

Q 2b) Differentiate arduino controller and other microcontrollers. Identify the importance of Arduino controller over other microcontrollers.

8051 Microcontroller	Arduino controller
Harvard Architecture-CISC (Complex Instruction Set Computer).8051 is an 8-bit microcontroller	Harvard Architecture-RISC(Reduced instruction set computing)Arduino uno houses 8-bit AVR microcontrollers
8051 operating voltage is between +5 volts to max 6.6 volts.	Arduino boards can work on +5 volts to max 20 volts
Flash Memory = 8 kB	Arduino uno Flash Memory = 32 kB
RAM(Random Access Memory) = 128 Bytes	Arduino uno RAM(Random Access Memory) = 2 kB
EEPROM= No eeprom	Arduino uno EEPROM= 1 kB
Clock speed = 12 Mhz	Clock Speed = 16 Mhz could be increase to 20 Mhz
One machine cycle = 12 clock cycles	One machine cycle = 1 clock cycle
Generally keil Uvision IDE is used to write and compile code for 8051 microcontroller.	Arduino Ide is used to write compile and upload code to the board..
32 GPIO pins.	GPIO pins = 14 + 6(ADC) analog to digital pins - can be used as digital. So total GPIO pins = 20
Few development kits are available in market, but the support is poor. Lesser development community.	Many development kits are available in market, with strong support. Huge development community and forums.

Arduino UNO

- The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010.
- The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.
- The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.
- It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.
- The sketch for automatic car parking system is developed by using Arduino IDE and downloaded on to the Arduino uno board .

13. What do you prefer Arduino for developing simple projects? A microcontroller or Arduino. Justify your Answer. What are the benefits of Arduino compared to Microcontrollers?

We do prefer arduino board. Because Arduino is a project development board that contains various other hardware for interfacing analog and digital, input and output devices.

- i. Arduino UNO is not a microcontroller but it is a microcontroller based **development board** and is one of the best development boards to start with microcontrollers.
- ii. Arduino board is an open source platform used to make electronics projects. There are many Arduino boards having different controllers/processors having different specifications. But all the boards are similar, they have input, output, analog, power and ground pins.
- iii. Input and output are classified into two categories –
 - a) Digital
 - b) Analog
- iv. So, simply different Arduino boards have different numbers of digital and analog pins. We can use digital pins in two states INPUT as well as OUTPUT. In general we call these pins as digital I/O pins.

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- v. In few microcontrollers / development boards analog pins are available for input for interfacing the analog devices like temperature sensors.
- vi. It is easy to interface MCU (microcontroller unit) and different modules like GPS, GSM, RFID, Bluetooth etc in the easiest way.
- vii. Boards have a wide application in IoT, automation, embedded system etc. All boards are open-source, allowing users to make their own circuitry.
- viii. We don't need to know the architecture of microcontroller to develop the projects as we use high level language for programming the controller.

12. Why do you prefer Arduino for developing simple projects? Compare Arduino and PLC controllers.

Arduino is preferred than PLC than PLC for simple Projects because

- i. Cost of Arduino is less.
- ii. Arduino has built in libraries for wide variety of applications such LCD control , Load cell etc.
- iii. Cost of interfacing I/O peripherals is less.
- iv. Easy to Interface (wiring) Sensors and output devices such as Motor drivers, LCDs.

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- v. The operating voltage level is arduino is 5V , thus simple 5 V-9V battery is enough and thus highly suitable for battery driven applications.
- vi. Many of the sensors and output drivers are of standard TTL logic .. Thus provides easy interfacing with the arduino as it operates on TTL.
- vii. The arduino has built-in PWM pins and thus easy to operate PWM applications . For example a single line code is enough for controlling the speed of the Motor using PWM.
- viii. The arduino IDE is open –source software . Thus one can download and develop arduino based projects.
- ix. Project development time is very less compared to the PLC.
- x. The arduino sketch uses High level Programming . user can easily learn and develop the codes for their applications.
- xi. Though it is less cost , it has 6 analog pins to interface the Analog sensors like LM35 temperature sensors.
- xii. The program can be analysed using serial Monitor.
- xiii. No separate software is necessary for Flash programming the Arduino controller.
- xiv. A huge user forum exists for arduino. For simple projects, the programs are readily available on the user forum.

* PLC is also known as - the industrial computer, Because it consists of power supply section, CPU, I/O modules, processors.

* It is able to control a process

* It has more storage space & very fast execution.

* So, this is the reason why we prefer the PLC over microcontrollers.



* PLC consists of many Input & output Modules.

* It don't require any additional circuit to interface.

* It supports the industrial standards in operating voltages of devices, communication between devices.

* It execute in very high speed but initial investment cost is high.

* The different types PLC has their software to operate & it is a open source software.

* For PLC the programming can be done with graphical (or) textual language.





5(b).

A:

Why PLC is Preferred over Microcontroller in
Because, industries.

Microcontroller is a open source device. (or)
it has open source software. Micro controller
has less storage space. In industries
it has many number of inputs & outputs.
* & In Industries some devices operate
with high power supply & high frequency.

The microcontroller cannot with stand with
that supply, the microcontroller operating
voltage does not support the Industrial
standards because the microcontrollers are
used only for simple appliances.

* If we prefer the PLC over micro-
controller we can achieve the desired
output like.

5 b) Why is PLC preferred over Microcontroller in industries

10marks

Specific industrial conditions

- 1. Shock and vibration- PLC is capable of withstanding strong amount of both shock and vibration common to warehouse environment.
Microcontroller requires special mounting and connection considerations designed to hold the abuse.
- 2. Corrosion- In some environments, equipment is around vapour/fumes that corrode wiring and other components. PLC has coatings that cut down on the bare/exposed metal on their boards. Also their wires include corrosion resistant materials
- 3. Noise- PLC has better level of protection against standard electronic noise or magnetic fields without issues , whereas microcontroller could go into fault mode or lose its program if the noise interference is significant.
- 4. Temperature levels-PLC can withstand extreme temperatures even when installed in outdoor enclosure, whereas microcontroller can work well only in temperature controlled environment.
- 5. Industry standards for testing- International electrotechnical commission (IEC) and Underwriters Laboratories (UL) include standards . as per it, each PLC system will include documentation that lists tests completed and methodologies used.
Most microcontrollers does not undergo such extensive testing, which becomes difficult to know their capabilities.

NOTE: Refer to the link to consider other relevant points

Reference Link- <https://www.c3controls.com/white-paper/microcontrollers-versus-plcs-detailed-comparison/>

5b (ii) Illustrate the differences between Arduino controller and other micro controllers
- 5 Marks

Answer: The differences between Arduino and micro controller are listed below:

Sl. No	Arduino	Micro controller
1	Arduino is not a microcontroller, but a system based on an AVR (microcontroller of ATMEL family)	It is just a microcontroller that can be 8 bit, 16-bit or 32-bit
2	It has its own IDE (s/w and h/w libraries) to program this board. (open source)	To program the micro controller, an external programmer board is required to program the chip.
3	It has almost every essential part (ports) needed to start a project on the board itself	Breadboard, DC power supply, wires etc are required to do any experimentation project.
4	It Has 32KB of flash memory and	It has less RAM (128 bytes), some



	2KB of SRAM. EEPROM is there to store long term information	microcontrollers do not have EEPROM.
5	Operating voltage 6V to 20V via Vin pin. It has power supply jack which has inbuilt 5-v and 3-V regulators	Operating voltage +5V. It requires an external power supply
	Applications: home automation system, IoT etc	Applications: remote controls, power tools, auto engine control systems, toys and more