Practice Questions

> *Remember – recommended units for measuring pressure are now the* **pascal (Pa)** *or* **kilopascal (kPa)**. *In physiology and medical practice the units 'mms of mercury' are still commonly used, simply because nearly all the instruments used for measuring pressures are calibrated in 'mms of mercury' and it would cost vast sums of money to replace them., Also, having two types of unit in use could result in serious medical errors occuring.*
> *1mm of mercury = 133.3 Pa.*
> *BHP = 3999 Pa.   IFOP = 799.8 Pa.   BOP = 3732.4 Pa.*
> *Data interpretation questions may use mms of mercury or pascals.*

1. (a) State **two** features of capillaries that enable tissue fluid to be formed.
    2

    (b) About 85% of the tissue fluid is reabsorbed at the venous end of the capillary. Describe what happens to the tissue fluid that is not reabsorbed.
    3

    (c) List **three** differences in the composition of tissue fluid at the arterial end of the capillaries to the tissue fluid at the venous end of the capillaries.
    3

    (d) When tissue fluid is inadequately reabsorbed, it accumulates in the tissues causing swelling (oedema). Suggest **two** possible causes for oedema.
    2
    Total 10

2. (a) Distinguish between:
    (i) tissue fluid and lymph,   1
    (ii) tissue fluid and plasma,   2
    (iii) extracellular fluid and intercellular fluid.   2

    (b) The equation below for effective filtration pressure relates the different pressures involved in forming tissue fluid. The table gives some actual values for some of these pressures and also some normal values bracketed in italics.

    $$Peff = \frac{\text{forces moving fluid}}{\text{out of capillaries}} - \frac{\text{forces moving fluid}}{\text{into capillaries}}$$

    Thus Peff = (BHP + IFOP) – (IFHP + BOP)

pressures in mm of mercury	arterial end of capillary bed	venous end of capillary bed
blood hydrostatic pressure (BHP)	?	16 *(15)*
interstitial fluid osmotic pressure (IFOP)	6	6
interstitial fluid hydrostatic pressure (IFHP)	0	-1 *(0)*
blood osmotic pressure(BOP)	28	28
effective filtration pressure (Peff)	10 *(8)*	? *(-7)*

    (i) Use the equation to calculate the missing values on the table. Show your working. Only use the actual values.   4
    (ii) Comment on the values shown in the table.   3
    Total 12

Answers

1. (a) ref to very thin pavement epithelium (of wall);
         ref to fenestrations/cell gaps in wall;
         ref to differentially permeable capillary walls (so that proteins cannot cross it);   max 2

    (b) taken up into lymph vessels (as lymph);
         aided by a positive tissue fluid hydrostatic pressure/pressure of 1 mm of mercury;
         returned to blood system (at subclavian veins)
         bacteria filtered out of lymph by phagocytes in lymph nodes;
         lymph nodes release lymphocytes into the lymph;   max 3

    (c) arterial end contains higher concentration of oxygen than venous end;
         arterial end contains a higher concentration of glucose/amino acids/ any correct named nutrient than venous end;
         arterial end contains a lower concentration of waste products/ correct named product than venous end; (only allow urea if liver is specified)   3

    (d) raised blood hydrostatic pressure/possible causes of this;
         decreased plasma protein concentration/possible causes of this;
         raised capillary wall permeability/possible causes of this;
         fluid retention/possible causes of this;   max 2
                                                                 Total 10

2. (a) (i) tissue fluid is present between cells/in tissues but lymph is within the lymph vessels;
              lymph tends to contain more lymphocytes than tissue fluid;
                                                                 max 1

         (ii) tissue fluid contains very little protein but plasma contains a lot;
               tissue fluid is between the cells/in tissues but plasma is within the blood vessels;
               tissue fluid does not contain red cells but plasma does; max 2

         (iii) extracellular refers to all body fluids outside cells;
                intercellular fluid refers only to tissue fluid between the cells;
                blood plasma/lymph/tissue fluid/cerebrospinal fluid/synovial fluid/aqueous humour are all examples of extracellular fluid;
                (look for two examples for one mark)   max 2

    (b) (i) Peff = (BHP + IFOP) – (IFHP + BOP)
              10 = (BHP + 6) – (0 + 28) ;
              BHP = 32 mm ;
              Peff = (16 + 6) – (-1 + 28) ;
              Peff = - 5 mm;   4

         (ii) the effective filtration pressure forming tissue fluid is higher than the norm;
               the effective filtration pressure reabsorbing tissue fluid is less than the norm;
               thus oedema may occur/tissue fluid may accumulate between cells;   3
                                                                 Total 12