ANSWER KEY

1	**C**	**2**	**C**	**3**	**C**	**4**	**D**	**5**	**B**
6	**D**	**7**	**C**	**8**	**B**	**9**	**C**	**10**	**C**
11	**A**	**12**	**D**	**13**	**B**	**14**	**C**	**15**	**D**
16	**C**	**17**	**A**	**18**	**A**	**19**	**D**	**20**	**B**
21	**D**	**22**	**C**	**23**	**C**	**24**	**B**	**25**	**C**
26	**C**	**27**	**D**	**28**	**C**	**29**	**C**	**30**	**B**
31	**A**	**32**	**C**	**33**	**C**	**34**	**C**	**35**	**C**
36	**C**	**37**	**A**	**38**	**D**	**39**	**C**	**40**	**C**

EXPLANATIONS

1 C
Glycogenolysis decreases after midnight because, during that time, hepatic glycogen stores gets depleted due to active glycogen breakdown (glycogenolysis).

2 C
In the early morning before breakfast, there is no food in the body. Therefore, blood glucose is mainly produced by gluconeogenesis, as depicted in the graph

3 C
The maximum contribution of blood glucose from gluconeogenesis occurs in the early morning before breakfast. After breakfast, glucose is supplied from the food consumed for breakfast.

4 D
After eating a large sweet meal, the body will break down complex carbohydrates to release glucose by the metabolic pathways operating in our bodies. This will lead to an increase in the glucose level in the blood. In response to high blood glucose levels, the hormone secreted in the body is insulin. Hence, after 30 minutes, both glucose levels and insulin levels in the blood will be high.

5 B
According to the growth curve, the growth of *Paramecium caudatum* starts decreasing after 6 days when grown together with *P. Aurelia*

6 D
When both species of *Paramecium* are grown together, the stationary phase of growth of *Paramecium caudatum* never appears, as per the curve. Growth of *Paramecium caudatum* decreases and finally ceases altogether, resulting in the population to become nearly extinct.

7 C
As depicted in the graphs, the time taken to achieve the stationary phase is maximal for *Paramecium aurelia* when it is grown together with *Paramecium caudatum.* The maximum time required to achieve the stationary phase (when bacterial population remains constant) is about 16 days.

8 B
As per the graphical representation of bacterial growth, the population densities of both *Paramecium* species are same after the 4^{th} day. It is clear that one of the *Paramecium* species (*Paramecium caudatum*) becomes nearly extinct when grown together with the other species.

9 C
The competition for survival occurs when both the *Paramecium* species are grown together; this competitive threat is due to competition for nutrients. Temperature remains constant in both cases. Oxygen is also constant for bacterial population of both *P. caudatum* and *P. aurelia*

10 C
Vasoconstriction of blood vessels causes an increase in the peripheral resistance and the increase in peripheral resistance results in an increase in arterial pressure.

11 A
Angiotensinogen is the precursor molecule that does not have enzymatic activity. Rennin, angiotensinase and angiotensin converting enzyme have enzymatic activity.

12 D
Angiotensin II causes water retention and prevents water diuresis. Prevention of natriuresis, i.e., Na^+ excretion and arteriolar constriction are induced by angiotensin II to increase arterial blood pressure. Therefore, water diuresis is not used by angiotensin II to increase arterial blood pressure

13 B
ACE inhibitors inhibit the angiotensin-converting enzyme. This would lead to an accumulation of angiotensin I as it cannot be converted to angiotensin II due to blockage of the converting enzyme. This, in turn, would decrease arterial pressure as angiotensin II is absent. Therefore, there will be no renal retention of salt and water and no vasoconstriction.

14 C
Activation of NK cells and macrophages are a non-specific defence response.

15 D
NK cells and neutrophils migrate into the infected area and destroy the bacteria.

16 C
The activation of T cells and B cells initiates the production of memory T cells and memory B cells.

17 A
Specific defences protect against threats on an individual basis as they develop memory T and B cells which are produced against specific antigen.

18 A
Muscle tension must increase gradually to prevent any tissue damage. This is why if the resistance is greater, it will take more time for the movement to initiate.

19 D
Opposing muscle contractions and elasticity both contribute to returning a muscle fibre to its original length. Muscle tone does not play any role in muscle relaxation and does not help in changing the length of a muscle.

20 B
There is potentially less damage to joints and muscle tissue possible with a lighter resistance.

21 D
Low flow velocity in capillaries is not related to a sharp drop in pressure. The sharp drop in pressure is due to the fact that the resistance of arterioles is amongst the highest in the entire vascular tree and is the main means by which the flow of blood through the capillaries is regulated. All the other statements about capillary flow are correct.

22 C
Once the arterial blood has traveled to the arterioles and then to the capillary bed, its pressure no longer depends on cardiac pumping. Blood flow to the right side of the circulation, mainly venous segments (venules, small veins and

vena cava) is largely passive, i.e., determined by the negative suction pressure generated by the left side of the heart, mainly atrium and ventricles.

23 C
The blood vessels - arteries and the vena cava have to be considered in this case. From the chart the pressures are 100 mm Hg and 2 mm Hg respectively. Therefore the net drop is 98 mm Hg

24 B
From the table, the drop in blood pressure from arterioles to capillaries is 55 mm of Hg. The maximum drop in blood pressure is an accurate measure of the extent of peripheral resistance offered by a segment. Among the options given, the drop in pressure from arterioles to capillaries is the maximum. Therefore, option B is the best answer.

25 C
The pulmonary vein is the only vein in the body that carries oxygenated blood; whereas all the other veins carry deoxygenated blood. It is also evident from the systemic circulation diagram given. Hence the correct option is C.

26 C
From the chart, it is evident that arteries must withstand more pressure than veins. The rate of blood flow is also higher in arteries than in veins. Hence, they are thick-walled so that they do not burst. The arteries regulate blood pressure which requires them to constrict and relax. The elastic tissue present in arterial walls aids in this activity.

27 D
From the chart, it is clear that the velocity of the blood flow is the slowest in the capillaries they have the largest cross sectional area. Each arteriole gives rise to a number of thin capillaries and hence the total cross–sectional area is greatly increased. All the other statements are incorrect.

28 C
As the diameter of blood vessel B is less than A, the pressure in B will be greater as compared to A. As the diameter of a blood vessel becomes smaller, a greater proportion of the blood is in contact with the wall of the vessel. Therefore, peripheral resistance to flow is increased and more pressure is required to maintain the flow of blood through the vessel. Therefore the pressure in B is greater than in A.

29 C
According to the Poiseullie's equation, flow rate is a function of the fourth power of the radius. That means that if the radius is reduced to one half of its value, then the flow rate will reduced by 1/16 of its original value. Here the original flow rate is 16 mL s^{-1}. If the radius is reduced by one half, the new flow rate is 16 times to 1/16. Hence the flow rate is now 1 mL s^{-1}

30 B
According to the Poiseullie's law, the flow rate is the function of the fourth power of the radius. Hence, a small increase in the radius will greatly increase the blood flow. Thus angioplasty serves to increase the radius of the blood vessels which, in turn, increases the blood supply to the deprived organ.

31 A
From the Poisuelle's equation, we know that the length is inversely proportional to the flow rate. Hence, if the length is doubled, the flow rate will be half of 0.4 mL s^{-1} i.e. 0.2 mL s^{-1}. We also know that the flow rate is a function of the fourth power of the radius. Hence, if the radius is halved, then the flow rate will be changed by a factor of 1/16 i.e., 0.4 times 1/16 = 0.025 mL s^{-1}

32 C
The law assumes that the rate of flow is steady, which means that it does not change with time. However, the heart beats periodically, which means that the law is not completely valid. If all the three assumptions are violated, the law cannot be applied to blood flow through the heart

33 C
One of the assumptions of Poiseullie's law is that the flow should be laminar, which means that the fluid acts like

layers of thin cylindrical sheets which travel individually without tearing or crossing. If turbulence develops, the flow will not be laminar. This means Poiseullie's law would not be valid in this situation.

34 C
The diameter of the large blood vessels cannot change much in diameter and, as a result, the blood flow rate is relatively constant. In comparison, nerve endings and vasoactive agents in the peripheral blood vessels exert a significant influence on radius and are the primary mechanisms by which blood flow is regulated in the human body

35 C
GIP and CCK both have an inhibitory affect on acid production and motility in the stomach.

36 C
Bile is released into the duodenum as a result of the release of cholecystokinin (CCK).

37 A
VIP dilates intestinal capillaries. The stimulus for VIP release is chyme arriving in the duodenum.

38 D
Chyme arrives in the duodenum, GIP is released and the endocrine pancreas then releases insulin.

39 C
Referring to the graph, it is evident that the metabolic rate of a mammal is inversely proportional to its size. Among the options provided, the guinea pig is the smallest mammal (slightly larger than a rat). Therefore, it will have the highest metabolic rate

40 C
It is clear from the graph that the metabolic rate of a rat is approximately 900 mm^3 of oxygen per gm per hr.