3 **(a)** State the first law of thermodynamics.

.....

.....

..... [2]

(b) A fixed mass of an ideal gas undergoes the cycle of changes XYZX, as shown in Fig. 3.1.

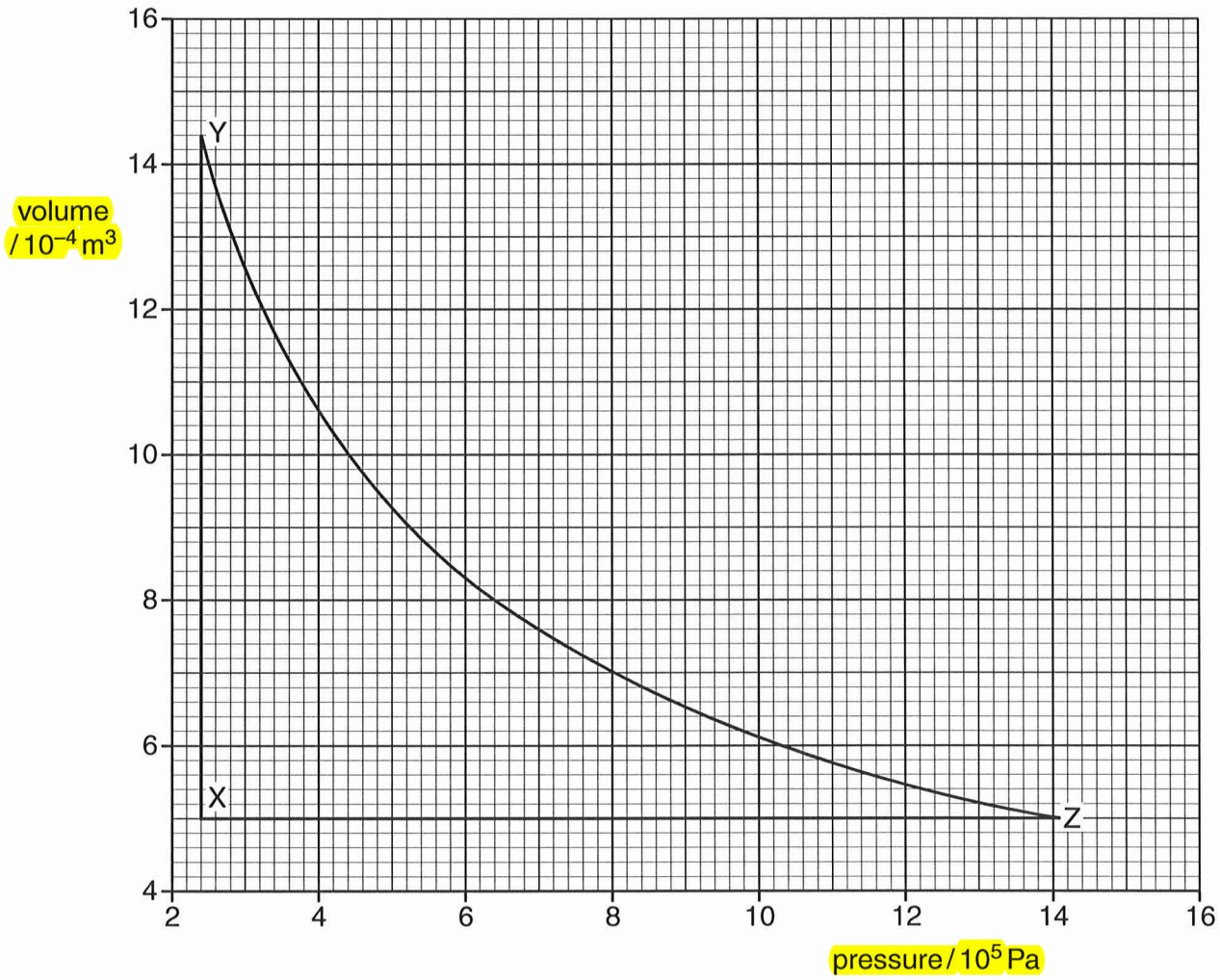

Fig. 3.1

At point X, the temperature of the gas is 290 K.

(i) Calculate the amount of gas.

amount = ...mol [2]

(ii) Determine, for this mass of gas, the magnitude of

1. the work done during the change from X to Y,

work done = ...J [2]

2. the change in the internal energy during one complete cycle XYZX.

change in internal energy = ...J [1]

(iii) Some energy changes during one cycle XYZX are shown in Fig. 3.2.

change	work done on gas/J	heating supplied to gas/J	increase in internal energy/J
X → Y		+ 570	
Y → Z	+ 540	0	
Z → X	0		

Fig. 3.2

Use your answers in **(ii)** to complete Fig. 3.2. [3]