H

St Andrews Junior College
JC1 Timed Trials for General Certificate of Education Advanced Level
Higher 2

ECONOMICS **9570**

2 hr 5 minutes

READ THESE INSTRUCTIONS FIRST

Write your name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY OF THE MARGINS.

Answer **all** questions.

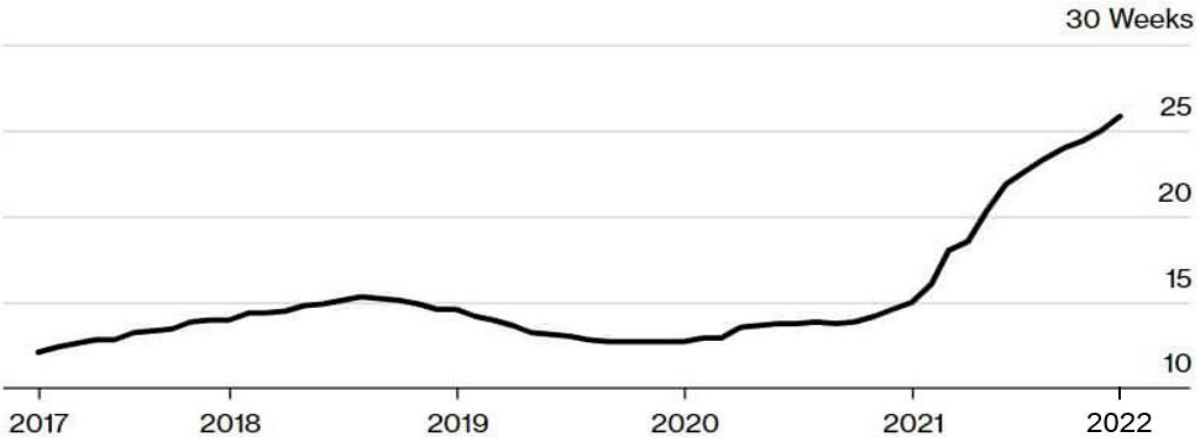
At the end of the examination, fasten all your work securely together with the cover sheet.
The number of marks is given in brackets [ ] at the end of each question or part question.

Section A

Answer **all** questions.

Question 1: Worldwide semiconductor industry

Figure 1: Lead time[1] for semiconductor



Source: Susquehanna Financial Group

[1] A lead time measures the time taken to create a product and deliver it to a consumer.

Extract 1: Global shortage of semiconductor

The global semiconductor or computer chips shortage made worse by the coronavirus pandemic and supply chain issues shows no signs of improving as industries worldwide have had to halt production while waiting for processors. A report from the United States (US) Department of Commerce released this week revealed an "alarming" shortage of computer chips at a time when the median demand for them was as much as 17% higher in 2021 than 2019. "This is a major supply and demand mismatch," the report stated.

The consumer electronics market took off during the pandemic. Companies and their employees increased their purchases of desktops and laptops for home-office use, and consumers leaned into purchases of a wide variety of devices such as televisions, gaming systems, headphones, and other electronics equipment.

In 2021, the dearth of computer chips forced car manufacturers to close down manufacturing and cut production by as much as 7.7 million cars; that, in turn, led to a massive car shortage just as some nations began lifting widespread quarantines, allowing people to travel again.

The chip manufacturing is not instant. It takes three or four months to begin to manufacture a chip, let alone to have it ready to ship. Those chips then have to be embedded into the various systems that make up any given product, such as a car or its various subsystems — and that means shipping chips to Asia, where most product manufacturing occurs.

Since the semiconductor shortage began, manufacturers increased plant production utilisation dramatically, operating at a rate of more than 90% utilisation of their facilities.

That high production rate is unusual because semiconductor machinery requires regular maintenance and uses massive amounts of power. The bottom line: there is not enough manufacturing capacity to meet the spike in demand.

Source: Computerworld, 26 January 2022

Extract 2: Semiconductor giants ramping up production

Semiconductor companies around the world are preparing to make major investments in their research and development facilities, in an effort to meet growing demand as the global chip shortage rages on. The world's largest contract chipmaker, Taiwan Semiconductor Manufacturing Company (TSMC), has committed to investing $100 billion over three years to ramp up production of its cutting-edge silicon wafers, which are used to make a variety of chips.

In January, it said that its capital expenditure will grow by up to 47% in 2022, adding that it plans to spend between $40 billion and $44 billion this year, up from $30 billion last year. The Taiwanese chip giant, which is headquartered in Hsinchu, is building a $12 billion factory in Arizona in US, and another in Japan to increase capacity. It has several other fabrication plants — also known as fabs — in development.

TSMC certainly is not the only chipmaker investing billions into high-technology factories, which tend to take three to four years to come online. Rival firm, Intel announced last March that it plans to spend $20 billion on two new chip plants in Arizona.

Source: CNBC, 4 February 2022

Extract 3: Huge carbon footprint for the semiconductor industry

The semiconductor industry has a problem. Demand is booming for computer chips, which are embedded in everything from smartphones and televisions to wind turbines, but it comes at a big cost: a huge carbon footprint. The industry presents a paradox. Meeting global climate goals will, in part, rely on semiconductors. They are integral to electric vehicles, solar arrays and wind turbines. But chip manufacturing also contributes to the climate crisis. It requires huge amounts of energy and water – a chip fabrication plant, or fab, can use millions of gallons of water a day – and creates hazardous waste.

As the semiconductor industry finds itself increasingly under the spotlight, it is starting to grapple with its climate impacts. Last week TSMC, the world's largest chipmaker, which supplies chips to Apple, pledged to reach net zero emissions by 2050. The company aims to "broaden our green influence and drive the industry towards low-carbon sustainability", said the TSMC chairman, Mark Lui.

But decarbonizing the industry will be a big challenge. TSMC alone uses almost 5% of all Taiwan's electricity, according to figures from Greenpeace, predicted to rise to 7.2% in 2022, and it used about 63 million tons of water in 2019. The company's water use became a controversial topic during Taiwan's drought this year, the country's worst in a half century, which pitted chipmakers against farmers. Chip manufacturing, rather than energy consumption or hardware use, "accounts for most of the carbon output" from electronics devices, the Harvard researcher Udit Gupta and co-authors wrote in a 2020 paper.

However, amid pressure from investors and electronics makers keen to report greener supply chains to customers, the semiconductor business has been ramping up action on tackling its climate footprint. Greater availability of renewable energy is helping chipmakers reduce their carbon footprint. Intel made a commitment to source 100% of its energy from renewable sources by 2030, as did TSMC, but with a deadline of 2050. Energy consumption accounts for 62% of TSMC's emissions, said a company spokesperson, Nina Kao. The company signed a 20-year deal last year with the Danish energy firm Orsted, buying all the energy from a 920-megawatt offshore windfarm Orsted is building in the Taiwan Strait.

To some observers of the chip business, the determination to clean up the industry seems real. The vast demand for chips at the moment will only help the semiconductor industry embrace sustainability goals, said Mark Li, a semiconductor analyst at the investment firm Bernstein. "Semiconductor firms have very good margins and make lots of money. So even though all these green carbon measures would have a cost, they can afford it. And increasingly, customers are willing to pay more for a greener device," he said.

Source: The Guardian, 18 September 2021

Extract 4: Carbon tax to be raised in Singapore

In his Budget speech, Finance Minister Lawrence Wong said Singapore's carbon tax rate will be raised from the current $5 per tonne of emissions to between $50 and $80 by 2030 to help the country reach net-zero emissions by or around 2050. The current rate will be in place until next year. It will go up to $25 in 2024 and 2025, and $45 in 2026 and 2027, before reaching $50 to $80 per tonne by 2030.

Singapore's carbon tax currently applies to all facilities producing at least 25,000 tonnes of greenhouse gas emissions in a year. They include 30 to 40 large emitters such as oil refineries, power generation plants and semiconductor companies. In total, these large emitters contribute 80% of Singapore's greenhouse gas emissions.

Ms Grace Fu, Minister for Sustainability and the Environment, added that the government will use the carbon tax collection to incentivise companies to adopt carbon-reduction measures. For instance, if a small or medium-sized enterprise wants to install an energy-efficient chiller or air-conditioner, it can apply for energy grants from the National Environment Agency (NEA), she said.

Source: The Straits Times, 23 February 2022

Questions

(a) With reference to Figure 1, describe the trend in the lead time for semiconductor from 2017 to 2022. **[2]**

(b) With reference to Extract 1:

(i) Explain how the global demand for semiconductor was affected during the pandemic. **[2]**

(ii) In view of the global semiconductor shortage, explain how a lifting of widespread quarantines is likely to affect the extent of change in the equilibrium quantity of cars. **[4]**

(c) With reference to Extract 2, explain two reasons why the semiconductor industry is likely to be an oligopoly. **[4]**

(d) Discuss the factors that TSMC might consider when choosing to build a new fabrication plant in another country such as US or Japan. **[8]**

(e) Intel made a commitment to source 100% of its energy from renewable sources by 2030 (Extract 3). **[10]**

Discuss whether relying on semiconductor firms to reduce carbon footprint on their own is the best way to address inefficiency in the allocation of resources in the semiconductor market.

[Total: 30]

Section B

Answer the **compulsory** essay question in this section.

Question 2

Netflix, a video streaming subscription service, lost 200 000 subscribers in the first quarter of 2022, slowing down its revenue growth. Unlike its many competitors which diversified to include sports, news and light entertainment in their packages, Netflix has focussed mostly on original and licensed film and TV.

Source: The Guardian, 20 April 2022

(a) Explain the factors that affect the pricing decisions of a firm. **[10]**

(b) Discuss the view that the best strategy for Netflix to respond to slower revenue growth rate is to implement a price cut. **[15]**

[Total: 25]