3) a- The maximum directly addressable memory capacity is

232-8 = 16,777,216 bytes.

b- 1) The address bus is 32 bits, the whole address can be transferred to memory at once and decoded there. The data bus only 16 bits, it will require two bus cycles(access to memory) to fetch the 32 bit instruction or operand.

2) The address bus is 16-bit bus, It has the processor perform two transmission in order to send to memory the whole 32-bit address; this will require more complex memory interface control to latch the two halves of the address before it performs an access to it. For this two-step address issue the data bus is also 16 bits, the microprocessor will need 2 bus cycles to fetch the 32 bit instruction or operand.

3) 24 bits for the PC(program counter) and 24-bit addresses, it contains the physical address issued by the microprocessor. 32 bits for the IR(Instruction Register) and 32-bit addresses. It is the whole instruction in register.

4) a) The processor can access directly if it is connected to a 16-bit memory = 2bytes [16 bit = 2 byte]

The microprocessor can access the locations = 216 = 64 K [1 KB = 1024 byte]

The maximum memory address space = 64K \* 2 = 128 Kbytes

b) The processor can access directly if it is connected to a 8-bit memory = 1bytes [8 bit = 1 byte]

The microprocessor can access the locations = 216 = 64 K [1 KB = 1024 byte]

The maximum memory address space = 64K \* 1 = 64 Kbytes

c) Seperate I/O instructions are needed whose execution will generate separate I/O signals (different from memory signals generated by executing memory-type instructions). At a minimum, this will require an addition output pin to carry the signal.

d) An I/O instructions can specify an 8-bit I/O port. So the microprocessor will support 28 = 256 I/O ports. The microprocessor has 16-bit I/O ports. So microprocessor will support 216= 65536 I/O ports.