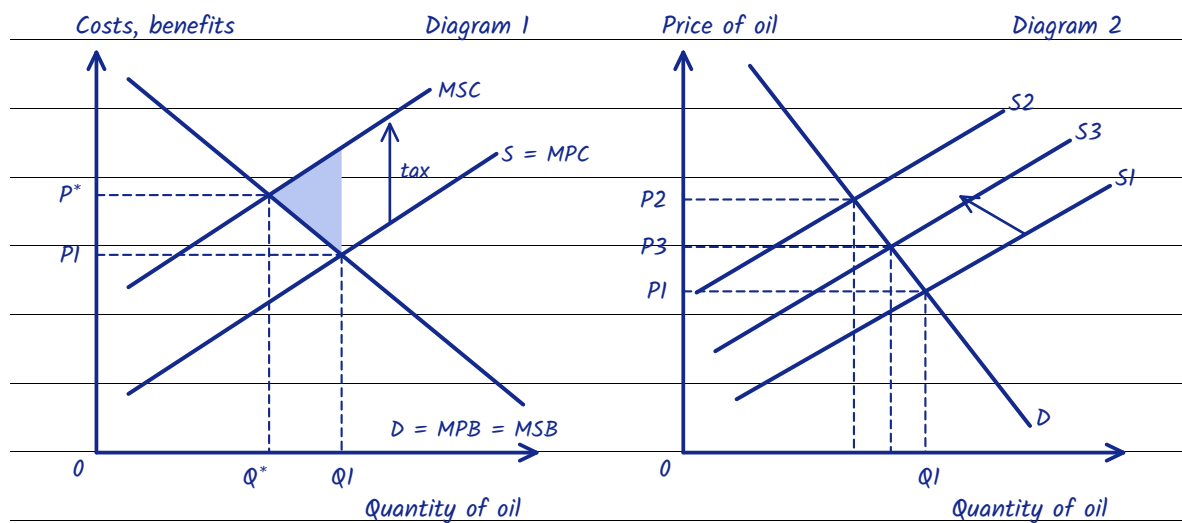
Use the extracts and your knowledge of economics to evaluate ways in which governments could deal with the market failures in the oil industry.

[25 marks]

Market failure occurs when the price mechanism allocates scarce resources inefficiently, so that economic welfare is not maximised. Extract C identifies several failures in the oil industry. First, burning oil creates negative externalities: it pollutes air, water and soil and is a major contributor to greenhouse gas emissions and global warming. These external costs are not paid by producers or consumers, so oil is overproduced and overconsumed. Second, OPEC, with about 40% of production and 80% of viable reserves (37.4% market share in 2019), has monopoly power and has cut production, for example in April 2020, to raise prices. Third, prices are unstable: annual average prices fell from about \$109 per barrel in 2013 to \$44 in 2016, rose to \$71 in 2018 and fell to \$42 in 2020, while the monthly price varied from \$116.52 to \$23.34. This happens because demand and supply are both price inelastic, so shifts cause large price changes. Finally, oil is a finite resource and markets may not invest enough in substitutes.

Taxation: the government could place an indirect tax on oil and oil products equal to the marginal external cost. In diagram 1, the free market produces Q_1 where $MPB = MPC$, but the socially optimal output is Q^* , where $MSB = MSC$, so the shaded triangle is the welfare loss. A tax shifts MPC up to MSC , internalising the externality: price rises to P^* and output falls to Q^* , removing the welfare loss. The tax revenue can be used to fund renewables or compensate poorer households. However, demand for oil is price inelastic (Extract B), so a tax may cause only a small fall in quantity in the short run, and it is hard to value the external cost of pollution accurately, so the





tax may be set too high or too low, causing government failure. Fuel taxes are also regressive and raise firms' costs, harming competitiveness.

Nevertheless, demand is more elastic in the long run, as people switch to electric cars, so the tax becomes more effective over time.

Regulation: governments can set emission limits, fuel efficiency standards or ban the sale of new petrol and diesel cars, or use tradable pollution permits to cap total emissions. Regulation gives more certainty about the quantity of pollution than a tax and is useful where damage is severe. However, it needs costly monitoring and enforcement, gives no incentive to cut pollution below the limit, and regulators may lack the information to set the right standard.

Subsidising alternatives: subsidies for solar, wind and tidal power and electric cars lower the price of substitutes, reducing the demand for oil. Technical progress has already cut the cost of renewables, and their share of electricity reached 10.4% in 2019. Subsidies are popular and do not raise prices for consumers, but they have an opportunity cost, as the money could be spent on healthcare or education, and Extract C shows that when oil prices fell, renewables became less competitive again, so large subsidies may be needed. Some uses of oil, such as aviation and plastics, still lack viable

Turn over ►



Extra space *substitutes, so subsidies cannot solve the whole problem.*

Monopoly power and unstable prices: OPEC is made up of sovereign governments, so national competition authorities cannot break it up or fine it. Oil-importing countries could instead reduce their dependence on OPEC by encouraging production elsewhere, for example the United States already has 17.9% of the market, and by reducing demand for oil. To deal with unstable prices, governments can hold strategic reserves. In diagram 2, a supply disruption shifts supply from S_1 to S_2 and the price rises from P_1 to P_2 ; releasing reserves shifts supply to S_3 , so the price only rises to P_3 . Buying oil when prices are low and selling when they are high stabilises the price, which benefits both consumers and producers, as Extract C notes that oil prices need to be stable to encourage new projects. However, reserves are expensive to store, and governments must predict prices correctly; if they cannot, the scheme makes losses.

Evaluation: different market failures require different policies, and their effectiveness depends on elasticities, the availability of substitutes and the time period. Environmental damage is the most serious failure because it is global and long-lasting. However, no single government can solve it, as pollution crosses borders: if one country taxes oil heavily, production and emissions may move to countries with weaker rules. This is why international agreements such as the Paris Agreement, signed by 195 countries, are vital, although they are hard to enforce and some countries find it easier to adopt greener methods than others. There are also winners and losers: oil-exporting countries and oil companies lose revenue, while consumers in importing countries gain from lower and more stable prices. Policies also take time: switching power stations and car fleets away from oil takes many years.

Conclusion: governments should intervene more, but the case is strongest for



the environmental externality. A combination of carbon taxes, regulation and subsidies for renewables is likely to be most effective, because taxes provide an incentive to cut use, regulation sets clear limits and subsidies provide the substitutes needed to make demand more elastic in the long run. Strategic reserves can reduce price instability at moderate cost, but there is little that governments can do directly about OPEC's monopoly power apart from reducing dependence on its oil. Since oil is a vital resource with no substitute in some uses, intervention should be gradual to avoid large rises in costs, and it should be co-ordinated internationally; otherwise the risk is that government failure replaces market failure.

Turn over ►



[illegible]

Do **not** answer Context 2 if you have answered Context 1.

OR

Context 2

Total for this context: 50 marks

DRONES

Use the Insert provided to study **Questions 27 to 32** and **Extracts D, E and F**, and then answer the questions in the spaces which follow.

2 7 Define 'factors of production' **Extract F** (line 2).

[3 marks]

Factors of production are the resources or inputs used to produce goods and services. They are land (natural resources), labour (human effort), capital (man-made goods used in production, such as drones) and enterprise, which organises the other factors and takes risks.

2 8 **Extract F** (lines 10–12) states: 'The total cost of a delivery consists of £150 for the drone and another £350 to carry out the whole operation. The drone carries food weighing 110 pounds (50 kilos), enough for 50 people for a day.'

Calculate the average total cost of delivering food weighing one pound. Give your answer to the **nearest penny**.

[4 marks]

Total cost of a delivery = £150 + £350 = £500

Food carried = 110 pounds

Average total cost = total cost ÷ output = £500 ÷ 110

= £4.5454...

Average total cost per pound of food = £4.55 (to the nearest penny)

Turn over ►



2 9

Use **Extract D (i)** to identify **two** significant features of the worldwide sales of commercial drones over the period shown.

[4 marks]

Feature 1 *Sales rose every year over the period: from about 110 000 drones in 2016 to a projected 1 910 000 in 2023, an increase of about 1 800 000 drones (more than 17 times higher).*

Extra space

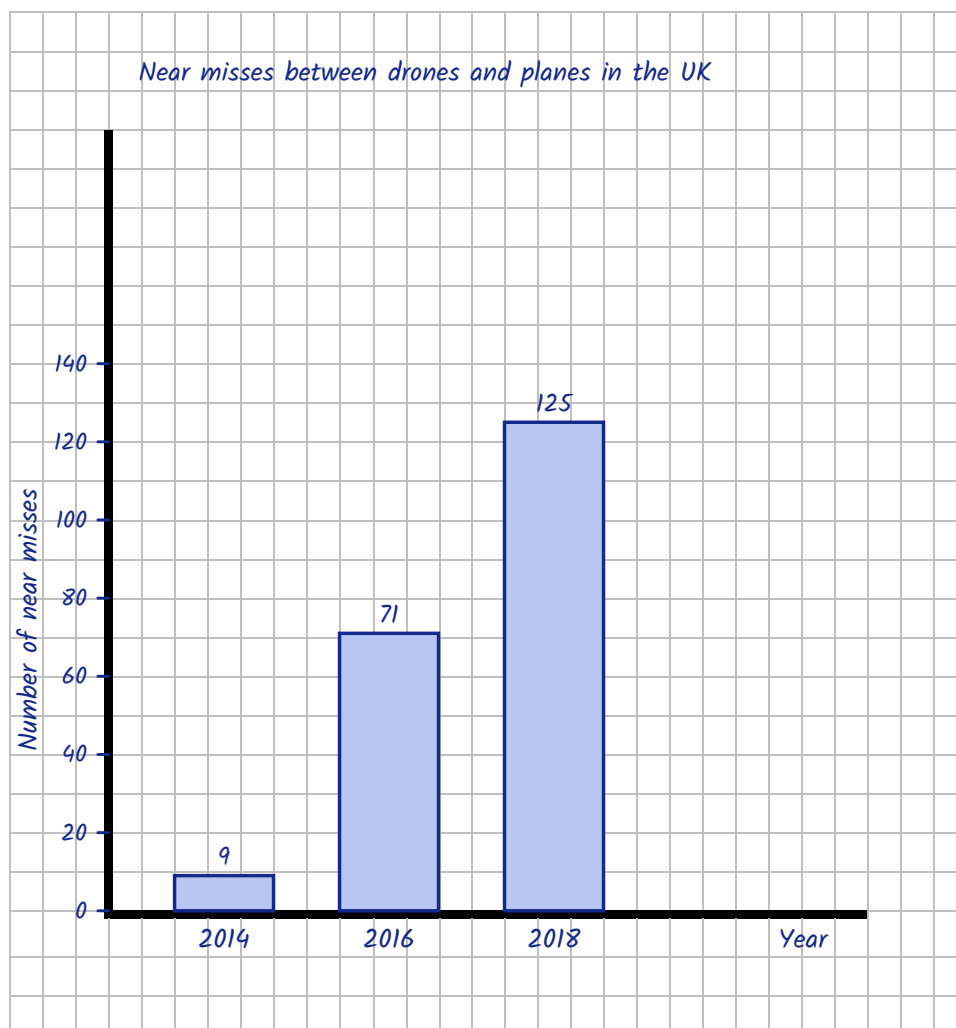
Feature 2 *The rise accelerated over time: the smallest rise was between 2016 and 2017, from about 110 000 to 160 000 (50 000), and the largest was between 2022 and 2023, from about 1 410 000 to 1 910 000 drones (500 000).*

Extra space



3 0

Use the data in **Extract D (ii)** to draw a bar chart to show the number of near misses between drones and planes in the UK for the years 2014, 2016 and 2018.

[4 marks]

Turn over for the next question

Turn over ►



3 1

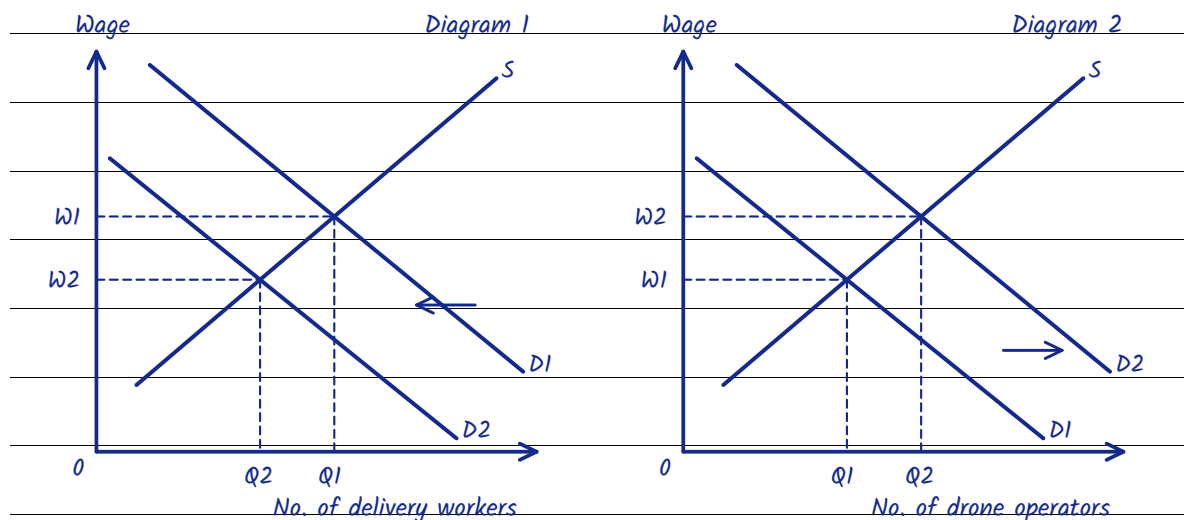
Extract E (lines 8–9) states: ‘Drones can reach remote areas quickly and easily, saving on labour and other costs.’

Explain how the increasing use of drones is likely to affect the market for delivery workers.

[10 marks]

Delivery workers are in derived demand: firms employ them because

consumers demand delivered goods such as parcels, food and medical supplies.



Drones are capital that can substitute for delivery workers, as they reach remote areas quickly and easily, saving on labour costs (Extract E), and Extract F states that drones increase productivity and reduce the need for other factors of production. As drones become cheaper and more widely used, for example by Amazon for short-distance parcels, firms substitute capital for labour. In diagram 1, the demand for delivery workers shifts left from D_1 to D_2 . At the original wage w_1 there is an excess supply of workers, so the wage falls to w_2 and employment falls from Q_1 to Q_2 .

The size of the effect depends on elasticities. The closer drones are as substitutes, and the higher the cross elasticity of demand between the price of drone deliveries and the number of deliveries by other methods, the greater the fall in demand for delivery workers. If the supply of delivery workers is elastic, because the jobs need few specific skills and workers can



Extra space *move to other jobs, the fall in demand mainly reduces*

employment rather than wages; if supply is inelastic, wages fall more.

The impact also varies between delivery markets. Drones currently carry light loads over short distances, so workers delivering small parcels, takeaway food and medical supplies to remote areas, such as the islands off the west coast of Scotland, are most affected. Workers delivering heavy or bulky goods, or in cities where the Dronecode restricts where drones can fly, are much less affected.

On the other hand, lower delivery costs may reduce prices and increase the total number of deliveries, and some workers are complements to drones, for example to load them and to deliver the final stage. Demand also rises for drone operators and technicians, as in diagram 2, raising their wages from w_1 to w_2 , so some delivery workers may retrain. Overall, the increasing use of drones is likely to reduce the wages and employment of traditional delivery workers, especially those making short, light deliveries, although the effect will be gradual.

Turn over ►



3 2

Extract F (lines 23–24) states: ‘if drones become more common, another review may be needed of what is best for all’.

Use the extracts and your knowledge of economics to assess whether governments should encourage, discourage or do nothing more to affect the use of drones.

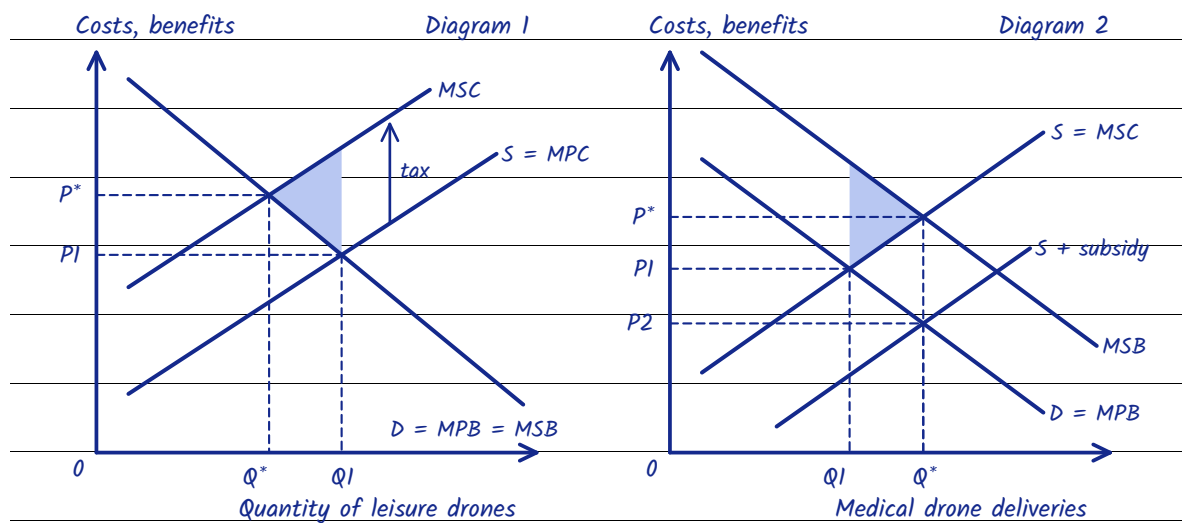
[25 marks]

A drone is an unmanned aerial vehicle controlled by a computer or smartphone app. Extract D shows that worldwide sales of commercial drones are expected to rise from about 110 000 in 2016 to 1 910 000 in 2023, more than seventeen times higher, so the question of how governments should respond is increasingly important. Drones create both private and external benefits and private and external costs, so the free market may not allocate resources efficiently.

Arguments for encouraging drones: Extract F states that drones increase productivity, reduce the need for other factors of production and so reduce total costs, helping firms gain a competitive advantage and higher profits. Lower costs shift supply to the right, lowering prices for consumers. Drones are used in agriculture to manage crops and animals, in construction to inspect buildings and infrastructure, and for weather prediction. They also provide large external benefits that are not taken into account by the market. In Rwanda, more than 10 000 packages of blood and medical supplies were delivered to remote areas in three years, and drones can carry food to areas suffering war or natural disasters at a cost of £500 per delivery, only about £4.55 per pound of food or £10 per person per day.

Diagram 2 shows that for medical deliveries the marginal social benefit is greater than the marginal private benefit, so the free market output Q_1 is below the social optimum Q^* and the shaded triangle is a welfare loss. Some uses are therefore under-provided, like a merit good. A subsidy equal to the marginal external benefit shifts supply to $S + \text{subsidy}$, increasing output to





Q^* . Governments could also give tax relief for research and development, or fund drone delivery services directly, as in the Scottish islands trial. This would improve international competitiveness and help the UK lead a fast-growing industry.

Arguments for discouraging drones: drones also create external costs. In December 2018, a thousand flights were cancelled when drones were seen near Gatwick airport, costing the industry an estimated £50 million. Extract D shows that near misses between drones and planes in the UK rose from 9 in 2014 to 125 in 2018, almost fourteen times higher, so the risk of a serious accident is growing as more drones fly. There are also concerns about privacy, as drones photograph people without consent, and the buzzing noise disturbs residents. In diagram 1, these external costs mean MSC is above MPC , so leisure drones are overused at $Q1$ rather than Q^* , causing the shaded welfare loss. A tax on drones or a licence fee equal to the marginal external cost would raise the price to P^* and reduce use to Q^* . Alternatively, regulation such as banning flights near airports, compulsory registration and higher fines for misuse would reduce the external costs directly. Drones may also reduce employment, for example for delivery workers.

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Arguments for doing nothing more: the UK already has the 2016 Dronecode, which requires operators of larger drones to take an online test and fines misuse, and UK laws are now in line with many other countries. Further intervention risks government failure. The government lacks the information to value external costs and benefits accurately, so taxes or subsidies could be set at the wrong level, and the technology is changing so fast that rules may soon be out of date. Excessive regulation could also stifle innovation and drive firms abroad, while subsidies have an opportunity cost and may be wasted on projects firms would have done anyway.

Evaluation: whether governments should encourage or discourage drones depends on the use. Commercial and humanitarian uses, such as delivering medical supplies, inspecting infrastructure and disaster relief, have large benefits and relatively low external costs, whereas leisure use near airports and over homes creates most of the external costs. A single policy towards all drones is therefore inappropriate. The magnitude also matters: the Gatwick incident cost £50 million, but this must be weighed against the productivity gains across many industries and the lives saved by faster medical deliveries. In the short run the main priority is safety, as near misses are rising quickly, while in the long run the benefits of drones are likely to grow as technology improves. Because drones cross borders and are used by global firms such as Amazon, international co-operation on rules is also desirable.

Conclusion: doing nothing more is not appropriate, because drone sales are rising rapidly and near misses with planes increased almost fourteen times between 2014 and 2018, so the existing Dronecode is unlikely to be enough. Governments should neither simply encourage nor simply discourage drones. Instead, they should encourage uses with external benefits, for example with



Extra space *subsidies or funding for medical and emergency drones and support for research, while discouraging harmful uses through stricter regulation, such as no-fly zones around airports, registration of all drones and larger fines. As Extract F suggests, the rules should be reviewed regularly as drones become more common, so that the policy remains what is best for all.*

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