1. Ocular melanoma is the most common form of cancer to affect the eye. More than 400 new cases are diagnosed each year in the UK.

   Fig. 7.1 shows the structure of a human eye.

   Ocular melanoma can develop in the choroid, ciliary body or at **A** in **Fig. 7.1**. Diagnosis is usually made earlier for melanomas that have developed at **A**.
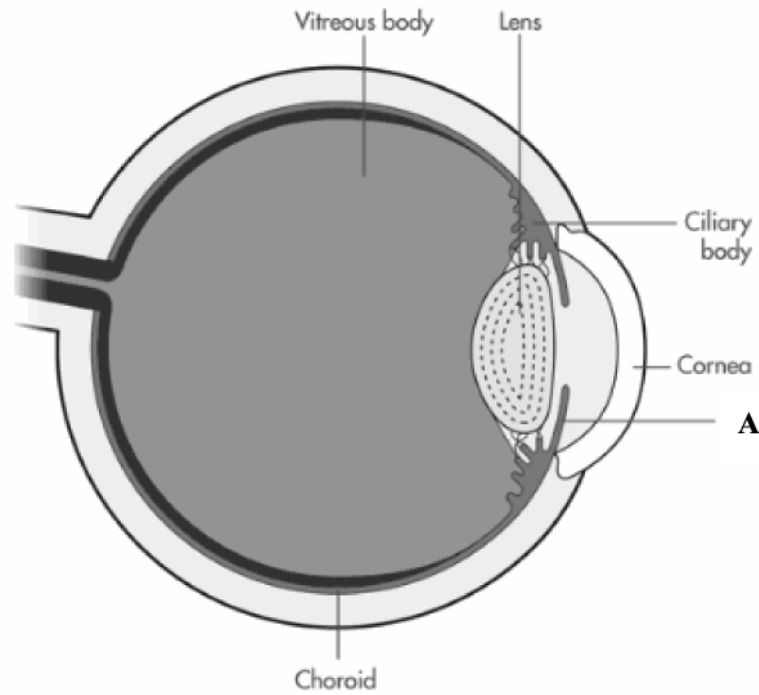

Fig. 7.1

   (i) Name the part of the eye labelled **A** in **Fig. 7.1**.

   _____[1]

   (ii) Suggest why melanomas at **A** are diagnosed earlier than other ocular melanomas.

   _____

   _____[1]

   (iii) Cells in the choroid and **A** in **Fig. 7.1** produce a pigment called melanin.

Suggest and explain **two** functions of melanin.

1

2

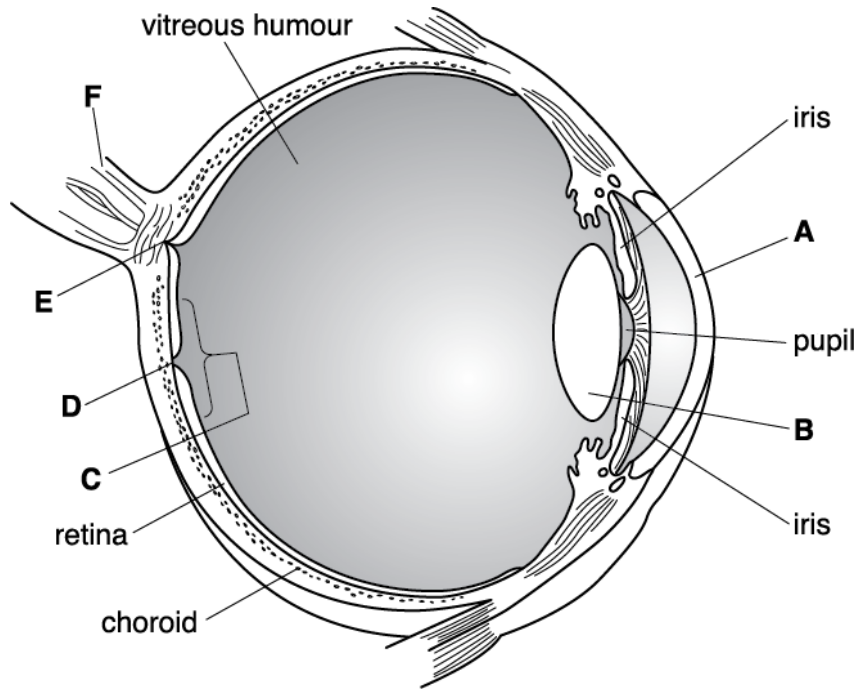---

[2]

2.   Partial sight or blindness can occur as a result of damage to several different parts of the eye.

The following figure shows a diagram of the eye.

Complete the table by inserting the appropriate letter or letters from the diagram.

Description	Letter(s)
The region that is damaged if glaucoma is not treated	
The region where a cataract can form	
The region of the retina where only cones are found	
The region of the retina where both rods and cones are found	
The region of the retina where no rods or cones are found	

[5]

3(a). Age-related macular degeneration (AMD) is one of the leading causes of irreversible sight loss in developed countries such as the United Kingdom.

AMD results in changes in the retina leading to the loss of visual acuity.

(i) State what is meant by visual acuity and describe briefly how visual acuity is assessed.

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[4]

(ii) Explain why damage to the macula leads to loss of visual acuity.

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[2]

(b). One form of AMD, known as **neovascular** AMD or wet AMD, is caused by the growth of blood vessels into the macula.

- A growth factor is normally released by cells in response to low oxygen concentrations.
- The growth factor stimulates the growth of blood vessels.
- Blood vessels may leak causing very rapid loss of vision.

(i) Suggest **one** factor, other than ageing, which may increase the risk of developing wet AMD.

Explain your suggestion.

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[2]

(ii) The growth of blood vessels is stimulated by a growth factor called **VEGF**.

VEGF binds to receptors on the cell surface membrane of endothelial cells.

One treatment available for wet AMD involves blocking the action of **VEGF** using a modified antibody.

Suggest how the modified antibody prevents the action of **VEGF**.

----

[2]

(c). Fig. 4.3 shows the results from one clinical trial of the modified antibody treatment.

At 3-monthly intervals, each patient's visual acuity was measured and compared to their visual acuity at the beginning of the trial. A positive value indicates an improvement and a negative value indicates a decline.

(i) State what may be concluded about the effectiveness of the modified antibody treatment based on the results of this clinical trial.

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[2]

(ii) Suggest **one** further piece of information that would be required in order for your conclusion to be valid.

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[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1		i	iris	1	
		ii	visible externally / AW	1	
		iii	**Any 2 from:** (choroid), absorbs light, (giving) clearer image / AW (iris), absorbs light, (allowing) amount of light entering the eyeball to be controlled / AW protection from, UV / dangerous, radiation	2	**ALLOW** choroid reduces light reflection (within eyeball)
			Total	4	
2			(see table below)	5	**Examiner's Comments** This was answered well with many candidates achieving full marks. Candidates had been told in the question that the allele was sex linked and given the symbols to choose from.
			Total	5	

Description	Letter
The region damaged by untreated glaucoma	F
The region where a cataract can form	B
The region where only cones are found	D
The region of the retina where both rods and cones are found	C
The region of the retina where no rods or cones are found	E

Question			Answer/Indicative content	Marks	Guidance
3	a	i	*visual acuity* how clearly / AW, objects can be seen ; **plus up to 3 marks from the following** use a Snellen chart / AW ; patient sits at a fixed distance and reads letters ; the smaller the letter read the greater the visual acuity ; AVP;	4	ACCEPT 'how clearly you can see' 'how much detail you can see' IGNORE references to focussing or accuracy ACCEPT a description of a chart CREDIT reference to 6m or 20 feet for distance e.g. one eye at a time, ref to 20/20 or 6/6 as 'very good' **Examiner's Comments** Part **(a)(i)** was accessible to most candidates although several could not recall the name of the Snellen Chart and some did confuse the visual acuity test with tests for colour blindness or the pupil response test. In **(a)(ii)** it is clear that the role of cone cells in visual acuity is not widely understood with relative few candidates referring to single cone cells being connected to single ganglion cells (in the fovea). The role of the macula as the region where high concentrations of cone cells are found (with the fovea being composed only of cone cells) was not understood with some candidates writing about the macula focussing the lens.
		ii	idea that (more) cone cells lost (which are responsible for visual acuity) ; macula / fovea, contains largest number of cone cells / region of concentrated cone cells ; *idea that* a single individual cone cell links to one ganglion cell ;	2	ACCEPT no cone cells outside macula / only rod cells outside macula

Question			Answer/Indicative content	Marks	Guidance
	b	i	*Factor* smoking / obesity / high altitude / sickle cell anaemia / (familial) hypercholesterolaemia / high blood pressure ; *Explanation* increases risk of, atherosclerosis / AW, (for smoking / obesity / hypercholesterolaemia / high blood pressure) **OR** carbon monoxide (in tobacco smoke) reduces oxygen transported by haemoglobin (smoking) **OR** lung damage reduces, gas exchange / uptake of oxygen (smoking) **OR** less haemoglobin saturation (in lungs) (high altitude) **OR** fewer red blood cells to transport oxygen (sickle cell anaemia);	2	One mark for named factor and one for correctly linked explanation. IGNORE ref to Diabetes **ACCEPT** 'high blood cholesterol' or 'high LDL' for hypercholesterolaemia **CREDIT** alternative biologically correct explanations for a named factor (one mark for factor and one for explanation). **ACCEPT** idea of less oxygen transported by red blood cells **Examiner's Comments** In part **(d)** many candidates could suggest a risk factor with high blood pressure appearing quite commonly. Again, a failure to read carefully the stem of the question meant that the cause of wet AMD (the *growth* of blood vessels) was then not addressed and weaker candidates suggested that high blood pressure meant the blood vessels leaked rather than explain why high blood pressure meant blood vessels would grow in the first place. Some very imaginative answers were seen in the form of high altitude or sickle cell anaemia as factors which increased the risk. In part **(ii)** some good explanations were seen although some weaker candidates assumed the antibody would engulf the VEGF. Part **(d)** was done well but in **(e)** the question required candidates to suggest what further information was needed for a

Question			Answer/Indicative content	Marks	Guidance
					valid statement - rather than simply identify a variable that was controlled. So answers such as 'age' required more development....the age might well be known but if the age of the two groups was not the same then the statement would not be valid.
		ii	variable / complementary, region / AW, binds to VEGF ; VEGF no longer, fits / is complementary to, membrane receptor ; **OR** antibody , binds to / AW, receptor for VEGF ; (antibody) blocks receptor / prevents binding of VEGF ;	2	**ACCEPT** idea that antibody has same shape as the VEGF receptor (as this implies it is complementary) **ALLOW** ref to binding site for variable region. **IGNORE** references to the active site
	c	i	(treatment) improves visual acuity, (within 3 months) I AW ; (treatment) prevents decline of visual acuity I improvement is maintained I AW ;		CREDIT idea that visual acuity declines with placebo
		ii	size of samples ; same test of visual acuity ; ref to double blind trial I randomised design ; AVP;	1	**Mark the first answer**. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = **0 marks** e.g. gender balance (between groups) e.g. not having any other treatment e.g. age profile similar (in both groups) e.g. ethnicity profile similar e.g. size of doses / how often treatment was given

Question			Answer/Indicative content	Marks	Guidance
			Total	13	