Question Paper

Exam Date & Time: 17-Jan-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

Nanomedicine [BME 4306]

Marks: 50 **Duration: 180 mins.**

Descriptive

Answer all the questions.

1A)	Discuss various strategies used by nanomaterials to reduce their surface energy.	(3)
1B)	Distinguish between homogenous and heterogenous nucleation process while preparing nanoparticles.	(4)
1C)	Summarize the various hallmarks of tumors and potential targets for treatment of tumors.	(3)
2A)	Illustrate and explain the components of plasma concentration-time profile for a nano formulation.	(2)
2B)	Varun wants to deliver an anticancer drug to treat Glioblastoma, a brain tumor using a nano carrier. Recommend a strategy that Varun can employ to enhance the retention of the drug in circulation. Explain how the recommended strategy helps to retain the drug in the blood for longer time.	(3)
2C)	A list of enzyme responsive peptide sequence and cleavage sites is mentioned in Figure 1. Using the information provided, design an enzyme responsive nanocarrier to deliver the drug doxorubicin to a hepatic tumor site. Illustrate and explain the mechanism of action, route of delivery and mechanism by which the drug reaches the intended site from your designed nanocarrier. Predict the drug release profile of your nanocarrier in the presence and absence of the enzyme.	(5)

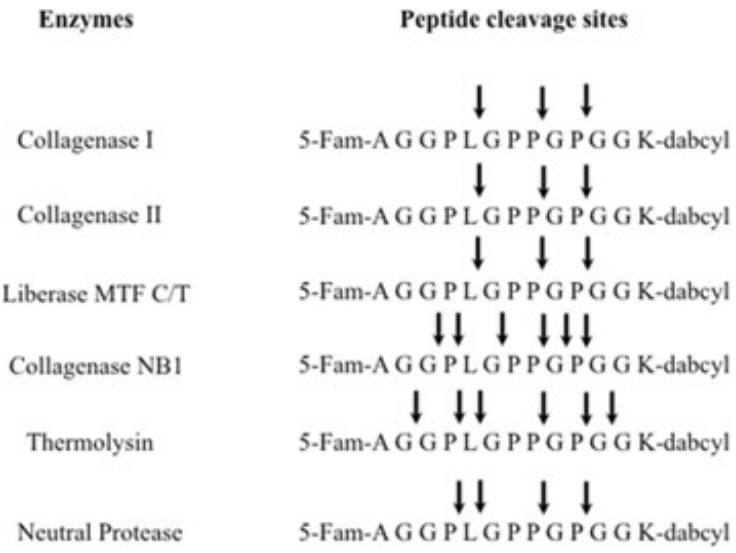

Figure 1: Enzyme responsive peptide sequence

3A)	Design a nano formulation using X-Rays, verteporfin (VP, a photosensitizer) and liposomes for X-ray activated photodynamic therapy (PDT). Illustrate and explain the working mechanism of nanocarrier formulation. Elaborate the design of animal studies you will perform to validate the nano formulation using mouse models.	(4)
3B)	Design a nano formulation for image guided photothermal therapy using photoacoustic imaging and gold nanoparticles. Illustrate the design and elaborate on the workings of your nano formulation.	(4)

3C)	Discuss the effects of hyperthermia on cancer cells.	(2)
4A)	Summarize the role of nanotechnology in the field of optical contrast agents for bioimaging applications.	(4)
4B)	Design a thermal based biosensor for detection of EGF in breast cancer using EGF and EGF antibodies. Illustrate and elaborate the working mechanism of the designed sensor. Explain the validation process for such a biosensor.	(4)
4C)	Distinguish between Förster resonance and Dexter exchange method of nonradiative energy transfer process.	(2)
5A)	An engineered nanomaterial which is water soluble was accidentally discharged into a nearby stream. Prepare a risk assessment of potential toxicity to the surrounding environment arising due to this accident.	(3)
5B)	Elaborate on cytotoxicity assays used to determine the toxicity of nanomaterials.	(4)
5C)	Discuss the ethical aspects pertaining to development and application of nanomedicine.	(3)

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