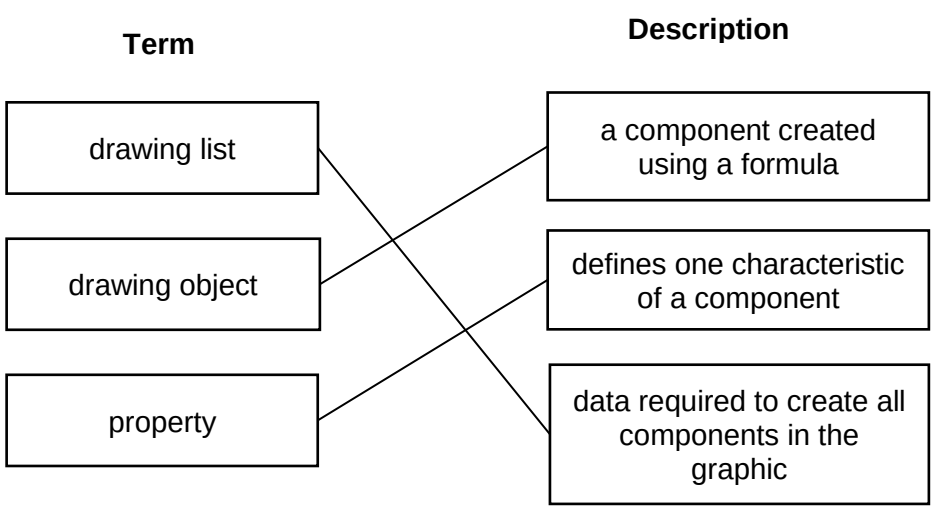
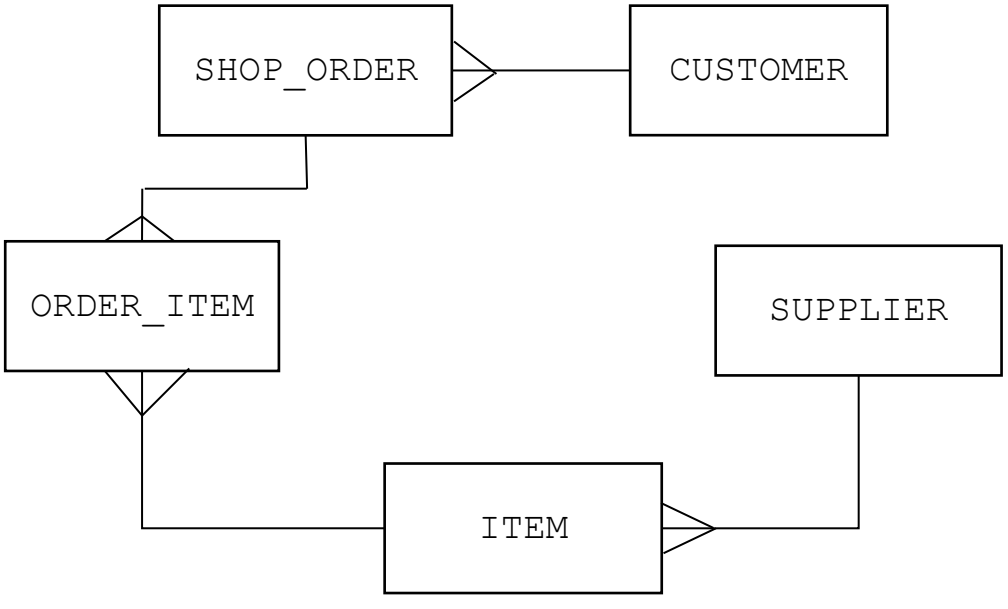
Question	Answer	Marks
1(a)	**2 marks** for all 3 lines correct **1 mark** for 1 line correct 	**2**
1(b)	**1 mark** for the definition • The number of bits used to represent each colour **1 mark** for each bullet point for the explanation • Increase in bit depth means the image has a greater range of colours // Decrease in bit depth means the image has a smaller range of colours • Increase in bit depth makes the image closer to the original / more realistic // Decrease in bit depth makes the image less like the original / less realistic	**3**
1(c)	**1 mark** for each bullet point (**max 2**) • Reduced bandwidth usage when transmitting the message • Reduced transmission time from email client to email server • Reduced storage space **on the email** • Email accounts often have a maximum size for an attachment	**2**

Question	Answer	Marks
2(a)	**1 mark** for each bullet point (**max 3**) • Receives packets from internet / external network • Implements a firewall • Analyses the destination IP address of each packet • Forwards the packet towards its destination // send packets onto local network or external network • ...using the routing table • Maintains / updates the routing • Allocates private IP addresses • Finds the most efficient route to the destination • Changes the packet format for transmission over the next network // • Network Address Translation (NAT):NAT is a technique used by routers to allow multiple devices in a private local area network (LAN) to share a single public IP address.	**3**
2(b)	Switch: **1 mark** for each bullet point (**max 1**) • To allow two or more devices to communicate with one another • To connect individual devices to each other • To receive transmissions and **forward** them to their destination Wireless Access Point (WAP): **1 mark** for each bullet point (**max 1**) • To allow connection of devices (to the central device) **using radio signals** / Wi-Fi • To allow the central device to send / receive **radio signals** / Wi-Fi signals • To allow wireless enabled devices to connect to a wired network Bridge:**1 mark** for each bullet point (**max 1**) • To connect two LANs / segments with the **same protocol** • To transmit data between two networks with the **same protocol**	**3**
2(c)	**1 mark** for each bullet point (**max 2**) • The students cannot access their files without a reliable internet connection • The amount of space for no payment may be limited so students will have to purchase more space if needed • The students do not have control over the backup (or security) of their work // the students are dependent on a third party for the (security and) backing up of their work	**2**

Question	Answer	Marks
2(d)	**1 mark** for each advantage and **1 mark** for valid corresponding expansion • Star topology is more resilient to faults • …because there is no single cable and leads to less disruption to teaching • Higher performance as fewer collisions • ...because each device in the classroom is only connected to the switch • Easier to add new nodes • …because each device in the classroom connects directly to the switch • Easier to fault find compared to bus topology	**2**

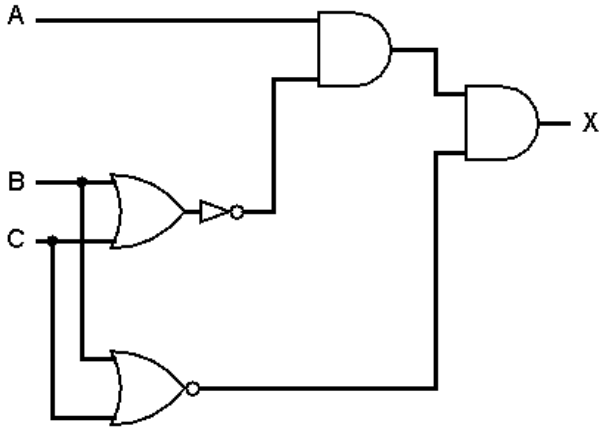
Question	Answer	Marks
3(a)	**1 mark** for each correct relationship or relationships • 1:M between CUSTOMER and SHOP_ORDER • 1:M between SUPPLIER and ITEM • 1:M between SHOP_ORDER and ORDER_ITEM **and** M:1 between ORDER_ITEM and ITEM  	**3**
3(b)	**1 mark** for each bullet point (**max 3**) • Reduced data **redundancy** • Improved data integrity / consistency / referential integrity • Allows for views / improved privacy • Allows for program-data independence • Complex queries can be executed	**3**

Question	Answer	Marks
3(c)(i)	**1 mark** for `CREATE DATABASE SHOP;`	**1**

3(c)(ii)	**1 mark** for each line (**max 4**)
	
	Either:
	`SELECT SUM(Quantity)`
	`FROM ORDER_ITEM, SHOP_ORDER`
	`WHERE ORDER_ITEM.OrderNo = SHOP_ORDER.OrderNo`
	`AND SHOP_ORDER.CustomerID = 'HJ231';`
	OR
	`SELECT SUM(Quantity)`
	`FROM ORDER_ITEM (INNER) JOIN SHOP_ORDER`
	`ON ORDER_ITEM.OrderNo = SHOP_ORDER.OrderNo`
	`WHERE SHOP_ORDER.CustomerID = 'HJ231';`
		4

Question	Answer	Marks
4(a)	**1 mark** for each set of 4 rows (shaded)	**2**

A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Question	Answer	Marks
4(b)	**1 mark** for both AND gates **1 mark** for NOT gate and OR gate and NOR gate 	**2**

Question	Answer	Marks
5(a)	**1 mark** for identification of the register and **1 mark** for role (**max 2** for each register) • Program Counter (PC) • stores the address where the next instruction is to be read from • Memory Address Register (MAR) • stores the address of the memory location (or an I/O component) **currently being read from** or **written to** • Current Instruction Register (CIR) • holds the instruction currently being decoded and/or executed • Status Register • Contains bits which can be referenced individually and set or cleared depending on the operation e.g. overflow, underflow	**4**
5(b)	**1 mark** for each bullet point (**max 2**) • Immediate Access Store holds all the data / instructions / programs currently in use • Immediate Access Store is volatile memory • Immediate Access Store has fast access times	**2**
5(c)(i)	**1 mark** for each bullet point (**max 1**) • The CPU can now perform nearly twice as many **F-E cycles** per second • Instead of 2.1 billion **F-E cycles** per second, the CPU can now perform 4 billion **FE cycles** per second	**1**

Question	Answer	Marks
5(c)(ii)	**1 mark** for each bullet point (**max 5**) • Multiple cores introduce additional overheads • …because of the need for communication between cores • Software may not be designed for multiple cores… • …so one of the cores will be left idle • Memory access speed may not match speed of cores… • …so causing delay • The two computers may have more differences than just the cores • …one may have more RAM which allows faster multitasking • ...one may have a GPU • ...etc.	**5**

Question	Answer	Marks
6(a)	**1 mark** for each bullet point (**max 4**) • easier to debug the program • … because it translates line-by-line and stops when an error is found whereas the compiler translates all the program at the same time • … only reporting one error at a time • … which allows the error to be corrected in real time whereas the program would need to be corrected and recompiled • ... and the program can restart at same point when error occurred with a compiler the program needs to be re-run • The effect of any changes made by the programmer can be seen immediately with a compiler the effects can only be seen after re-running • A partially completed program can be translated / tested on its own a compiler cannot translate a partial program	**4**
6(b)	**1 mark** for each bullet point (**max 1**) • Partially compiled programs can be used on different platforms as they are interpreted when run • Code is optimised for the CPU as machine code is generated at run time • Source code does not need recompiling so more efficient to run	**1**
6(c)(i)	**1 mark** for each bullet point (**max 2**) • Prettyprint • Expand/collapse code blocks • **Auto** indentation / formatting	**2**
6(c)(ii)	**1 mark** for each bullet point **(max 2**) • Single stepping • Breakpoints • Report window • Variable expressions	**2**

Question	Answer	Marks
7(a)	**1 mark** for each bullet point (**max 3**) Generic mark points: • Additive manufacturing • Uses a digital 3D model or a Computer Aided Design (CAD) (file) • Builds up the model one layer at a time • ...starting from the bottom • ...using x, y and z co-ordinates • The material is fused / cured together layer by layer Specific mark points: **Fused Deposition Modelling (FDM)** • Material is heated and pushed through nozzle / extruder **Stereolithography (SLA)** • Photosensitive liquid resin is exposed to a UV-laser beam **Digital Light Processing (DLP)** • Uses liquid plastic resin melted with arc lamps **Selective Laser Sintering (SLS)** • Uses a laser to form objects from powdered material	**3**
7(b)	**1 mark** for each bullet point (**max 2**) • To prevent **overheating** // ensure material is hot enough • ...by identifying the temperature of the object (being printed) • ...by identifying the temperature of the material being used	**2**
7(c)	**1 mark** for each bullet point (**max 2**) • Dynamic RAM has lower cost per unit • A fast access speed is not needed • Higher bit density // more data can be stored per chip	**2**

Question	Answer	Marks
8(a)	**1 mark** for: • To **create** a symbol table	**1**
8(b)(i)	**1 mark** for each bullet point • Data movement: e.g. LDR #50 // STO 201 • Arithmetic operation: e.g. ADD 100 // INC IX • Conditional instruction: e.g. JPE 96	**3**
8(b)(ii)	**1 mark** for each bullet point (**max 2**) Similarity: • both load the **contents** of an address into the Accumulator Difference: • direct accesses the address given by the operand whereas indexed adds the contents of IX to the operand and accesses the data at that calculated address	**2**
8(b)(iii)	**1 mark** for • Indirect (addressing) • Relative (addressing)	**1**
8(c)(i)	0000 0101	**1**
8(c)(ii)	0000 0010	**1**
8(c)(iii)	1101 0010	**1**

Question	Answer	Marks
9(a)	**One mark** for each bullet point (**max 2**) • Feedback ensures that a system operates within set criteria / constraints • ...by enabling system output to affect (subsequent) system input • ...thus allowing conditions to be automatically adjusted	**2**
9(b)	**One mark** for each reason to **max 3** to match the example given • Dedicated to one task **applied to example** • Does not require much processing power **applied to example** • Built into a larger system **applied to example** •	**3**